TO HOLDERS OF SYSTEM DESCRIPTION AND INSTALLATION MANUAL, PUB. NO 8600600-001, DATED 03 FEB 2014, NXT-600 MODE S/ADS-B TRANSPONDER

REVISION 001 DATED 26 MAR 2014

HIGHLIGHTS

This revision replaces all of the pages in the manual. All pages have a new date and pages with changed data are identified in the List of Effective Pages. Pages with changed data are identified with revision bars. Replace all pages in this document and discard all previous pages.

Page	Description of Change
All	All pages have been revised to indicate the latest revision and revision date.
All	All pages have been reviewed for spelling and grammar changes. ATA numbers have been changed from 23-80-02 to 34-52-13.
1-1	Removed reference to JAA LEAFLET NO 13, added compliance statement for CS-ACNS Subpart D. Removed second paragraph referring to A718A-4.
1-2	Added BDS 6,1, BDS 6,2 and BDS 6,5 to the DF17 Extended Squitters list.
1-3	Added Operational and XIC FPGA part numbers to Table 1-2.
1-4	Updated wording of Deviation 2 in Table 1-3.
1-6	Added F. GPS Interface description. All other letters incremented up.
1-8, 1-9	Added K. Failure Classifications description and Table 1-5. All other tables incremented up.
1-11	Updated first paragraph in section 5. A.
1-13	Table 1-6 added information to Power Consumption Specifications.
1-16	Table 1-7 Changed Section 13 Category from X to F and add reference to analysis document. Section 22 added Category A4. Section 26 added reference to analysis document.
1-32, 1-33	Updated Figure 1-7 and description below to include BDS 6,1, BDS 6,2 and BDS 6,5.
1-37, 1-39	Table 1-15 and 1-16, updated description for Bits 38-46.
1-40	Table 1-17 updated to remove references to legacy product.
1-47 thru 1-51	Added Tables 1-24 thru 1-27. All others incremented up.
4-6	Updated J1-42/43 in Table 4-1 to remove reference to legacy product.
4-9	Updated J1-59 in Table 4-1 to add a note for clarification.
4-19	Updated description for (2), removed lines that were not used in Table 4-7.
4-20	Updated description for (4).
4-27	Added Table 4-20, all others incremented up.
4-28 thru 4-29	Updated Table 4-21 and Figure 4-1.
6-7	Updated Table 6-2 to include Control L350 BIT/FAULT Codes.

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System Description and Installation Manual

NXT-600

Mode S/ADS-B Transponder System

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1	26 Mar 2014	26 Mar 2014	A

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INTRODUCTION

1. Proprietary, Export, and Precautionary Data

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- A WARNING is an operation or maintenance procedure or condition that, if not obeyed, can cause injury or death.
- A CAUTION is an operation o r maintenance procedure or condition that, if not obeyed, can cause damage to the equipment.
- A NOTE gives data to make the work easier or gives directions to go to a procedure.

(2) All personnel who operate equipment and do maintenance specified in this manual must know and obey the safety precautions. The warnings and cautions that follow apply to all parts of this manual.

WARNING: BEFORE YOU USE A MATERIAL, REFER TO THE MANUFACTURERS' MATERIAL SAFETY DATA SHEETS FOR SAFETY INFORMATION. SOME MATERIALS CAN BE DANGEROUS.

CAUTION: DO NOT USE MATERIALS THAT ARE NOT EQUIVALENT TO MATERIALS SPECIFIED BY ACSS. MATERIALS THAT ARE NOT EQUIVALENT CAN CAUSE DAMAGE TO THE EQUIPMENT AND CAN VOID WARRANTY.

CAUTION: THE MODE S TRANSPONDER SYSTEM CONTAINS ITEMS THAT ARE ELECTROSTATIC DISCHARGE SENSITIVE (ESDS). IF YOU DO NOT OBEY THE NECESSARY CONTROLS, A FAILURE OR UNSATISFACTORY OPERATION OF THE UNIT CAN OCCUR FROM ELECTROSTATIC DISCHARGE. USE APPROVED INDUSTRY PRECAUTIONS TO KEEP THE RISK OF DAMAGE TO A MINIMUM WHEN YOU TOUCH, REMOVE, OR INSERT PARTS OR ASSEMBLIES.

2. Content Data

A How to Use This Manual

(1) This manual gives general system description and installation information for the NXT-600 Mode S/ADS-B Transponder System. It also gives block diagram and interconnect information to permit a general understanding of the overall system.

(2) The purpose of this manual is to help you install, operate, maintain, and troubleshoot the transponder in the aircraft. Common system maintenance procedures are not presented in this manual. The best established shop and flight line practices should be used.

(3) Related publications that are referred to in this manual are identified in Table INTRO-1.

Table INTRO-1: Related Publications

Publication	Publication No.
Handling, Storage, and Shipping Procedures Instruction Manual for ACSS Avionics Equipment	A09-1100-001

NOTES:

1. You can order an ACSS Publication from ACSS as follows:

   Telephone No. 623-445-7040
   Fax No. 623-445-7004
   For publications please visit www.acsscustomerservices.com

B Weights and Measurements

(1) All weights and measurements are in U.S. and S. I. (metric) values.

(2) The letter symbols for units of measurement are the same as shown in ANSI/IEEE Std 260.

C Acronyms and Abbreviations

(1) The acronyms and abbreviations that follow help the reader identify terms and definitions used in this document.

(2) The letter symbols for units of measurement are the same as shown in ANSI/IEEE Std 260.

Table INTRO-2: Acronyms and Abbreviations

Term	Definition
ABV	Above
AC	Advisory Circular
ac	Alternating Current
ACSS	Aviation Communication & Surveillance Systems
ADLP	Airborne Data Link Processor
ALT	Altitude
ADS-B	Automatic Dependent Surveillance-Broadcast
ANSI	American National Standards Institute
ARINC	Aeronautical Radio, Incorporated
ASCII	American Standard Code for Information Interchange
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
AUTO	Automatic
AWG	American Wire Gauge
BIT	Built-In Test
BITE	Built-In Test Equipment
BLW	Below
CFR	Code of Federal Regulations
CRC	Cyclic Redundancy Code
CS-ACNS	Certification Specification-Airborne Communications, Navigation, and Surveillance
DADS	Digital Air Data System
DAPS	Downlink of Aircraft Parameters
dc	Direct Current
DF	Downlink Format
DLP	Data Link Processor
DPSK	Digital Phase Shift Keying
E/W	East/West
EAR	Export Administration Regulations
EASA	European Aviation Safety Agency
ELM	Extended Length Message

Table INTRO-2: Acronyms and Abbreviations

Term	Definition
ELS/EHS	Elementary and Enhanced Surveillance
ERR	Error
ESDS	Electrostatic Discharge Sensitive
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FL	Flight Level
FMS	Flight Management System
GICB	Ground Initiated Comm-B
GND	Ground
GNSS	Global Navigation Satellite System
HAE	Height Above Ellipsoid
HIL	Horizontal Integrity Limit
HPL	Horizontal Protection Limit
ICAO	International Civil Aviation Organization
ID, IDENT	Identification
IEEE	Institute of Electrical and Electronic Engineers
IPC	Illustrated Parts Catalog
kts	Knots
LCD	Liquid Crystal Display
LRU	Line Replaceable Unit
MAN	Manual
MCP	Mode Control Panel
MEL	Minimum Equipment List
MSL	Mean Sea Level
MTL	Minimum Trigger Level
N/A	Not Available
N/S	North/South
NAC_V	Navigation Accuracy Category for Velocity
NAV	Navigation
NIC	Navigation Integrity Category
NM	Nautical Mile
NXT	NXT Mode S/ADS-B Transponder
OTS	Organized Track System
PAM	Pulse Amplitude Modulation
PAST	Pilot-Activated Self-Test
PN	Part Number
PPM	Pulse Position Modulation
PWR	Power
RA	Resolution Advisory
RF	Radio Frequency
RMU	Radio Management Unit
RPTG	Reporting
RTCA	Radio Technical Commission for Aeronautics, Inc
RTN	Return
S.I.	International System of Units
SDA	System Design Assurance

Table INTRO-2: Acronyms and Abbreviations

Term	Definition
SDI	Source Destination Identifier
SEL	Select
SIL	Source Integrity Level
SLS	Side Lobe Suppression
SPI	Special Position Identifier
SPR	Sync Phase Reversal
SRC	Source
STBY	Standby
TA	Traffic Advisory
TCAS	Traffic Alert and Collision Avoidance System
TSO	Technical Standard Order
TSU	Technical Services Unit
TST	Test
UAT	Universal Access Transceiver
UELM	Uplink Extended Length Message
UF	Uplink Format
UTC	Coordinated Universal Time
VFOM	Vertical Figure of Merit
VSWR	Voltage Standing Wave Ratio
WGS-84	World Geodetic System 1984
XPDR	Transponder

3. Customer Assistance

For assistance with installation, operation or maintenance of the transponder, contact your local ACSS Dealer or ACSS Customer Services Representative. Additional assistance can be obtained from:

ACSS
19810 N. 7th Ave.
Phoenix, AZ. 85027-4741

Tel: 623-445-7070
Fax: 623-445-7001

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SYSTEM DESCRIPTION

1. General

The NXT-600 Mode S/ADS-B Transponder supplies surveillance functions to both ground-based and airborne interrogators and communication functions to onboard systems. The transponder contains data link functions that allow it to function as part of the Aeronautical Telecommunications Network (ATN). The data link functions allow communication with a Communication Management Unit (CMU) through a Mode S Airborne Data Link Processor (ADLP). The transponder replies to Air Traffic Control (ATC) Secondary Surveillance Radar (SSR) ground based interrogations with Mode 3/A (aircraft identification or 4096 code) and Mode C (barometric altitude reporting). The transponder also contains Mode S specific transmissions, which are selective interrogations and replies directly to onboard systems with a unique 24-bit code (Mode S address) assigned to each aircraft. The transponder can be upgraded to supply an internal ADLP function.

The NXT-600 Transponder is compliant with the applicable requirements in EASA CS-ACNS Subpart D initial issue 17 December 2013.

ELS Reports:

- Data Link Capability (BDS 1,0)
- GICB (BDS 1,7)
- Flight Identification (BDS 2,0)
- ACAS Active Resolution Advisory (BDS 3,0).

EHS Reports:

- Aircraft Intent (BDS 4,0)
- Track and Turn (BDS 5,0)
- Speed and Heading (BDS 6,0).

The NXT-600 Transponder also provides Automatic Dependent Surveillance-Broadcast (ADS-B) “OUT” support using the Mode S DF17 Extended Squitter. This is a function for airborne and surface aircraft which transmits horizontal and vertical position and velocity as well as other pertinent surveillance information. The NXT-600 Transponder will automatically transmit DF17 information based on onboard navigation sensors with or without an interrogation from a ground station or aircraft.

The FAA Final Rule for Automatic Dependent Surveillance–Broadcast (ADS-B) OUT, effective on August 11, 2010, adds requirements for aircraft operating in the following areas of the National Airspace System (NAS) to meet 14 CFR Part 91.225 by January 01, 2020:

- Class A, B, and C
- Class E within the 48 contiguous states and the District of Columbia at and above 10,000 feet MSL, excluding the airspace at and below 2,500 feet above the surface.
- Class E airspace at and above 3,000 feet MSL over the Gulf of Mexico from the coastline of the United States out to 12 nautical miles.
- Around those airports identified in 14 CFR Part 91, Appendix D.

A set of specific aircraft parameters are required in order for the transponder to transmit correct Mode S Extended Squitters. Refer to SYSTEM DESCRIPTION Section for Mode S, ELS/EHS, and ADS-B OUT for a list of required inputs. ARINC 718A-4 defines a method to strobe transponder inputs for DO-260B compliant units in order to set values and thresholds for the required parameters. Refer to Section 4 Loading/Gradient Specifications for more information.

DF17 Extended Squitter Reports:

- Airborne Position (BDS 0,5)
- Surface Position (BDS 0,6)
- Extended Squitter Status (BDS 0,7)
- Identity and Category (BDS 0,8)
- Airborne Velocity (BDS 0,9)
- Emergency/Priority Status (BDS 6,1)
- Target State and Status (BDS 6,2)
- Aircraft Operational Status, Airborne (BDS 6,5)
- Aircraft Operational Status, Surface (BDS 6,5).

ADS-B functionality supports improved use of airspace, improved surface surveillance, and enhanced safety.

2. System Components

Table 1-1: NXT-600 Configurations and Table 1-4: Control Panel Configurations give the components that are necessary to do an installation and are either supplied by ACSS or are available from the manufacturer.

Table 1-1: NXT-600 Configurations

Components	Model	ACSS Part No.
Mode S/ADS-B Out Transponder	NXT-600	9006000-55YYY[1]
NXT-600 Tray Assembly	MT-600	9516000-001
Tray Connector Kit (Contains 106-pin ARINC 404 mating connector and required hardware)		7510359-910
Components	**Comments**	
Gables G7130 Series ATC/TCAS Dual Transponder Control Panel[2].	General aviation type controller that operates from +28 V dc aircraft power[3].	
Omnidirectional ATC Antennas[4].	ATC blade antenna, dc shorted, TSO-C112 compliant, 1030 to 1090 MHz. Installer to supply antennas.	

NOTES:

1. The part number for the NXT-600 Mode S/ADS-B Transponder is 9006000-55YYY, where the five digit dash number corresponds to the hardware/software version. The last three digits of the five digit dash number (YYY) correspond to the unit software version.
2. Refer to Table 1-4 for individual part number descriptions.
3. For additional information, pricing, and availability contact:
   Gables Engineering, Inc., 247 Greco Avenue, Coral Gables, Florida 33146
   Telephone: (305) 774-4400
   Fax: (305) 774-4465
4. A diversity transponder installation requires both a top and bottom ATC antenna.

Table 1-2: NXT-600 Unit Configurations

Transponder Identification	Description	Applicable TSO/ETSO & Deviations	Level/Class
NXT Release 1 Model NXT-600 PN 9006000-55000	This Transponder operates from 28 V dc aircraft power. Operational Software – PN 9002000-001 XIC FPGA Firmware – PN 9008060-001	TSO-C112d – Deviation 2 TSO-C166b – Deviations 1 and 2	Level 3adens Class 1 Class A3 - Transmit Only
NOTE: For deviations refer to Table 1-3.			

Table 1-3: NXT-600 Unit Deviation Notes

Deviation 1: TSO-C166b, Section 4(a)(b)(e) part marking. This deviation is in regards to the part marking requirements of TSO-C166b, Sections 4(a), 4(b) and 4(e). This deviation allows these specific TSO-C166b part marking details to be listed in this installation manual instead of on the article.
Deviation 2: TSO-C112d and TSO-C166b: DO-160G 21.5 Radiated RF Emissions The NXT-600 Processor has a high power RF transmitter which is used to generate the 1090 MHz waveforms required to perform the Mode S Transponder and ADS-B OUT functions. Due to the high RF power requirement and inherent non-linearity in RF transmitters, three of the harmonics of the transmitter exceed the RF radiated emissions limit in DO-160G Category M. The NXT-600 exceeds the Category M Radiated RF Emissions by the indicated levels in the following frequency bands when the transmitter is active: 2180MHz ± 78MHz (2nd Transmitter Harmonic) Exceeds Cat M limits by 27dB 4360MHz ± 78MHz (4th Transmitter Harmonic) Exceeds Cat M limits by 5dB 5450MHz ± 78MHz (5th Transmitter Harmonic) Exceeds Cat M limits by 10dB The avionics installer must conduct the appropriate testing required to ensure that other aircraft systems are not adversely affected in the above frequency bands when the NXT-600 transmitter is active. Although the NXT-600 does not exceed the Category M limits at any other frequency, the installer should also conduct non-interference testing in the 3rd transponder harmonic frequency band (3270 ±78MHz) due to emissions in these bands approaching the specified limits.

Table 1-4: Control Panel Configurations

Control Panel Part Number	Description
Gables Control Panels	
G7130-02	Control Panel, Dual Mode S/TCAS, Rotary knob 4096 code entry, Black Bezel, Operates from +28 V dc aircraft power
G7130-05	Control Panel, Dual Mode S/TCAS, Rotary knob 4096 code entry, Gray Bezel, Operates from +28 V dc aircraft power
G7130-06	Control Panel, Dual Mode S/TCAS, Rotary knob 4096 code entry, Black Bezel, Extended Range (80, 120 NM), Operates from +28 V dc aircraft power
G7130-07	Control Panel, Dual Mode S/TCAS, Rotary knob 4096 code entry, Gray Bezel, Extended Range (80, 120 NM), Operates from +28 V dc aircraft power

3. System Description

System description gives a general overview and summary of the features and interfaces that the NXT-600 Transponder implements. Figure 1-1 shows a block diagram of the NXT-600 Transponder as part of an installed aircraft system.

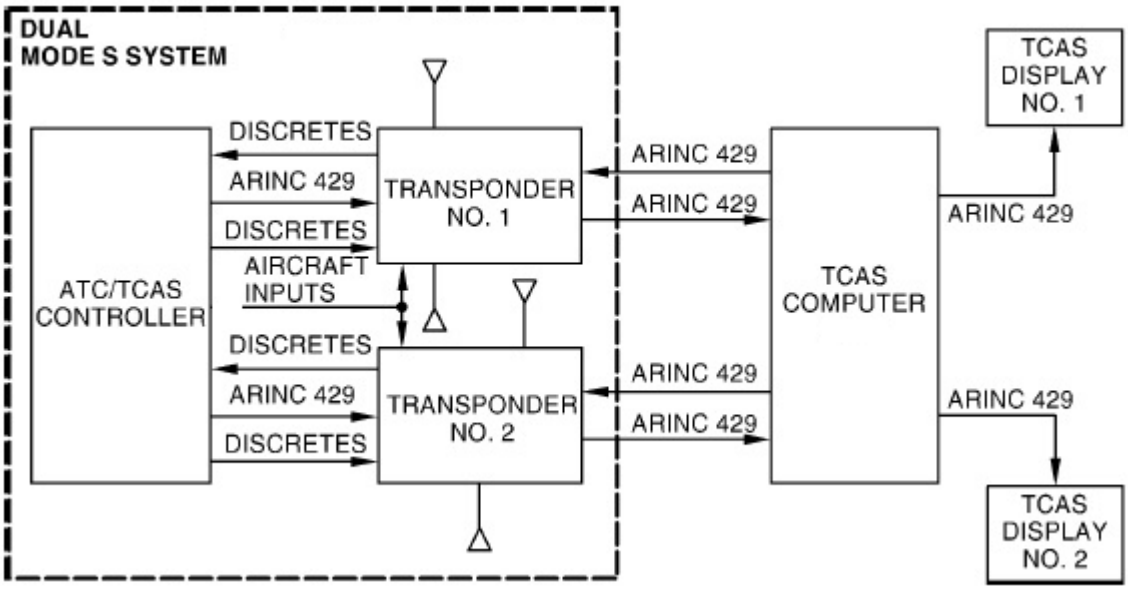

Figure 1-1: NXT-600 System Configuration

A. Radio Frequency (RF) Transmitter and Receiver

The NXT-600 Transponder receives interrogations on 1030 MHz, and transmits replies to interrogations and transmits squitters on 1090 MHz. The transponder has optional antenna diversity, which means it has two RF antenna ports connected to antennas on the top and bottom of the aircraft. When an interrogation is received, the transponder monitors the signal on the top and bottom antenna ports, and chooses the best port, based on signal strength and time of arrival. The transponder then replies to the interrogation on the port that contained the best interrogation. The transponder contains two independent RF receiver channels, which allow both top and bottom interrogations to be monitored simultaneously.

The NXT-600 Transponder also contains data link capability, which lets it receive COMM-A (UF=20/21) uplink messages and transmit COMM-B (DF 20/21) downlink messages.

The NXT-600 Transponder can receive COMM-C (UF=24, 16 Segment) Uplink Extended Length Messages (UELM) when interfaced to an external Mode S Airborne Data Link Processor (ADLP), which is defined functionally by RTCA DO-218B.

B. TCAS II Interface

The NXT-600 Transponder has an interface that allows it to work with an onboard TCAS II system. The interface consists of two ARINC 429 high speed data buses: 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. The data bus data word format and protocol used is the industry defined ARINC 718A-4/ARINC 735B interface standard.

Since interface requirements are often interpreted differently by equipment manufacturers when they are implemented, the transponder has been designed to interface with the ACSS TCAS II systems, as well as major competitors' TCAS II systems.

C. ADLP Interface, ADLP Function, and Transponder Level

The initial implementation of the NXT-600 Transponder is a Level 3 transponder according to the definitions in DO-181E and ICAO Annex 10. It can process COMM-A/B Data Link messages and it interfaces to an external Mode S Airborne Data Link Processor (ADLP) to process COMM C Data Link messages, which is defined functionally by RTCA DO-218B. The NXT-600 Transponder contains four High Speed ARINC 429 Data Buses, a COMM-A/B Input and Output Bus, and a COMM-C Input and Output Bus. COMM-A Data received by the transponder in an interrogation is transferred to the ADLP on the COMM-A/B data bus; COMM-B data received from the ADLP is transmitted in replies to interrogations. In a similar manner, COMM-C Data received by the transponder in an UELM interrogation is transferred to the ADLP on the COMM-C data bus.

D. Altimeter Interface

The NXT-600 Transponder can accept uncorrected pressure altitude inputs from altimeter or air data systems. The transponder has dual interfaces for ARINC 429 Air Data and ARINC 575 Air Data Systems. The transponder contains two independent inputs for each source and a discrete input for source selection.

E. Controller Interface

The NXT-600 Transponder is controlled from a standard Mode S or Mode S/TCAS control panel through an ARINC 429 input data bus and discrete inputs and outputs. The control panel interface is defined in ARINC 718A-4. However, several variations exist for different customers and airlines. The NXT-600 Transponder interfaces to all commonly used Mode S and Mode S/TCAS control panels.

The NXT-600 Transponder has a dedicated low speed ARINC 429 data input for receiving the Aircraft Identification Subfield (AIS) Flight Identification from another aircraft system (i.e., a Flight Management System [FMS] or Onboard Maintenance System [OMS]). The flight ID can also be received on any one of the five DAPS buses (high or low speed) or from the control panel on the control data bus (low speed). The flight identification can be the aircraft's flight identifier or registration.

F. GPS Interface

The NXT-600 Transponder has two dedicated ARINC 429 data inputs for receiving the required GPS parameters to support the ADS-B OUT functionality. These ARINC 429 buses must be used to input (high or low speed) GPS label information directly from a qualified source, as specified in FAA AC 20-165A, for ADS-B OUT enabled aircraft.

(1) Source Selection

If two valid GPS sources are available the one with the best reported integrity (HIL at least 0.01 NM lower than the other source) value in label 130 for 10 seconds or more will be used as the priority position source. The difference in HIL must be greater than 0.01 NM in order for a source to be considered better integrity. If two valid GPS sources are reporting the integrity (HIL) from label 130 within 0.01 NM of each other, then GNSS source 1 will be selected as the priority source. Integrity is considered equivalent if HIL is within 0.01 NM. If only one GPS source is valid it will immediately be used as the priority position source.

(2) HAE Altitude Processing

Since not all GPS units output Height Above Ellipsoid (HAE) Altitude, conversion may need to be done to convert the geometric altitude from Mean Sea Level (MSL) to HAE. AC 20-165A Section 3-3.c.8 requires that all Geometric Altitude transmitted for ADS-B be based on Height Above Ellipsoid.

The Transponder will process HAE Altitude based on the following priority:

- Use HAE Altitude input, (Label 370 per ARINC 743A), if available from the selected ADS-B Position Source
- Use HAE converted from GPS MSL Altitude input, (Label 076), if available from the selected ADS-B Position Source.

Appendix 6 of NATO STANAG 4294 provides a method using lookup tables and interpolation to convert HAE Altitude from MSL Altitude. This method is referred to as WGS84/NATO. Per AC 20-165A the same algorithm that the GPS uses to calculate MSL from HAE must be used by the transponder to recover HAE from MSL. Some GPS units do not use the WGS84/NATO conversion. In this case the WGS84/NATO conversion will be used and VFOM, (the GPS Altitude Accuracy Parameter), will be adjusted to make up for the maximum differences between the conversion algorithms. Pin Programming is provided to determine if the VFOM Adjustment is required, reference J1-52 pin description in the Loading/Gradient Specifications section.

(3) Horizontal Protection Limit (HPL) Limiting

The NXT-600 limits the HPL to 80 meters. AC 20-165A states “If the position source does not limit the HPL output in non-augmented modes, the position source manufacturer should provide guidance to the ADS-B system installer to ensure the ADS-B equipment limits the NIC to ≤ 8 in non-augmented modes.” Further industry work since the release of AC 20-165A has indicated that using the GPS indication of augmentation mode is not a reliable method of determining if limiting can be disabled, therefore the transponder will always limit the HPL.

Due to HPL limiting, the maximum reported NIC is 8, when HPL is 80 meters, the Type Code is set to 11 and the NIC Supplements A and B are set to 0.

The NXT-600 does not inflate the HPL by 3% when in LPV/LNAV approach modes.

G. Discrete Interfaces and Configuration Interfaces

The NXT-600 Transponder has discrete inputs for configuration and control of Mode S transponder functions and interfaces, and discrete outputs for annunciating transponder status information. The NXT-600 Transponder implements the discrete inputs and outputs defined by ARINC 718A-4. The input/output discretes default to an open state when power is removed.

H. Built-In Test Functions

The NXT-600 Transponder contains built-in test functions that supply power-on and continuous monitoring of internal transponder circuitry and external interfaces. Detected failures of circuitry that are critical to continued transponder operation are announced on the Mode S Control Panel with a fail light. Failures are logged in a non-volatile fault log that can be recalled through the transponder's front panel lamps, maintenance computer interface, or through the front panel RS-232 RJ-45 connector.

I. RS-232 Data Loader Interface

The NXT-600 Transponder has a front panel connector that interfaces to WebEddit through an RS-232 connection. The operational software for the transponder can be updated via this connection without removing the unit from the aircraft.

J. Navigation Data ARINC 429 Interfaces

The NXT-600 Transponder has ARINC 429 input bus circuitry for extended squitter and enhanced DAPS capability in addition to ELS/EHS requirements.

K. Reserved I/O for Future Features

The NXT-600 Transponder has reserved Input/Output (I/O) interface circuitry that can be used for future upgrades to the transponder. The hardware supplied in the existing unit allows these functions to be added through a software upgrade.

L. Failure Classifications

The following table summarizes the failure classification of each NXT-600 function and the rigor that the NXT-600 was developed to support (which in some cases exceeds the requirements):

Table 1-5: NXT-600 Failure Classifications

Function No.	Function Description	Hazard Classification	NXT-600 Development Level/Rigor
1	Transponder Mode S Operation: Incorrect Transponder Response to SSR	Major TSO-C112d	Hazardous
2	Transponder to TCAS Coordination: Incorrect Transponder Response to TCAS Interrogation	Hazardous	Hazardous
3	ADS-B OUT: Incorrect Transponder ADS-B Message Output	Major AC 20-165A	Hazardous
NOTE 1: Hazards with classifications less than Major are not listed in this table. **NOTE 2:** Due to the above Hazard Classifications, the NXT-600 software and airborne electronic hardware were developed to Design Assurance Level B.			

4. General Description

The Line Replaceable Units (LRUs) of the Mode S/ADS-B System include control panels, an ATCRBS transponder or a second Mode S transponder and antennas. The system complies with ARINC Characteristic 718A-4 (Mode S) functionality and meets the requirements of TSO-C112d, Air Traffic Control Radar Beacon System/Mode S (ATCRBS/Mode S) Airborne Equipment.

The Mode S/ADS-B system is made up of a Mode S/ADS-B transponder accompanied by an ATCRBS transponder or a second Mode S/ADS-B transponder, a control panel, and antennas. If the transponder is used with the TCAS, top and bottom omnidirectional antennas are required. If the transponder is used alone as surveillance, a bottom omnidirectional antenna is sufficient. Figure 1-2 details the signals and overall interconnects associated with the NXT-600 Transponder installation. Figure 1-3 shows a high-level interconnect (optional) used to switch between the single pair of antennas in a dual Mode S installation.

A. Purpose of System

Mode S is a cooperative surveillance and communication system for air traffic control. It employs ground-based sensors (interrogators) and airborne transponders. Ground-air-ground data link communications can be accommodated integrally with the surveillance interrogations and replies. Mode S has been designed as an evolutionary addition to the ATCRBS to supply the enhanced surveillance and communication capability required for air traffic control automation.

To facilitate the introduction of Mode S into the ATCRBS, both ground and airborne Mode S installations include full ATCRBS capability. Mode S interrogators supply surveillance of ATCRBS-equipped aircraft and Mode S transponders reply to ATCRBS interrogators. The data link capability of Mode S allows it to serve as an essential element of the Traffic Alert and Collision Avoidance System (TCAS) II. All TCAS II avoidance maneuvers are coordinated through the Mode S System. In addition, the Mode S transponder is responsible for reporting pressure altitude data and, through its control panel, supplies manual control of the TCAS unit.

A principal feature of the Mode S system that differs from ATCRBS is that each aircraft is assigned a unique address code. Using this unique code, interrogations can be directed to a particular aircraft and replies can be positively identified. Channel interference is minimized because a sensor can limit its interrogations to targets of interest. By proper timing of interrogations, replies from closely spaced aircraft can be received without mutual interference. The unique address in each interrogation and reply also permits the inclusion of data-link messages to or from a particular aircraft.

For the purpose of Automatic Dependant Surveillance-Broadcast, the NXT-600 transponder will transmit a set of squitters including Airborne Position (BDS 0,5), Surface Position (BDS 0,6), Status (BDS 0,7), Aircraft ID and Category (BDS 0,8), and Airborne Velocity (BDS 0,9).

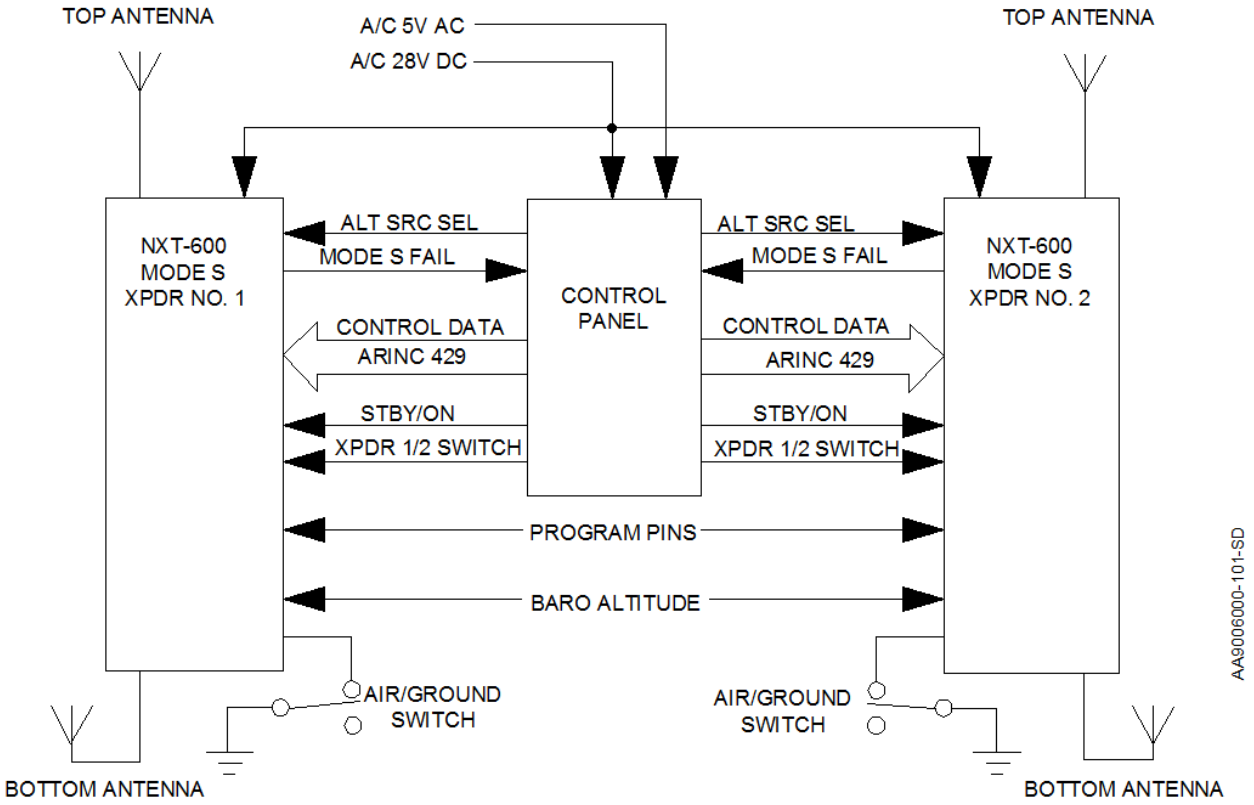

Figure 1-2: Basic Mode S System Interconnection

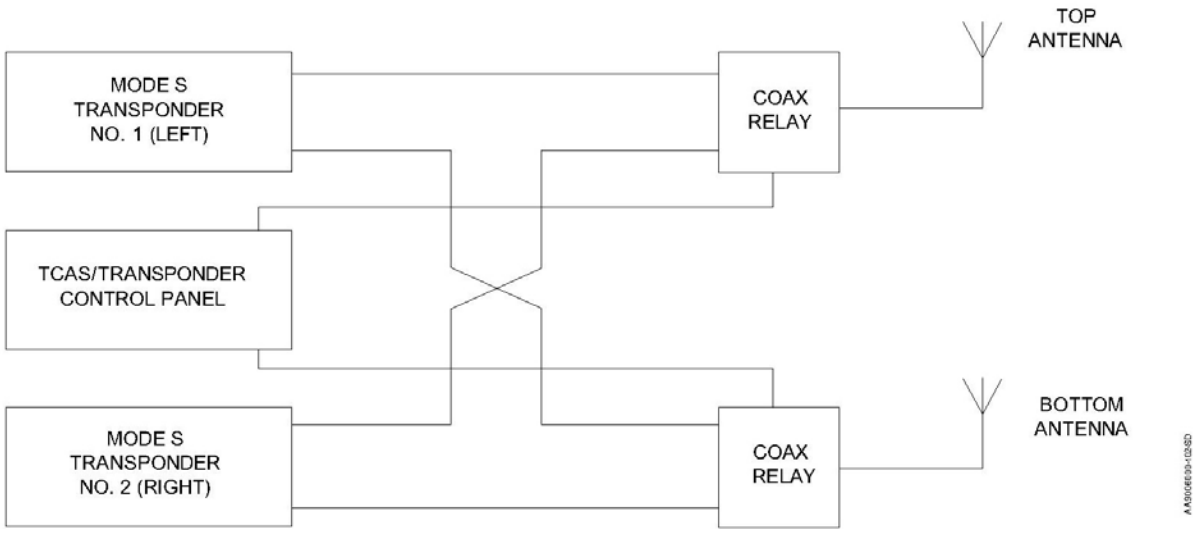

Figure 1-3: Switch Transponder Antennas

5. Component Descriptions

A. NXT-600 Mode S/ADS-B Transponder

The NXT-600 transponder is mounted remotely in the aircraft and electrically interfaces to the aircraft systems via three connectors on the rear of the unit. J1 is a 106-pin ARINC 404 connector that interfaces to +28 V dc power, a mode controller, program pin strapping, pressure altitude source(s), and optionally to a TCAS computer, selected altitude source, GPS source(s), aircraft heading source(s), and onboard maintenance computer(s). J2 and J3 are RF connectors through which the transponder receives interrogations at 1030 MHz and transmits replies and squitters at 1090 MHz via two coaxial cable interfaces to top and bottom mounted omni directional antennas.

Figure 1-4 shows a graphical view of the NXT-600 Mode S/ADS-B Transponder. Table 1-6 lists leading particulars for the transponder.

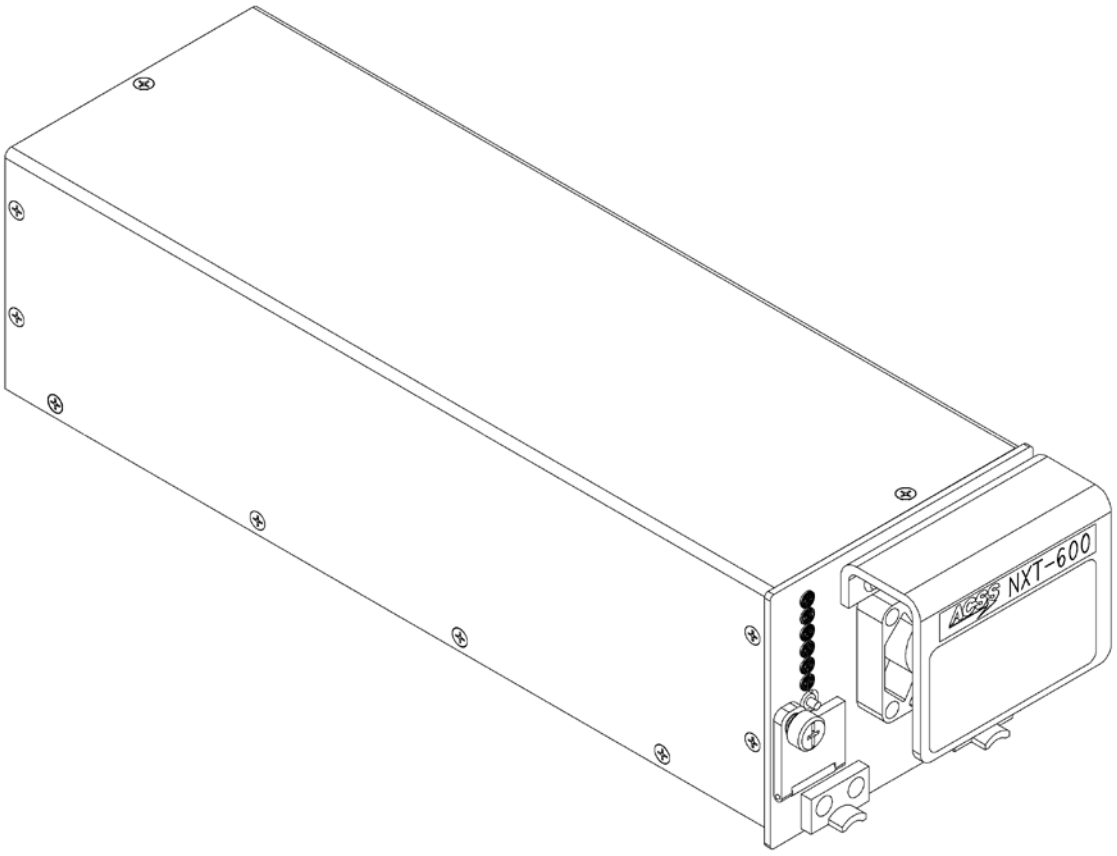

Figure 1-4: NXT-600 Mode S/ADS-B Transponder

Table 1-6: NXT-600 Mode S/ADS-B Transponder Leading Particulars

Item	Specification
Dimensions (maximum):	
● Length	14.09 in. (355.85 mm)
● Width	4.15 in. (104.14 mm)
● Height	3.44 in. (86.36 mm)
Weight (maximum)	5.2 lbs (2.36 kg)
Power Requirements:	
● Operating Voltage	+18.0 V to +30.3 V dc (+27.5 V dc nominal)
● Current	Receive mode: 1 A nominal at 27.5 V dc Transmit mode: 2 A nominal at 27.5 V dc
● Power Consumption:	
- Standby Mode (No Replies)	28 Watts nominal at +27.5 V dc
- Active Mode (Maximum Load)	55 Watts maximum at +27.5 V dc
● External Circuit Breaker Rating	5 A at +27.5 V dc
Cooling Requirements	Fan installed on unit
Tray Connector Kit	ACSS Part No. 7510359-910
Mounting	MT-600 Tray Assembly, Part No. 9516000-001
TSO	Refer to Table 1-2 for Part Numbers & Applicable TSO.
ETSO	Refer to Table 1-2 for Part Numbers & Applicable ETSO.
Environmental Specifications	DO-160G, Refer to Table 1-7
Operating Modes:	
● STANDBY	Ready but not replying
● ATC ON	Transponder Modes A, C, and S; no altitude reporting
● ATC ALT	Transponder Modes A, C, S, and ADS-B; altitude reporting is enabled
Transmitter Frequency	1090 ±0.5 MHz
Transmitter Power	500 Watts peak pulse maximum, 250 Watts minimum
Receiver Frequency	1030 MHz
Minimum Trigger Level (MTL)	-77 ±3 dBm
Mutual Suppression	Bidirectional, accepts +18 to +70 V dc pulse input, provides +28 V dc nominal output
Controller Interface:	
● Circuit Configuration	Two ARINC 429 control data input ports. 12.5k bits/sec (low-speed).
● Bus Protocol	Bus protocol meets requirements defined in ARINC 718A-4 for receiving transponder and TCAS control information.

Table 1-6: NXT-600 Mode S/ADS-B Transponder Leading Particulars (cont)

Item	Specification
TCAS II Interface:	
● Circuit Configuration	ARINC 429 input and output bus. 100k bits/sec (high-speed).
● Bus Protocol	Bus protocol meets requirements defined in ARINC 718A-4 and ARINC 735B for Standard transponder to TCAS bus interface.
Airborne Data Link Processor (ADLP) Interface:	
● Circuit Configuration	COMM-A/B messages have an ARINC 429 input and output bus. COMM-C messages have an ARINC 429 input and output bus. Both sets of buses are 100k bits/sec (high-speed).
● Bus protocol	Bus protocol meets requirements defined in ARINC 718A-4 for Standard transponder to ADLP bus interface.
Elementary Surveillance (ELS) Function:	When the transponder is connected to the appropriate onboard sources (e.g., ADC, ADIRU, control panel, FMS, etc.) specific data is extracted by the transponder (e.g., uncorrected pressure altitude in 25 ft increments, flight ID, flight status (in air/on ground), etc.). The ELS function transmits replies with this data along with the strapped/strobed 24-bit aircraft address and the transponder's capability report to ground-based interrogators.
● Digital Air Data Interface	ARINC 429 and ARINC 575 label 203 uncorrected pressure altitude are accepted. ARINC 429 or ARINC 575 data format, 12.5k bits/sec (low-speed). Two redundant digital air data inputs are provided. A discrete input to switch to the second digital air data source is provided.
● Flight Identification (Flight ID) Interface	ARINC 429 labels 233, 234, 235, 236, and 360 are accepted. ARINC label 237 if present is ignored. The interface to the transponder can be with a FID/ATC/TCAS or FID control panel or from a FMS. ARINC 429 data format, 12.5k bits/sec (low-speed).
● Aircraft Air/Ground Status Interface	Two open/ground discrete inputs are provided to indicate to the transponder the aircraft's air/ground status.
● 24-bit Aircraft Address Interface	Eight open/ground/strobed program pins wired to either one common (ground), or six strobed ouputs are provided to indicate to the transponder the aircraft's unique 24-bit aircraft address.

Table 1-6: NXT-600 Mode S/ADS-B Transponder Leading Particulars (cont)

Item	Specification
Downlink Airborne Parameters (DAPS) / EHS Function:	When the transponder is connected to the appropriate onboard sources (e.g., GNSS, ADC, LRU, ADIRU, MCP/FCU, etc.) specific data is extracted by the transponder (e.g., lat/long position, E/W and N/S velocities, track angle rate, selected altitude, etc.). The DAPS function transmits replies with this data to ground-based and airborne interrogators (EHS) and also broadcasts to ground-based and airborne receivers with 1090 Extended Squitters.
● Mode Control Panel/Flight Control Unit (MCP/FCU) Interface	ARINC 429 labels 101, 102, 233, 234, 235, 235 are accepted. 102 is accepted as long as the configuration discrete do not indicate GAMA. ARINC 429 data format, 12.5k bits/sec (low-speed) or 100 k bits/sec (high-speed). The transponder automatically detects whether the data is low-speed or high-speed format.
● ARINC 743 Global Positioning System (GPS) Interface	ARINC 429 labels 076, 103, 110, 111, 112, 120, 121, 130, 136, 140, 145, 150, 165, 166, 174, 247, and 370 are accepted. ARINC 429 data format, 12.5k bits/sec (low-speed) or 100k bits/sec (high-speed). The transponder automatically detects whether the data is low-speed or high-speed format.
● Inertial Reference System/Flight Management System (IRS/FMS) Interface	ARINC 429 labels 101, 102, 312, 313, 314, 320, 325, 335 and 365 are accepted. ARINC 429 data format, 12.5k bits/sec (low-speed) or 100k bits/sec (high-speed). The transponder automatically detects whether the data is low-speed or high-speed format.
● Digital Air Data Computer (ADC) Interface	ARINC 429 and ARINC 575 low-speed labels 203, 204, 205, 206, 210, 212, 234 and 236 are accepted. Two redundant digital air data inputs are provided. A discrete input to switch to the second digital air data source is provided.
● Extended Squitter Disable Interface	A discrete input to disable the transmission extended squitters/DO-260B is provided.
Onboard Software Uploading/ Fault Log Downloading:	
● Circuit Configuration	Data Loading/Maintenance Interface through RJ-45 front panel connector.
● Bus Protocol	The data transfer protocol for the RJ-45 RS-232 front panel connection is XMODEM 1K.

Table 1-7: NXT-600 Transponder DO-160G Categories

Condition	Category	Description of Conducted Test
4 Temperature and Altitude	CAT A2F2	Partial temperature control pressurized location, pressures no lower than 15,000 feet MSL, unpressurized locations with altitude not to exceed 15,000 MSL Sea level to 70,000 feet
In-Flight Loss of Cooling	CAT Y	+70 degrees C for 300 minutes
5 Temperature Variation	CAT B	-55 to +70 degrees C
6 Humidity	CAT B	Severe Humidity Environment
7 Operational Shocks and Crash Safety	CAT E	Low frequency operational shock and low frequency crash safety.
8 Vibration	CAT RBB1	Fixed Wing, Zone 2- Robust Vibration – Curve B and B1
	SM	Standard – Curve M
9 Explosion Proofness	CAT E	
10 Waterproofness	CAT W	
11 Fluids Susceptibility	CAT X	
12 Sand and Dust	CAT X	
13 Fungus Resistance	CAT F	Analysis Doc. 8010042-001
14 Salt Fog	CAT X	
15 Magnetic Effect	CAT Z	
16 Power Input	CAT BXX	B for DC Power Inputs X for DC Current Ripple, alternate test X for DC Inrush Current Test, alternate test
17 Voltage Spike	CAT A	
18 Audio Frequency Conducted Susceptibility – Power Inputs	+28 V dc: CAT Z	
19 Induced Signal Susceptibility	CAT CC	
20 Radio Frequency Susceptibility	CAT M CAT R	Radiated Susceptibility Conducted Susceptibility

Table 1-7: NXT-600 Transponder DO-160G Categories (cont)

Condition	Category	Description of Conducted Test
21 Emission of Radio Frequency Energy	CAT M	
22 Lightning Induced Transient Susceptibility	CAT A3H3L3 A4	
23 Lightning, Direct Effects	CAT X	No test required
24 Icing	CAT X	No test required
25 Electrostatic Discharge	CAT A	
26 Flammability	CAT C	Analysis Doc. 8010037-001

B. NXT-600 Front Panel Description

The NXT-600 front panel includes connections to the front panel test switch, access door to RS-232 Connector (RJ-45) and status lamps. Figure 1-5 shows front panel layout, and Table 1-8 defines the purpose of each status lamp.

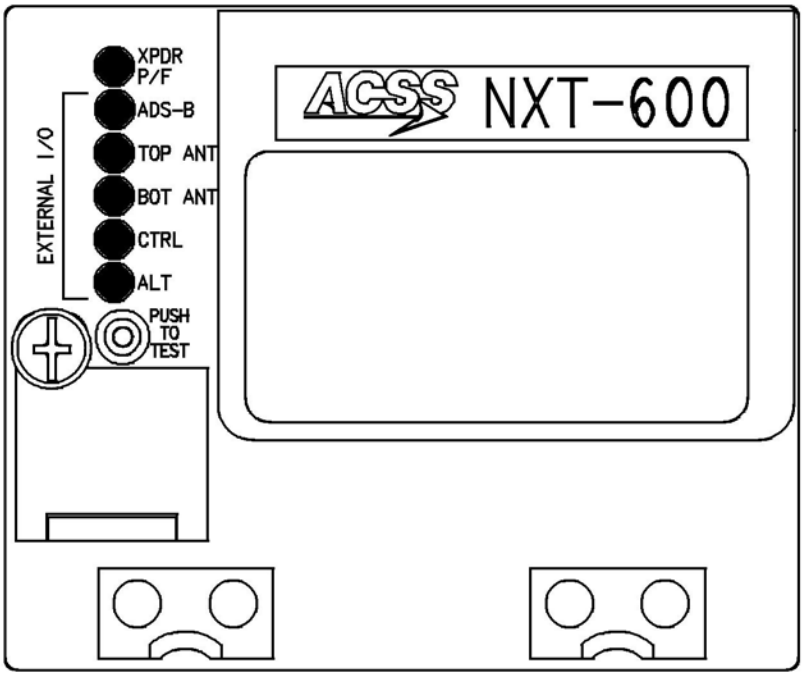

Figure 1-5: NXT-600 Front Panel

On power-up, or if self-test is initiated by PUSH TO TEST button, all lamps default to "ON" state (Green for XPDR P/F, Red for the rest). After successfully passing Power-on Test, all lamps switch OFF. See Section 6 of this Manual for detailed lamp fault diagnostic.

"PUSH TO TEST" momentary button initiates self-test, and can be activated ON GROUND only.

Access door to RS-232 Connector (RJ-45) is attached to the Front Panel, and opens by loosening a screw. No tools are required to open the access door.

The front panel is equipped with a handle for safe convenient handling while inserting, removing or, carrying the NXT-600 Transponder. There is a cooling fan mounted underneath the handle, so it is advised not to put fingers under the handle until Transponder powers down.

Table 1-8: Front Panel Lamp Definition

Position	Name (Labeled)	LED or Switch Type
1	XPDR P/F	Green/Red, Bi-Color
2	ADS-B	Red Lamp, single color
3	TOP ANT	Red Lamp, single color
4	BOT ANT	Red Lamp, single color
5	CTRL	Red Lamp, single color
6	ALT	Red Lamp, single color
Below Lamp's	PUSH TO TEST	Momentary Switch

C. Gables Dual Mode and Control Panel Figures

The Gables control panel for the transponder and TCAS systems supply mode control for dual or single ATC Mode S transponder and TCAS II system.

For more information on Gables G7130 Control Panels, refer to the applicable Gables Installation Manual.

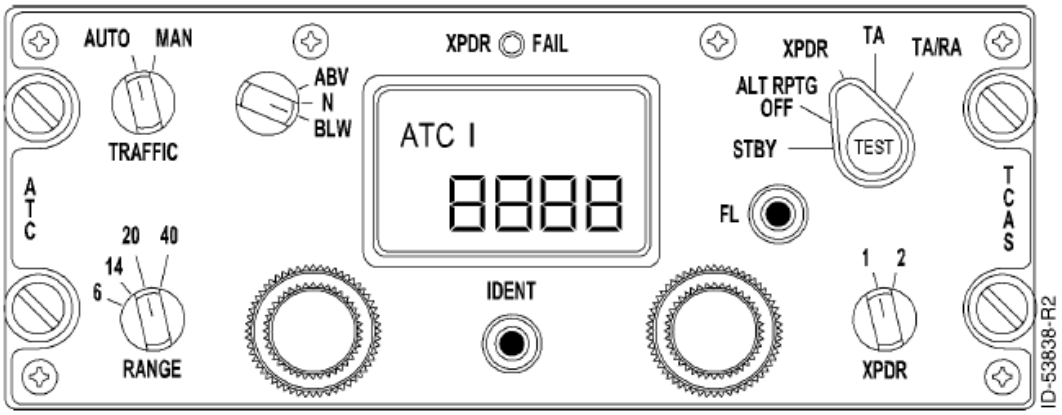

Figure 1-6: Gables G7130 Series Control Panel

Table 1-9: Gables G7130 Control Panel Leading Particulars

Item	Specification
Dimensions (maximum):	
• Height	2.25 in. (57.2 mm)
• Weight	5.75 in. (146.1 mm)
• Length	5.80 in. (147.3 mm)
Weight (maximum)	2.0 lb (0.907 kg) (Gables units)
Power Requirements:	
• Primary	+28 ±4 V dc, 0.25 A maximum current
• Lighting	5 V, 400 Hz, 2.3 A maximum
Mating Connectors:	
• J1	M83723/75R16247 or equivalent
• J2 (Dual Mode S transponder Version)	M83723/75R16248 or equivalent
Mounting	Unit Dzus Fasteners

D. Gables Control Panel Functions

The G7130 for the Mode S System supplies mode control for the ATC transponders, as well as TCAS commands to the TCAS computer and displays. Figure 1-6 shows only one of the numerous variants for the G7130 series of ATC/TCAS control panels.

Communication with the Mode S transponders is accomplished via an ARINC 429 bus as defined in ARINC characteristic 718A-4. Control panel functions include 4096 ident code selection and display, altitude source and reporting inhibit selection, and selection between two onboard transponders. A listing of the possible control panel functions follow.

(1) ALT RPTG OFF, Altitude Source 1-2 Selection

On the Mode Select knob, a position defined as ALT OFF disables altitude reporting in transponders replies. Other selections to the right of this position will enable altitude reporting. Altitude source can be selected from the control panel using different methods. Capabilities within the control panel allow users to use a two position rotary switch, or a dedicated ALT key. Using a push button key basically toggles between ADC 1 and ADC 2. Selection is displayed in the control panel.

(2) XPDR FAIL Front Panel Indicator

The XPDR FAIL annunciator displays the functional status of the active transponder. The fail annunciator lights during one of three situations:

(a) When a failed transponder is selected on the XPDR 1-2 switch.

(b) When own-aircraft navigation and position information from a GPS (utilized for ADS-B transmissions) is not available for the selected transponder.

(c) When the antenna diversity required by TCAS II cannot be guaranteed due to a failure in the antenna BITE monitor.

NOTE: For (a) above, TCAS functionality is affected and results in a TCAS FAIL message on the TCAS display, as well as a TCAS FAIL annunciation during self-test.

For (b) above, all other XPDR functionality is not affected. ADS-B transmissions continue but will be without GPS position data. TCAS functionality is not affected and will remain available. Refer to Section 6 Fault Isolation for troubleshooting prior to removing the transponder for a XPDR FAIL indication. Installations with EFBs and/or OMS pages will have a separate fault annunciation.

For (c) above, a TCAS FAIL and ATC FAIL is indicated. Selecting TCAS STBY or TA Only will clear the FAIL indications. During this case the NXT-600 is still functioning through the non-FAIL antenna.

(3) ATC Front Panel Indicator

The ATC/TCAS control panel shall have a dead front white ATC indicator controlled by the ATC mode key to annunciate activation of the ATC mode.

(4) ALT Front Panel Indicator (Operations)

The ATC/TCAS control panel shall have a dead front amber ALT indicator controlled by the transponder to annunciate an altitude failure condition.

(5) Mode Control Knob

The mode control knob disables reply capability in the STANDBY mode. It enables Mode S transponder in the XPDR position. TA and TA/RA modes support the operation of a TCAS system providing traffic and resolution advisories.

(6) XPNDR 1-2 Select Knob

The XPDR knob selects which transponder (1 or 2) is used for reporting replies.

(7) TRAFFIC Display Mode Selection – AUTO-ON

TRAFFIC displays can be set in two modes. In the AUTO mode the VSI/TCAS displays are in the pop up mode. Should a nearby traffic create a threat condition, then the displays will be turned ON. In the ON mode, all traffic within the range capabilities will be displayed. The G7130s provides the capability of selection TRAFFIC modes by using a rotary switch or a dedicated TFC push button switch.

(8) TCAS Test Button

The TCAS TEST button activates a system functional test as well as an internal test in the control panel. During this test, the control panel displays BIT information for each electronic module within the control panel.

(9) IDENT Button

The IDENT key is a momentary button. Upon activation, the Special Position Identifier (SPI) pulse shall be transmitted to ground controllers, in accordance with ARINC 718A-4, when replying to ATCRBS Mode A or Mode S UF-4 and UF-5 interrogations for a period of 18 ±1 seconds. The SPI pulse can be reinitiated at any time.

(10) 4096 Code

The 4096 code can be entered by means of a front panel controls. 4096 code entry can be described as follows:

- Use the rotary dials to select the ATC code. The ATC indicator is illuminated and display shows the last 4-digit ATC code entered when the ATC mode is selected.
- The ATC code can be set to any values from 0000 to 7777. To set an ATC code, use the keypad buttons 0 thru 7 to enter a 4-digit code.

  NOTE: Do not use codes 7500, 7600 or 7700 these codes are reserved for emergency operation.
- The new ATC code will be transmitted after 5 seconds. If you press the IDENT button before 5 seconds has elapsed, the new code will be transmitted immediately.
- If you press the **IDENT** button while the code entered is incomplete (if the code has less than 4 digits), the incomplete code is not transmitted and the previously transmitted code will re-appear on the display.

(11) ABV/N/BLW Function

The G7490 series provides capabilities to select the ABV/N/BLW function via a rotary switch, or a dedicated push button switch defined as A/N/B.

ABV (Above) Mode – The TCAS system will only display and provide traffic information for targets located between 9900 feet above and 2700 feet below your aircraft (+9900 ft and -2700 ft relative to your aircraft).

N (Normal Mode) – In the Normal mode, the TCAS system will only display and provide traffic information for targets located between 2700 feet above and 2700 feet below your aircraft (+2700 ft and -2700 ft relative to your aircraft).

BLW (Below) – The TCAS system will only display and provide traffic information for targets located between 2700 feet above and 9900 feet below your aircraft (+2700 ft and -9900 ft relative to your aircraft).

(12) Flight Level Function

The G7130 series has the capability of selecting the Flight Level function. A dedicated push button switch “FL” operates as follows:

- FL key not pressed: Flight Level bit is transmitted as 0 commanding the displays to show Relative Flight Level.
- FL key pressed: Flight Level bit is transmitted as 1 commanding the displays to show Absolute Flight Level. Absolute mode will be transmitted from the control panel for as long as the FL push button is pressed.

(13) Range Selection

The G7130 is capable of providing a combination of range values based on specific installation provided. For this purpose range can be selected via a rotary switch, two push button keys defined as RNG+ and RNG-, or by means of a dedicated range key defined as RANGE.

Possible range selections from the control panel are:
- 6-14-20-40-80-120

6. Functional Description and Operation

The Mode S Data Link System can be configured with either one or two Mode S transponders. The system provides air traffic information to Mode S and ATCRBS ground stations to aid in air traffic control. The Mode S System does all of the following:

- 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).
- Receives ELS/EHS interrogations (ground-to-air) and transmits ELS/EHS replies (air-to-ground).
- Receives and processes onboard navigation data and transmits Extended Squitters (air-to-air, air-to-ground).

Although TCAS is beyond the scope of this manual, it is mentioned to further clarify the capability of the Mode S System.

A. Functional Operation

(1) Mode A and Mode C

An ATCRBS transponder responds to ATCRBS interrogations with a Mode A (4096 code) reply or Mode C (altitude status) reply contingent upon the type of interrogation received. Interrogations are received by the transponder on 1030 MHz and replies are transmitted by the transponder on 1090 MHz. All ATCRBS transmissions are between the ground station and aircraft.

(2) Stand-Alone Mode S or Mode S in Conjunction with TCAS

A Mode S transponder receives and transmits on the same frequencies as the ATCRBS transponder and can receive and transmit ATCRBS interrogations and replies. However, the Mode S transponder was developed for Mode S operation and can function alone as Mode S or in conjunction with TCAS. When functioning alone as Mode S, all Mode S transmissions are between the ground

station and aircraft. When functioning in conjunction with TCAS, transmissions may also be from aircraft to aircraft.

(3) Transponder Self-Test

Mode S System operation begins when aircraft power is applied. Initial self-test is performed automatically upon power-up and is completed in approximately 1 second. Self-testing of the system occurs continuously while in the power-on mode. If a transponder failure occurs, it is indicated on the control panel. Other failures are indicated via front panel-mounted lamps on the transponder; however, these failure indications are not available to the pilot. All failures, whether hard or intermittent, are recorded in the transponder non-volatile fault log for analysis by maintenance personnel.

(4) 4096 Code and Mode S Address

After power-up, the pilot enters the assigned 4096 code via the control panel. This code is the ATC identification code for that aircraft and is used during ATCRBS (Mode A) interrogations and replies. Mode S interrogations and replies use a 24-bit address code entered into transponder memory automatically upon power-up. Each aircraft has its own unique address that is permanently programmed to the airframe. No manual entry of this address is available.

(5) Reply Capability Disabled

The system can be placed in STANDBY mode. When the STANDBY mode is selected, the transponder reply transmit capability (Mode S or ATCRBS) is disabled. The remainder of the transponder functions are operational, including Built-In Test (BIT). STANDBY mode is typically engaged while on the ground to prevent unnecessary RF radiation. The STANDBY mode is disengaged just prior to takeoff and engaged again upon landing. In addition, an air/ground switch, which functions as part of the Weight-On-Wheels (WOW) circuitry, can disable ATCRBS transponder reply capability while the aircraft is on the ground if this feature has been enabled. To disable ATCRBS or ground replies with the air/ground switch, the appropriate air/ground transponder discrete must be connected. Refer to Section 4 Loading/Gradient of this manual for details on this interface. Mode S transponder replies and squitters, however, are not disabled by the air/ground switch, and aircraft status (on ground or airborne) is included in the Mode S reply and squitter data.

(6) Transponder Selection

In a dual Mode S transponder installation, the pilot can choose either transponder from the control panel. Only one transponder is enabled at a time. If a transponder failure occurs, the XPDR FAIL indicator on the control panel lights; however, the failed transponder must be the one selected on the control panel for the indicator to light. Switching between the transponders occurs without loss of system function.

(7) Special Position Identifier Transmission

A Special Position Identifier (SPI) is added to the ATCRBS and Mode S replies when the control panel IDENT button is pressed and released. The SPI is enabled for approximately 18 seconds and supplies the ground station with a more positive aircraft identification capability. This function is typically activated upon verbal command from the ground station.

(8) Altitude Switching

Dual altitude input ports are supplied for each transponder; the capability to switch between the two is supplied by a switch on the control panel. This function lets the pilot select an alternate altitude source if the first fails. It also lets the ground station verbally verify one source against the other.

B. Mode S/ATCRBS Interrogations and Replies

(1) Identification Code and Baro Altitude

The Air Traffic Control Radar Beacon System (ATCRBS) has been in operation for several decades. Its purpose is to ensure safe separation and operation of aircraft, especially in busy terminal areas. ATCRBS transponder-equipped aircraft transmit replies to interrogations from ground-based sensors (interrogators). Depending on the type of interrogation, the reply contains either the identification code currently assigned to the aircraft by ATC (Mode A) or uncorrected barometric altitude with 100-foot resolution (Mode C).

(2) Range and Relative Bearing

The ground station uses reply delay time to compute range to within approximately 500 feet. The current angle of the rotating ground antenna determines azimuth. There is an 18 ±2 second duration SPI pulse to aid in identifying specific aircraft. Thus, ATC is provided with the information required to ensure safe separation of aircraft.

(3) Assigned Code Number - ATCRBS

The digits of the assigned code number indicate the code groups to be used and the pulse coding within each group. The assigned code is a four-digit octal number (any of 4096) in which the first or left-most digit designates the A group; the second digit designates the B group; the third digit designates the C group; and the last or right-most digit designates the D group. Typical information pulses present in assigned reply codes are given in Table 1-10.

Table 1-10: Typical ATCRBS Reply Code Numbers

4096 Code Number	Information Pulses	4096 Code Number	Information Pulses
0000	None	3000	A1, A2
0001	D1	3100	A1, A2, B1
0002	D2	3200	A1, A2, B2
0003	D1, D2	3300	A1, A2, B1, B2
0004	D4	3400	A1, A2, B4
0005	D1, D4	3500	A1, A2, B1, B4
0006	D2, D4	3600	A1, A2, B2, B4
0007	D1, D2, D4	3700	A1, A2, B1, B2, B4
		4000	A4
0010	C1	4100	A4, B1
0020	C2	4200	A4, B2
0030	C1, C2	4300	A4, B1, B2
0040	C4	4400	A4, B4
0050	C1, C4	4500	A4, B1, B4
0060	C2, C4	4600	A4, B2, B4
0070	C1, C2, C4	4700	A4, B1, B2, B4
		5000	A1, A4
0100	B1	5100	A1, A4, B1
0200	B2	5200	A1, A4, B2
0300	B1, B2	5300	A1, A4, B1, B2
0400	B4	5400	A1, A4, B4
0500	B1, B4	5500	A1, A4, B1, B4
0600	B2, B4	5600	A1, A4, B2, B4
0700	B1, B2, B4	5700	A1, A4, B1, B2, B4
1000	A1	6000	A2, A4
1100	A1, B1	6100	A2, A4, B1
1200	A1, B2	6200	A2, A4, B2
1300	A1, B1, B2	6300	A2, A4, B1, B2
1400	A1, B4	6400	A2, A4, B4
1500	A1, B1, B4	6500	A2, A4, B1, B4
1600	A1, B2, B4	6600	A2, A4, B2, B4
1700	A1, B1, B2, B4	6700	A2, A4, B1, B2, B4
2000	A2	7000	A1, A2, A4
2100	A2, B1	7100	A1, A2,A4, B1
2200	A2, B2	7200	A1, A2, A4, B2
2300	A2, B1, B2	7300	A1, A2,A4, B1, B2
2400	A2, B4	7400	A1, A2, A4, B4
2500	A2, B1, B4	7500	A1, A2,A4, B1, B4
2600	A2, B2, B4	7600	A1, A2,A4, B2, B4
2700	A2, B1, B2, B4	7700	A1, A2,A4, B1, B2, B4

1) Mode Select

Air traffic density has significantly increased since the inception of ATCRBS. Aircraft within the same approximate range and azimuth from the interrogator may interfere with each other's replies. Much verbal communication is also needed to coordinate ATC, creating more traffic on communication channels. This also places a heavier burden on the air traffic controllers.

Mode Select (Mode S) has been designed as an evolutionary addition to ATCRBS to supply enhanced surveillance as well as data communication capability for ATC, with greater degree of automation in mind. Ground-air-ground data link communications can be accommodated with the surveillance interrogations and replies, permitting use of the transponder for a number of different ATC functions. Messages can be either 56 or 112 bits in length. The same transmit and receive frequencies are used as for ATCRBS.

(a) Ground and Airborne Installations

1. Mode S Compatibility with ATCRBS

To facilitate the introduction of Mode S into ATCRBS, both ground and airborne Mode S installations include full ATCRBS capability. Mode S interrogators supply surveillance of older ATCRBS-equipped aircraft, and Mode S transponders reply to ATCRBS interrogators. Mode S interrogators are able to command Mode S transponders not to reply to compatible ATCRBS-only interrogations. They are also able to solicit only Mode S replies from Mode S transponders which minimizes RF transmissions.

2. Mode S Address

Another unique aspect of Mode S is that each aircraft equipped with a Mode S transponder is assigned a unique 24-bit address. This address appears in either a coded or clear form in every Mode S reply. This not only improves aircraft identification by ATC, but also permits selective interrogation once the aircraft has been acquired by an ATCRBS/Mode S or Mode S-only All-Call interrogation.

3. Minimizing RF Channel Loading

Selective interrogation is aimed toward reducing RF channel loading. Another way to minimize RF traffic is the capability of locking out the transponder from replying to All-Calls, from either all interrogators or from specific ones, for 18-second intervals. Including the station's identity code in the interrogation message enables this lockout. Probability-based replies make it possible to separate transmissions from aircraft that would otherwise be garbled when a group of aircraft might answer a single interrogation.

4. Uplink/Downlink Transmission CRC

All transmissions for surveillance or data communications, from the ground up to the aircraft (uplink) and from the aircraft down to the ground (downlink), are protected by a 24-bit Cyclic Redundancy Code (CRC) error detection scheme, also referred to as parity. In addition, ground interrogators can perform error correction on received downlink messages.

(b) Traffic Alert and Collision Avoidance System

Mode S transponders are an integral part of the Traffic Alert and Collision Avoidance System (TCAS). TCAS-equipped aircraft are airborne interrogators, communicating with other TCAS-equipped aircraft through their Mode S transponders for coordination of collision avoidance maneuvers. TCAS aircraft acquire other Mode S transponder-equipped aircraft by receiving squitter transmissions (unsolicited All-Call type replies, transmitted pseudo-randomly every 0.8 to 1.2 seconds with aircraft Mode S address), and thereafter by specific addressed interrogations. Although either Mode S or ATCRBS Mode C transponders aid TCAS-equipped aircraft in avoiding collisions, coordination of collision avoidance maneuvers is possible between two aircraft only if both are Mode S and TCAS equipped.

(c) Mode S Message

1. Interrogation and Reply Formats

Mode S features have been added to the ATCRBS already in place. This procedure ensures that the older airborne transponders and the ground-based interrogators used in the ATCRBS are still functional. The Mode S signal formats used for this combined system operation include ATCRBS/Mode S All-Call [Mode A, Mode C, and Mode S], Mode S interrogation, Mode S SLS and Mode S reply.

2. Interrogation Pulses and Timing

The uplink Mode S format for the interrogation pulse group consists of pulses designated P1, P2, and P3. The time spacing between the P1 and P3 pulses determines the type of interrogation (Mode A aircraft identification or Mode C altitude reporting). Pulse P2, which follows P1 by 2 microseconds, is used for Side Lobe Suppression (SLS) in the ATCRBS. The amplitude of P2 is recognized by the airborne transponder as either a main beam or SLS interrogation. With Mode S interrogation, the basic P1 and P3 pulse system is extended to include a P4 pulse, which follows P3 by 2 microseconds. The P4 pulse uses the same spacing as between P1 and P2. However, P4 has an additional feature in that its pulse width can be either 1.6 microseconds or 0.8 microsecond, whereas the P1 and P3 pulse widths are always 0.8 microsecond.

3. Replies to All-Call Interrogations and Pulse Width

In operation, when a standard ATCRBS transponder receives this interrogation of P1, P3, and P4 pulses, it responds with the ATCRBS reply, which consists of 14 pulses that carry the identity code or the altitude code. The P4 pulse is ignored since the ATCRBS transponder circuit is designed so that it does not recognize the P4 pulse. The response is dependent upon the presence and length of P4. When a standard P1 and P3 interrogation is received from an ATCRBS interrogator (no P4), the Mode S transponder responds with a standard ATCRBS reply. An uplink interrogation pulse group, which includes a P4 pulse, makes the Mode S transponder prepare to measure the P4 pulse width. As soon as the Mode S transponder detects the rising edge of the P4 pulse, it disables its ATCRBS reply.

It then looks for a pulse width of 0.8 or 1.6 microseconds. A pulse width of 0.8 microsecond is recognized by the Mode S transponder as an uplink ATCRBS-only All-Call, and it does not respond at all. In this case, the ground station is looking for all the aircraft in the vicinity that are equipped with ATCRBS only. In the case of a 1.6-microsecond pulse width, the Mode S interrogator wants the Mode S transponder to respond with the Mode S All-Call coded reply. In this case, the interrogator receives the aircraft's identity, which is the unique number that is given to the Mode S-equipped aircraft. The 1.6-microsecond pulse width is in fact an All-Call interrogation for both ATCRBS and Mode S transponders, eliciting both ATCRBS and Mode S replies. There is no interrogation addressing in this case as each system responds within its own capability.

4. Mode S Interrogation

The final type of uplink interrogation is made up of P1 and P2 pulses of equal amplitude followed by a long pulse of constant amplitude called P6. This is a Mode S interrogation pulse (P6) that occurs 1.5 microseconds after P2. When the P1 and P2 pulses are of equal amplitude, the standard ATCRBS transponders see the P2 pulse and do not respond, since they interpret this as a side lobe interrogation.

5. Mode S Short/Long Interrogation Messages

The Mode S transponder sees the P1 and P2 pulses and prepares to receive P6 and the uplink Mode S message. There are two types of messages that are defined in terms of length. The first type of interrogation is a short message and is 56 bits long; the second is a long message and is 112 bits long.

(d) Mode S Reply Timing

1. Reply Trigger Point

For the ATCRBS/Mode S All-Calls, the timing reference, or trigger point, for the Mode S reply is from the leading edge of pulse P4. From pulse P4, the response time for a Mode S reply is 128 ±0.5 microseconds. When responding to a standard ATCRBS interrogation, the timing reference is the leading edge of pulse P3 and the ATCRBS response time is 3 microseconds.

2. P6 Phase Encoding

The Mode S Interrogation signal contains equal amplitude P1 and P2 pulses, in addition to the video pulse P6 that contains the Mode S uplink message phase encoded information.

3. Sync Phase Reversal

Inside the P6 pulse, the first phase change occurs 1.25 microseconds into the pulse. This phase change is called the Sync Phase Reversal (SPR), and it is used to synchronize the transponder with the ground station. The SPR is used as the timing reference for the Mode S reply for uplink messages. Response time is 128 ±0.25 microseconds.

4. **Differential Phase Shift Keying**

   All the possible phase changes (chips), corresponding to the data bits, are inside the P6 pulse and occur after the SPR. Since the uplink message consists of 4 megabits per second, it means that there is a possible phase change (chip) every 0.25 microsecond. This process is called Differential Phase Shift Keying (DPSK). If there is a one in the data stream, the phase changes. However, if there is a zero in the data stream, it does not change.

5. **Short Message Interrogations**

   All of the short 56-bit Mode S uplink messages have the following two things in common:

   - The first five bits are always the Uplink Format (UF) number. For example, in a UF=0, the first five bits are all zero (00000); in a UF=5, the first five bits are 00101. Downlink messages are identified by the abbreviation DF for Downlink Format.
   - The last 24 bits are an address/parity field. This is a means of addressing the uplink message (interrogation) and it is also a means of error detection. The last 24 bits do not carry data, but rather the unique address of the aircraft overlaid with the parity bits. A CRC system is actually used for the entire uplink message. The transponder starts to handle the uplink message only when it ensures that the message is intended for the aircraft in which the transponder is installed.

6. **Mode S All-Call**

   The uplink message can be a broadcast-type message intended for all aircraft in range of the ground station. This is the Mode S-only All-Call message, which is a special format (UF=11) that contains an all-ones address.

7. **Side Lobe Suppression**

   Mode S SLS is handled by a P5 pulse, which has a pulse width of 0.8 microsecond. P5 is transmitted simultaneously with the P6 Sync Phase Reversal (SPR); the P5 pulse subsequently covers the SPR. When this occurs, the decoder in the receiver cannot see the SPR and, therefore, does not process the uplink message. This decoding procedure is different from the ATCRBS method where the amplitude of the P2 pulse must actually be detected for SLS.

8. **Mode S Reply Pulses**

   The Mode S reply is then generated either in response to a Mode S interrogation or by one of the ATCRBS/Mode S All-Calls. The reply includes a preamble made up of two pairs of pulses that occur 8 microseconds before the first Mode S downlink pulse. The preamble precedes the actual data on the downlink message, much like the P1, P2, and P6 pulses precede the uplink message.

9. UF and DF Messages

There are two fundamental differences between the uplink message and the downlink message, as follows:

- The uplink burst is at 4 megabits per second, while the downlink is at 1 megabit per second.
- The uplink uses DPSK, while the downlink uses Pulse Position Modulation (PPM). Using PPM, there is one pulse for every bit, either in the first half or the second half of the bit interval (window). The first half of the window represents a 1; the second half of the window represents a 0.

10. Mode S Reply Delay

The reply delay time for Mode S is 128 microseconds with respect to the P6 SPR. This is true for both long and short messages. However, the downlink message data cannot be prepared until the uplink message is complete. There is an additional derived timing specification that indicates how much time is available from the end of an interrogation until the reply starts. For a short message, it is 113 microseconds; for a long message, it is 99 microseconds. The basic Mode S transponder handles only the short messages, but this timing shows that a data link transponder, which handles long messages, has more data to process and a shorter time to prepare the message.

C. Mode S ELS/EHS and ADS-B OUT

Traditional Secondary Surveillance Radar (SSR) includes Mode 3/A (aircraft identification or 4096 code) and Mode C (uncorrected barometric altitude reporting). Then to increase ATC capacity which included implementing TCAS operation, Mode S was developed which made transponder interrogations addressable and transponder replies more accurate and reliable. Basic Mode S requires the aircraft to be;

- equipped with a Mode S capable transponder
- equipped with a means for the operator to enter the ATC assigned 4096 code that then provides standard ARINC 429 label 016 Mode S Control
- equipped with a source of uncorrected barometric altitude with at least 25 feet resolution via one of the following:
  - standard ARINC 429 label 203 Uncorrected Barometric Altitude
  - standard ARINC 575 label 203 Uncorrected Barometric Altitude
- strapped/strobed with the aircraft's unique 24-bit ICAO aircraft address.

Mode S Elementary Surveillance (ELS) was the first step of down linking additional aircraft derived data. In addition to the Mode S aircraft requirements listed above, minimally Mode S ELS requires the aircraft to be:

- equipped with a Mode S ELS capable transponder
- equipped with a means for the operator to enter Flight Identification that then provides standard ARINC 429 labels:
  - 233, 301 Characters 1 and 2
  - 234, 301 Character 3

- 234, 302 Character 4
- 235. 302 Characters 5 and 6
- 236 Characters 7 and 8.

Mode S Enhanced Surveillance (EHS) was the second step of down linking additional aircraft derived data. In addition to the Mode S and Mode S ELS requirements listed above, minimally Mode S EHS requires the aircraft to be:

- equipped with a Mode S ELS/EHS capable transponder
- equipped with sources of standard ARINC 429 labels;
  - 102 Selected Altitude
  - 325 Roll Angle
  - 103 True Track Angle or 312 Ground Speed
  - 335 Track Angle Rate (if available)
  - 210 True Airspeed (TAS)
  - 320 Magnetic Heading
  - 365 Inertial Vertical Velocity
  - 205 MACH
  - 206 Indicated Airspeed (IAS)
  - 212 Barometric Rate

Automatic Dependent Surveillance-Broadcast (ADS-B OUT) is the next step of down linking additional aircraft derived data. In addition to the Mode S, Mode S ELS, and Mode S EHS requirements listed above, minimally ADS-B OUT requires the aircraft to be:

- equipped with a Mode S ELS/EHS and ADS-B OUT capable transponder
- equipped with sources of standard ARINC 429 labels:
  - 076 GNSS Altitude (MSL)
  - 103 GNSS True Track Angle
  - 110 GNSS Latitude, Coarse
  - 111 GNSS Longitude, Coarse
  - 112 GNSS Ground Speed or else 312 Ground Speed
  - 120 GNSS Latitude, Fine
  - 121 GNSS Longitude, Fine
  - 130 GNSS Horizontal Protection Limit or else 112 Ground Speed or 312 Ground Speed or else 133 VIL or else 203 Uncorrected Barometric Altitude or 370 GNSS HAE
  - 136 GNSS Vertical Figure of Merit
  - 140 GNSS UTC, Fine (binary, “0.200 sec”)
  - 150 GNSS UTC (binary, e.g., “12 h 23 m 12 s”)
  - 165 GNSS Vertical Velocity
  - 166 GNSS N/S Velocity
  - 174 GNSS E/W Velocity
  - 247 GNSS Horizontal Figure of Merit
  - 314 True Heading or else 103 GNSS Track Angle or else 313 True Track Angle

- 370 GNSS Geodetic Height (above WGS-84 ellipsoid).

(1) BDS Registers

The transponder assembles data into Binary Data Store (BDS) registers. These registers are also referred to as GICB registers since they can be down linked via Ground Initiated Comm B transactions.

The transponder's 256 BDS registers are commonly notated in hexadecimal format with the first register notated as BDS 0,0 (00_{16} or 0 decimal) and the last register notated as BDS F, F (FF_{16} or 255 decimal). Each BDS register consists of 56 bits as specified in the ICAO Manual of Mode S Specific Services and Mode S Standard and Recommended Practices (SARPs). Each BDS register contains the data payload of a specific Mode S reply or extended squitter. Registers not updated within a fixed time are cleared, i.e. filled with 0's. Refer to Figure 1-7 for a simplified block diagram of DAPS Data Processing.

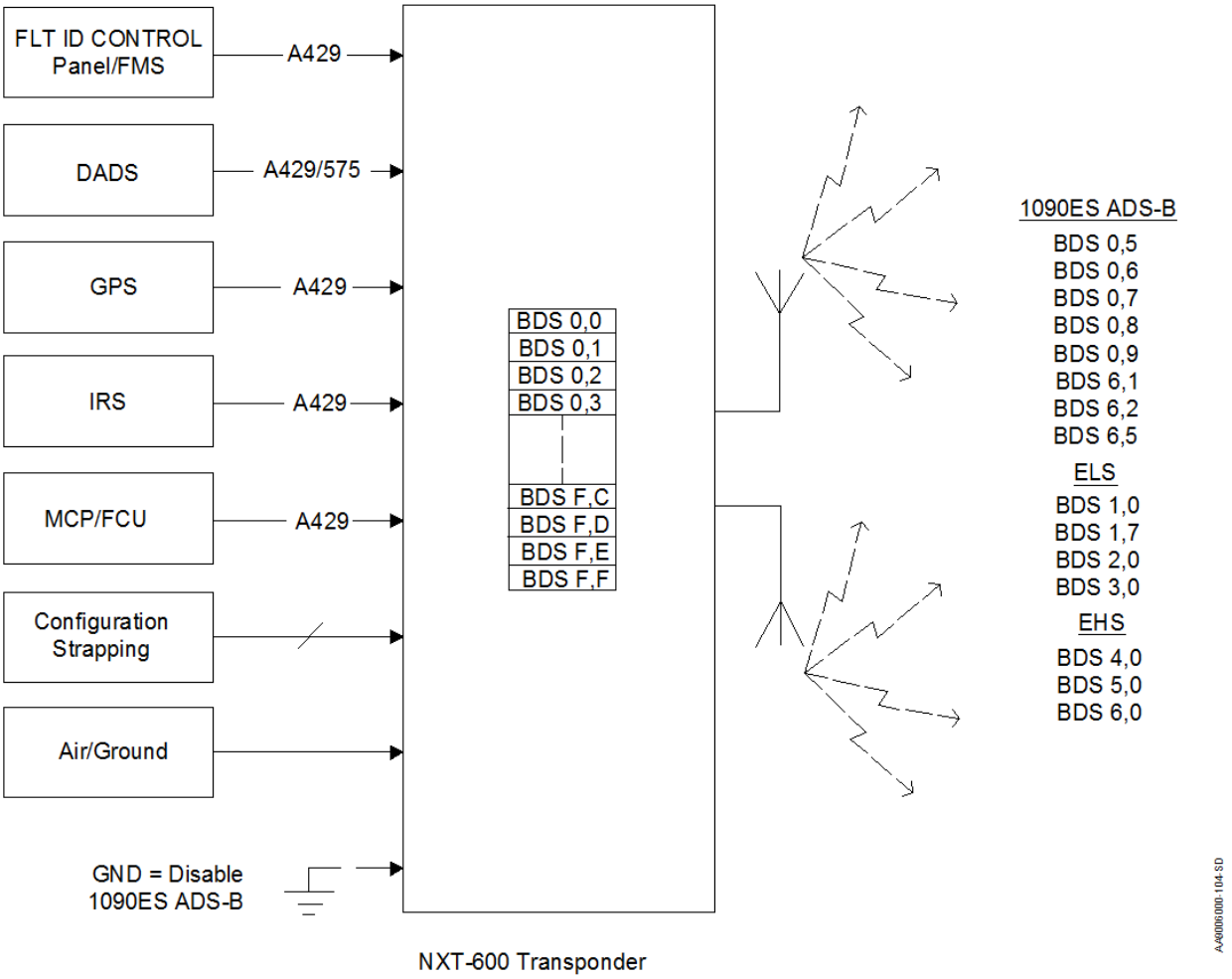

Figure 1-7: NXT-600 Transponder DAPS Data Processing

BDS registers currently specific to 1090 ES ADS-B are:

- 0,5 Airborne Position
- 0,6 Surface Position
- 0,7 Status
- 0,8 Aircraft ID and Category
- 0,9 Airborne Velocity
- 6,1 Emergency/Priority Status
- 6,2 Target State and Status
- 6,5 Aircraft Operational Status, Airborne
- 6,5 Aircraft Operational Status, Surface

NOTE: 1090 ES ADS-B BDS data is transmitted in the ME field of DF 17.

BDS registers currently specific to Elementary Surveillance (ELS) are:

- 1,0 Data Link Capability
- 1,7 Common Usage GICB Capability
- 2,0 Aircraft Identification
- 3,0 ACAS Active Resolution Advisory

NOTE: ELS BDS data is transmitted in the ME field of DF 20 or DF 21.

BDS registers currently specific to Enhanced Surveillance (EHS) are:

- 4,0 Selected Vertical Intent
- 5,0 Track and Turn
- 6,0 Heading and Speed

NOTE: EHS BDS data is transmitted in the MB field of DF 20 or DF 21.

(2) Detailed BDS Register Descriptions

This section provides a detailed description of the BDS register data currently specific to 1090 ES ADS-B, ELS, and EHS. The first column in each of the BDS register tables that follow provides the number of bits allocated for each parameter listed that is listed in the second column. The third column provides typical transponder ramp tester parameter data. The fourth and last column provides the external sources and details that are required by the transponder to effectively assemble each parameter into the BDS register.

Refer to ICAO Annex 10, Vol III, Part 1, Chapter 5 and RTCA DO-260B for more details.

Table 1-11: BDS 0,5 Airborne Position

Bits	Parameter	Parameter Data	External Source(s)
1-5	Format Type Code	0, 9-18, 20-22	See **NOTE:**
6-7	Surveillance Status	NO INFO PERM ALERT TEMP ALERT SPI	Label 016 from ATC/TCAS control panel.
8	Single Antenna Flag (SAF)	SINGLE DUAL	
9-20	Barometric altitude or GNSS Altitude	Decoded Barometric Altitude in feet Decoded HAE in feet.	Label 203 uncorrected pressure altitude from ADC. Label 370 HAE from GPS
21	Time	N/UTC (Not UTC) UTC	Time mark from GPS.
22	CPR Format	EVEN ODD	Label 150 UTC Coarse, Label 140 UTC Fine, and Label 141 UTC Fine Fraction from GPS
23-39	Encoded Latitude	Decoded CPR format in degrees, minutes, and seconds	Label 110 Latitude (coarse) and Label 120 Latitude (fine) from GPS 1 or 2 (Best HIL value)
40-46	Encoded Longitude	Decoded CPR format in degrees, minutes, and seconds	Label 111 Longitude (coarse) and Label 121 Longitude (fine) from GPS 1 or 2 (best HIL value)
NOTE: Label 130 HIL from GPS or Label 171 RNP from FMS or IRS, or else Label 112 Ground Speed from GPS or Label 312 Ground Speed from FMS or IRS, or else Label 133 VIL from GPS, or else Label 203 Baro Altitude from ADC or label 370 HAE from GPS.			

Table 1-12: BDS 0,6 Surface Position

Bits	Parameter	Parameter Data	External Source(s)
1-5	Format Type Code	0, 5-8	See **NOTE:**
6-12	Movement	NO INFO STOPPED Speed in Knots DECELERATING ACCELERATING BACKING UP	Label 112 Ground Speed from GPS 1 or 2 (best HIL value) or else Label 312 Ground Speed from IRS or FMS or else derived from Label 174 E/W and Label 166 N/S velocities.
13	Status Heading		
14-20	Heading	N/A Decoded Heading in degrees.	Label 314 True Heading from IRS or else Label 103 Ground Track from GPS 1 or 2 (best HIL value) - only if GS >20 kts or Label 313 True Track Angle from IRS only if GS >20 kts.
21	Time	N/UTC (Not UTC) UTC	
22	CPR Format	EVEN ODD	Label 150 UTC Coarse, Label 140 UTC Fine, and Label 141 UTC Fine Fraction from GPS
23-39	Encoded Latitude	Decoded CPR format in degrees, minutes, and seconds.	Label 110 Latitude (coarse) and Label 120 Latitude (fine) from GPS 1 or 2 (best HIL value)
40-56	Encode Longitude	Decoded CPR format in degrees, minutes, and seconds.	Label 111 Longitude (coarse) and Label 121 Longitude (fine) from GPS 1 or 2 (best HIL value)
NOTE: Label 130 HIL from GPS or Label 171 RNP from FMS or IRS, or else Label 112 Ground Speed from GPS or Label 312 Ground Speed from FMS or IRS, or else Label 133 VIL from GPS, or else Label 203 Baro Altitude from ADC or label 370 HAE from GPS.			

Table 1-13: BDS 0,7 Status

Bits	Parameter	Parameter Data	External Source(s)
1-2	Transition Rate	No capability to determine surface squitter rate High surface squitter rate selected Low surface squitter rate selected Unassigned	Label 110 Latitude (coarse), Label 111 Longitude (coarse), Label 120 Latitude (fine), and Label 121 Longitude (fine) from GPS.
3	Altitude Type	Barometric Altitude GPS height above ellipsoid (HAE)	
4-56	Reserved		

Table 1-14: BDS 0,8 Aircraft ID and Category

Bits	Parameter	Parameter Data	External Source(s)
1-5	Format Type Code	1-4	
6-8	Aircraft Category	A, B, C, D	
9-14	Character 1	ICAO Character	Label 233 Flight Identifier from control panel.
15-20	Character 2	ICAO Character	Label 233 Flight Identifier from control panel.
21-26	Character 3	ICAO Character	Label 234 Flight Identifier from control panel.
27-32	Character 4	ICAO Character	Label 234 Flight Identifier from control panel.
33-38	Character 5	ICAO Character	Label 235 Flight Identifier from control panel.
39-44	Character 6	ICAO Character	Label 235 Flight Identifier from control panel.
45-50	Character 7	ICAO Character	Label 236 Flight Identifier from control panel.
51-56	Character 8	ICAO Character	Label 236 Flight Identifier from control panel.

Table 1-15: BDS 0,9 Airborne Velocity Subtypes 1 & 2 – Velocity Over Ground

Bits	Parameter	Parameter Data	External Source(s)
1-5	Format Type Code	19	
6-8	Sub Type	1 (Ground Speed Normal)	Label 166 N/S velocity and Label 174 E/W velocity from GPS.
9	Intent Change Flag		
10	IFR Capability Flag		
11-13	NACv	0, 1, 2, 3, 4.	Label 247 HFOM from GPS. Label 136 VFOM from GPS.
14	Direction E/W	E W	
15-24	E/W Velocity	N/A Knots	Label 174 E/W Velocity from GPS 1 or 2 (best HIL value) or calculated from Label 112 Ground Speed from GPS, or Label 367 E/W velocity from FMS or IRS.
25	Direction N/S	N S	
26-35	N/S Velocity	N/S Knots	Label 166 N/S Velocity from GPS 1 or 2 (best HIL value) or calculated from Label 112 Ground Speed from GPS, or Label 366 N/S velocity from FMS or IRS.
36	Source of Vertical Rate	N/A BARO GEO	
37	Sign for Vertical Rate	+ -	
38-46	Vertical Rate	N/A Feet per minute	Blended Inertial Vertical Rate (Label 365) from selected NAV source or Barometric Vertical Rate (Label 212) from selected ADC source or Geometric Vertical Rate (165) from selected ADS-B Position Source

Table 1-15: BDS 0,9 Airborne Velocity Subtypes 1 & 2 – Velocity Over Ground (cont)

Bits	Parameter	Parameter Data	External Source(s)
47-48	Reserved		
49	Difference Sign	+ -	
50-56	Difference from Geo and Baro Altitudes	Feet	Label 370 Height Above Ellipsoid (HAE) from GPS 1 or 2 (best HIL value) or Label 076 Altitude (MSL) from GPS 1 or 2 (best HIL value) or Label 203 Uncorrected Barometric Altitude from ADC.
NOTE: Subtype 1 is used when NS and EW velocities are valid and both are less than 1022 knots. Subtype 2 is used when NS and EW velocities are valid and both are greater than 1022 knots.			

Table 1-16: BDS 0,9 Airborne Velocity Subtypes 3 & 4 – Airspeed and Heading

Bits	Parameter	Parameter Data	External Source(s)
1-5	Format Type Code	19	
6-8	Sub Type	1 (Ground Speed Normal)	Label 166 N/S velocity and Label 174 E/W velocity from GPS.
9	Intent Change Flag		
10	IFR Capability Flag		
11-13	NACv	0, 1, 2, 3, 4.	Label 247 HFOM from GPS. Label 136 VFOM from GPS.
14	Status	N/A Available	
15-24	Magnetic Heading	Degrees	Label 320 Magnetic Heading from FMS or IRS.
14	Status	N/A Available	
15-24	Magnetic Heading	Degrees	Label 320 Magnetic Heading from FMS or IRS.
25	Airspeed Type	IAS TAS	
26-35	Airspeed	N/A 0 to >1021 Knots 0 to >4084 Knots	Label 206 Indicated Airspeed or Label 210 True Airspeed from ADC.

Table 1-16: BDS 0,9 Airborne Velocity Subtypes 3 & 4 – Airspeed and Heading (cont)

Bits	Parameter	Parameter Data	External Source(s)
36	Source of Vertical Rate	N/A BARO GEO	
37	Sign of Vertical Rate	+ -	
38-46	Vertical Rate	N/A Feet per minute	Blended Inertial Vertical Rate (Label 365) from selected NAV source or Barometric Vertical Rate (Label 212) from selected ADC source or Geometric Vertical Rate (165) from selected ADS-B Position Source
47-48	Reserved		
49	Difference Sign	+ -	
50-56	Difference from Geo and Baro Altitudes	Feet	Label 370 Height Above Ellipsoid (HAE) from GPS 1 or 2 (best HIL value) or Label 076 Geometric Altitude from GPS 1 or 2 (best HIL value) or Label 203 Baro Altitude from ADC.
NOTE: Subtype 3 is used when NS and EW velocities are Not valid and Airspeed is less than 1022 knots. Subtype 4 is used when NS and EW velocities are Not valid and Airspeed is greater than 1022 knots.			

Table 1-17: BDS 1,0 Data Link Capability

Bits	Parameter	Parameter Data	External Source(s)
1-8	BDS 1,0 Code		
9	Continuation Flag	0	
10-14	Reserved		
15	Overlay Command Capability	0 = No OCC 1 = Transponder has OCC	
16	Reserved for TCAS/ACAS		

Table 17: BDS 1,0 Data Link Capability (cont)

Bits	Parameter	Parameter Data	External Source(s)
17-23	Mode S Sub Network Version Number	0 = Mode S sub network not available 1-5 = Version No. 1-5 respectively 6-127 = Not Assigned	
24	Transponder Enhanced Protocol Indicator	0 = Level 2-4 1 = Level 5	
25	Mode S Specific Services Capability	0 = No services available 1 = At least 1 service is available and valid	
26-28	Uplink ELM Capability (Comm C)	NO UELM 16/5 ms 16/500 ms 16/250 ms 16/128 ms 16/60 ms 16/30 ms	
29-32	Downlink ELM Capability	NO DELM 4/15 8/15 16/15 16/500 ms 16/250 ms 16/125 ms	
33	Aircraft Identification Capability		
34	Squitter Capability Subfield (SCS)	0, 1	
35	Surveillance Identifier (SI)	0, 1	
36	Common Usage GICB Capability	0 1	
37-40	Reserved for ACAS		
41-56	DTE	YES NO	

Table 1-18: BDS 1,7 Common Usage GICB Capability

Bits	Parameter	Parameter Data	External Source(s)
1	0,5 Extended Squitter Airborne Position	0,5	
2	0,6 Extended Squitter Surface Position	0,6	
3	0,7 Extended Squitter Status	0,7	
4	0,8 Extended Squitter Identification and Category	0,8	
5	0,9 Extended Squitter Airborne Velocity	0,9	
6	0,A Extended Squitter Event Driven Information	0,A	
7	2,0 Aircraft Identification	2,0	
8	2,1 Aircraft Registration		
9	4,0 Aircraft Intention	4,0	
10	4,1 Next Way- Point Identifier		
11	4,2 Next Way- Point Position		
12	4,3 Next Way-Point Information		
13	4,4 Meteorological Routine Report		
14	4,5 Meteorological Hazard Report		
15	4,8 VHF Channel Report		

Table 1-18: BDS 1,7 Common Usage GICB Capability (cont)

Bits	Parameter	Parameter Data	External Source(s)
16	5,0 Track and Turn Report	5,0	
17	5,1 Position Coarse	5,1	
18	5,2 Position Fine	5,2	
19	5,3 Air-Referenced State Vector		
20	5,4 Way-Point 1		
21	5,5 Way-Point 2		
22	5,6 Way-Point 3		
23	5,F Quasi-Static Parameter Monitoring	5,F	
24	6,0 Heading and Speed Report	6,0	
25-56	Reserved		

Table 1-19: BDS 2,0 Aircraft Identification

Bits	Parameter	Parameter Data	External Source(s)
1-8	BDS Code 2,0		
9-14	Character 1	ICAO Character	Label 233 Flight Identifier from control panel, or Label 301 Tail Number from CDFIU.
15-20	Character 2	ICAO Character	Label 233 Flight Identifier from control panel, or Label 301 Tail Number from CDFIU.
21-26	Character 3	ICAO Character	Label 234 Flight Identifier from control panel, or Label 301 Tail Number from CDFIU.
27-32	Character 4	ICAO Character	Label 234 Flight Identifier from control panel, or Label 302 Tail Number from CDFIU.
33-38	Character 5	ICAO Character	Label 235 Flight Identifier from control panel, or Label 302 Tail Number from CDFIU.
39-44	Character 6	ICAO Character	Label 235 Flight Identifier from control panel, or Label 302 Tail Number from CDFIU.
45-50	Character 7	ICAO Character	Label 236 Flight Identifier from control panel, or Label 303 Tail Number from CDFIU.
51-60	Character 8	ICAO Character	Label 236 Flight Identifier from control panel, or Label 303 Tail Number from CDFIU.

Table 1-20: BDS 3,0 ACAS Active Resolution Advisory

Bits	Parameter	Parameter Data	External Source(s)
1-8	BDS Code 3,0 or 0,0	3,0 = TCAS Bus Valid 0,0 = TCAS Bus Invalid	
9-22	Active Resolution Advisories		
23-26	Resolution Advisory Compliment		
27	RA Terminated (RAT)	0 1	
28	Multiple Threat Encounter	0 1	
29-30	Threat Type Indicator (TTI)	0 1 2	
31-56	Threat Identity Data (TID)	Mode S Address of the threat	

Table 1-21: BDS 4,0 Selected Vertical Intent

Bits	Parameter	Parameter Data	External Source(s)
1	Status	N/A Available	
2-13	MCP/FCU Selected Altitude	N/A Feet	Label 102 Selected Altitude from MCP/FCU
14	Status	N/A Available	
15-26	FMS Selected Altitude	N/A Feet	Label 102 Selected Altitude from FMS.
27	Status	N/A Available	
28-39	Barometric Pressure Altitude	N/A	Label 203 Baro Alt or Label 234 Baro Alt Correction from ADC or else Label 273 Baro Pressure Setting Ref from MCP/ FCU.
40-47	Reserved		
48	Status of MCP/FCU Mode Bits		
49	Vertical Navigation(VNAV) Mode	YES NO	
50	Altitude Hold Mode	YES NO	
51	Approach Mode	YES NO	
52-53	Reserved		
54	Status of Target Altitude Source	YES NO	
55-56	Target Altitude Source	N/A UNKNOWN AIRCRAFT ALT FCU/MCP SEL ALT FMS SEL ALT	

Table 1-22: BDS 5,0 Track and Turn

Bits	Parameter	Parameter Data	External Source(s)
1	Status	N/A Available	
2	Sign	+ -	
3-11	Roll Angle	Degrees	Label 325 Roll Angle from IRS.
12	Status	N/A Available	
13	Sign	+ -	
14-23	True Track Angle	Degrees	Label 103 True Track Angle from GPS or else Label 313 True Track Angle from IRS.
24	Status	N/A Available	
25-34	Ground Speed	Knots	Label 112 Ground Speed from GPS or else Label 312 Ground Speed from IRS.
35	Status	N/A Available	
36	Sign	+ -	
37-45	Track Angle Rate	Degrees per second	Label 335 Track Angle Rate from IRS.
46	Status	N/A Available	
47-56	True Airspeed	Knots	Label 210 True Airspeed from ADC.

Table 1-23: BDS 6,0 Heading and Speed

Bits	Parameter	Parameter Data	External Source(s)
1	Status	NA Available	
2	Sign	East West	
3-12	Magnetic Heading	Degrees	Label 320 Magnetic Heading from IRS or FMS.
13	Status	NA Available	
14-23	Indicated Airspeed	Knots	Label 206 Indicated Airspeed from ADC.
24	Status	NA Available	
25-34	MACH	MACH Number	Label 205 MACH from ADC.
35	Status	NA Available	
36	Sign	+ -	
37-45	Barometric Altitude	Feet per minute	Label 212 Barometric Rate from ADC.
46	Status	NA Available	
47-	Sign	+ -	
48-56	Inertial Vertical Velocity	Feet per minute	Label 365 Inertial Vertical Velocity from IRS or FMS.

Table 1-24: BDS 6,1 Extended Squitter, Emergency/Priority Status

Bits	Parameter	Parameter Data	External Source(s)
1-5	Type Code	28	
6-8	Subtype Code	1	
9-11	Emergency/Priority Status	0-7	
12-24	Mode A Code		Label 016 from Control Panel
25-56	Reserved		

Table 1-25: BDS 6,2 Extended Squitter, Target State and Status

Bits	Parameter	Parameter Data	External Source(s)
1-5	Type Code	29	
6-7	Subtype Code	1	
8	SIL Supplement	0, 1	
9	Selected Altitude Type	0, 1	
10-20	Selected Altitude	0 – 2047	Label 102 Selected Altitude from MCP/FCU or FMS
21-29	Barometric Altitude	0 – 511	Label 234 Baro Correction (mb) #1 or Label 236 Baro Correction (mb) #2
30	Selected Heading Status	0, 1	
31	Selected Heading Sign	0, 1	
32-39	Selected Heading		Label 101 from MCP/FCU or FMS
40-43	NAC_P	0-11	Label 247 Horizontal Figure of Merit
44	NIC_{BARO}	0, 1	
45-46	SIL	0-3	Label 120 GNSS Latitude Fine, Label 121 GNSS Longitude, Fine
47	Status of MCP/FCU Modes	0, 1	
48	Autopilot Engaged	0	
49	VNAV Mode	0	
50	Altitude Hold	0	
51	Reserved		
52	Approach Mode	0	
53	TCAS Operational	0, 1	Label 274 from TCAS
54	LNAV Mode	0	
55-56	Reserved		

Table 1-26: BDS 6,5 Extended Squitter, Aircraft Operational Status, Airborne

Bits	Parameter	Parameter Data	External Source(s)
1-5	Type Code	31	
6-8	Subtype Code	0 ,1	
9-10	CC Type	0, 1	
11	TCAS Operational	0, 1	Label 274 from TCAS
12	1090ES In	0, 1	
13-14	Reserved		
15	ARV	0, 1	
16	TS	0, 1	
17-18	TC	0-3	
19	UAT In	0, 1	
20-24	Reserved		
25-26	OM Type		
27	TCAS RA Active	0, 1	Label 270 TCAS RA or Label 273 TCAS RA
28	Ident Active	0, 1	Label 016 ATC Control
29	Reserved		
30	Single Antenna Flag	0, 1	
31-32	SDA	0-3	
33-40	Reserved		
41-43	Version Number	0-2	
44	NIC Supplement A	0-11	Label 130 GPS HIL
45-48	NAC_P	0-11	Label 247 Horizontal Figure of Merit
49-50	GVA	0-3	Label 136 Vertical Figure of Merit
51-52	SIL	0-3	Label 120 GNSS Latitude Fine, Label 121 GNSS Longitude, Fine
53	NIC_{BARO}	0, 1	
54	HRD	0, 1	
55	SIL Supplement	0, 1	
56	Reserved		

Table 1-27: BDS 6,5 Extended Squitter, Aircraft Operational Status, Surface

Bits	Parameter	Parameter Data	External Source(s)
1-5	Type Code	31	
6-8	Subtype Code	0 ,1	
9-10	CC Type	0, 1	
11	Reserved		
12	1090ES In	0, 1	
13-14	Reserved		
15	B2 Low	0, 1	
16	UAT In	0, 1	
17-19	NAC_V	0-3	Label 145 Horizontal Velocity Figure of Merit
20	NIC Supplement C	0, 1	Label 130 GPS HIL
21-24	Length/Width Codes	0-15	
25-26	OM Type		
27	TCAS RA Active	0, 1	Label 270 TCAS RA or Label 273 TCAS RA
28	Ident Active	0, 1	Label 016 ATC Control
29	Reserved		
30	Single Antenna Flag	0, 1	
31-32	SDA	0-3	
33-40	GPS Antenna Offset	0 ,	
41-43	Version Number	0-2	
44	NIC Supplement A	0-11	Label 130 GPS HIL
45-48	NAC_P	0-11	Label 247 Horizontal Figure of Merit
49-50	Reserved		
51-52	SIL	0-3	Label 120 GNSS Latitude Fine, Label 121 GNSS Longitude, Fine
53	Track Angle/Heading	0 = Track Angle 1 = Valid Heading	
54	HRD	0 = True 1 = Mag	Type of heading in BDS 0,9

Table 1-27: BDS 6,5 Extended Squitter, Aircraft Operational Status, Surface (cont)

Bits	Parameter	Parameter Data	External Source(s)
55	SIL Supplement	0, 1	
56	Reserved		

D. Mode S Message Format and Data Field Definition

Refer to RTCA DO-181E, DO-185B, DO-218B, and DO-260B for further details of Mode S Message Formats and Field definitions.

Table 1-28 defines the Mode S interrogation UF (Uplink Format) messages and Table 1-29 defines the Mode S reply DF (Downlink Format) messages. The first 5 bits of the message indicate the UF/DF type. The message structure including the number of bits per subfield is included in Table 1-28 and Table 1-29. For example, UF=0 [Binary 00000] is composed of X:3 (3 bits assigned as padding), RL:1 (1 bit assigned to Reply Length) etc. The Uplink Format message field descriptions are listed in Table 1-30 and the Downlink Format message field descriptions are listed in Table 1-31.

Table 1-28: Uplink Format Messages

Uplink Format		Field Description	Message Format with Number of Bits
UF=0	[00000]	Short Air-Air Surveillance	X:3, RL:1, X:4, AQ:1, DS:8, X:10 AP:24 X:Pad
UF=4	[00100]	Surveillance, Altitude Request	PC:3, RR:5, DI:3, SD:16, AP:24
UF=5	[00101]	Surveillance, Identity Request	PC:3, RR:5, DI:3, SD:16, AP:24
UF=11	[01011]	Mode S Only All-Call	PR:4, II/IC:4, CL:3, X:16, AP:24 X:Pad
UF=16	[10000]	Long Air-Air Surveillance	X:3, RL:1, X:4, AQ:1, X:18, MU:56, AP:24 X:Pad
UF=20	[10100]	Comm-A, Altitude Request	PC:3, RR:5, DI:3, SD:16, MA:56, AP:24
UF=21	[10101]	Comm-A, Identity Request	PC:3, RR:5, DI:3, SD:16, MA:56, AP:24

NOTE: PC, RR, DI, and SD subfields are undefined for UF=20/21 broadcast interrogations.

Table 1-29: Downlink Format Messages

Downlink Format	Field Description	Message Format with Number of Bits
DF 0 [00000]	Short Air-Air Surveillance	VS:1, CC:1, X:1, SL:3, X:2, RI:4, X:2, AC:13, AP:24 X:Pad
DF 4 [00100]	Surveillance, Altitude Reply	FS:3, DR:5, UM:6, AC:13, AP:24
DF 5 [00101]	Surveillance, Identity Reply	FS:3, DR:5, UM:6, ID:13, AP:24
DF 11 [01011]	All-Call Reply	CA:3, AA:24, PI:24
DF 16 [10000]	Long Air-Air Surveillance	VS:1, X:2, SL:3, X:2, RI:4, X:2, AC:13, MV:56, AP:24 X:Pad
DF 17 [10001]	Extended Squitter (ADS-B)	CA:3, AA:24, ME:56, PI:24
DF 20 [10100]	Comm-B, Altitude Reply	FS:3, DR:5, UM:6, AC:13, MB:56, AP:24
DF 21 [10101]	Comm-B, Identity Reply	FS:3, DR:5, UM:6, ID:13, MB:56, AP:24

Table 1-30: Uplink Format Fields

Designator	Field	Description
AP	Address Parity	24-bit discrete address with parity check bits overlaid
AQ	Acquisition	Designates formats UF=0, 16 as acquisition transmissions or non-acquisition.
CL	Code Label	Identifies the contents of the IC field
DI	Designator Identification	Identifies the coding contained in the SD field
DS	COMM-B Data Selector	Contains the identity of the ground-initiated COMM-B register
IC	Interrogator Code	Contains either the II Code or SI Code
II	Interrogator Identification	Identifies the interrogator
MA	Message COMM-A	56-bit uplink field contains messages directed to the aircraft
MU	Message COMM-U	56-bit uplink field contains information used in air-to-air exchanges part of the long special surveillance interrogation
NC	Number of C Segments	Number of segments transmitted in ELM mode and part of a COMM-C interrogation
PC	Protocol	Operating commands to the transponder

Table 1-30: Uplink Format Fields (cont)

Designator	Field	Description
PR	Probability of Reply	Contains commands to the transponder which specify the reply probability to the Mode S only All-Call interrogations
RC	Reply Control	Designates the transmitted segment as initial, intermediate or final
RL	Reply Length	Commands a reply of DF 0 Short Message or DF 16 Long Message
RR	Reply Request	Contains length and content of the reply requested by the interrogators
SD	Special Designator	Contains control codes affecting transponder protocol
SI	Surveillance Identifier	Defines the surveillance identifier code

Table 1-31: Downlink Format Fields

Designator	Field	Description
AA	Address Announced	Contains the aircraft address
AC	Altitude Code	Field contains the aircraft altitude
AP	Address Parity	24-bit field contains the parity overlaid on the address
CA	Transponder Capability	Reports transponder communication capability
CC	Crosslink Capability	Indicates the transponder's ability to support crosslink capability
DR	Downlink Request	Requests extraction of downlink messages from the transponder by the interrogator
FS	Flight Status	Reports flight status of the aircraft
ID	Identification	Contains the Mode A identification code reporting the numbers as set by the pilot
MB	Message COMM-B	56-bit MB field contains messages transmitted to the interrogator
ME	Message Extended Squitter	56-bit downlink field used to broadcast messages
MV	Message COMM-V	Contains information used in air-to-air exchanges and is part of the long special surveillance reply

Table 1-31: Downlink Format Fields (cont)

Designator	Field	Description
PI	Parity/Interrogator Identity	24-bit field contains the parity overlaid on the interrogator's identity code
RI	Reply Information	4-bit field reports airspeed capability and the type of reply to the interrogating aircraft
SL	TCAS Sensitivity Level	This field reports the sensitivity level at which the TCAS unit is currently operating
UM	Utility Message	Contains the transponder status readouts
VS	Vertical Status	Reports the aircraft airborne or on-ground state

7. System Software Upload/Fault Log Download

The NXT-600 Mode S/ADS-B Transponder has a RJ-45 connector on its front panel. This connector provides a means to connect to the WebEDDIT software for Software Loading and Maintenance.

The following functions are supported by the RJ-45 interface:
- Operational Software Upload
- Fault Log Download.
- Software Part Number Verification

A. Software Program Description and Configuration

The NXT-600 transponder's part number contains a 5-digit dash number (9006000-XXYYY). The first two digits (XX) correspond to the unit's hardware configuration and functionality. The last three digits (YYY) correspond to the operational software load in the unit. The unit's label also has a separate hardware and software modification status table. Changes to the boot software are reflected by a change to either the hardware portion of the dash number or the hardware modification status. Changes to the operational software are reflected by a change to either the software portion of the dash number or the software modification status.

Once software is loaded into the transponder, it is necessary to verify that the correct software version is loaded in the unit and that the unit's label is remarked with the correct part number or modification status. The transponder's operational product software part number uniquely identifies the software load. The following methods may be used to verify that the correct software part number has been loaded.

- If the aircraft is configured with an ACSS TCAS Computer Unit 4066010-905 or higher dash number, or an ACSS 7517900-XXXXX and an ACSS 4067241-XXX VSI/TRA, or a Thales 457400XX-1900, -1901, or -2000 dash number VSI/TCAS unit, the software part number is displayed on the extended test maintenance pages.

- If the aircraft contains an OMS that is connected to the transponder, the software part number may be displayed on a Multifunction Control Display Unit (MCDU) controller for the OMS system.
- The software part number may be displayed by connecting a PC with the WebEDDIT software to the RS-232 port on the transponder's front panel RJ-45 DATA LOADER connector.

B. WebEDDIT Interface Description

RS-232 PC Interface Description

The RJ-45 connector contains an RS-232 input and output bus interface that may be connected to a standard serial port on a PC. The RS-232 bus has a Baud Rate of 115,200 Baud, a data size of 8 data bits with 1 stop bit and no parity. ACSS WebEDDIT software can be used to perform all data transfer functions.

The transponder then expects the software to be transferred in blocks using an XMODEM 1K communication protocol. The protocol allows for error detection and block re-transmission during block transfer operations. After a successful software load is completed, the XPDR PASS indicator on the transponder's front panel is on. A failed load is annunciated by the XPDR FAIL indicator on the front panel.

The fault log is downloaded by issuing a WebEDDIT download command through the RJ-45 port. The fault log is then downloaded through an ASCII file transfer.

The WebEDDIT software can capture the data and write it to a file for analysis.
The software part number for the software that is loaded in the unit can be displayed on the WebEDDIT software. The command displays the part number for the boot and operational programs, as well as CRCs, the unit part number, and unit serial number.
See Table 1-32 for WebEDDIT user interface commands.

Table 1-32: WebEDDIT User Commands

Test	Input	Output
Software CRC	CR	BOOT xxxx OPER xxxx DL xxxx XIC xxxx
Unit Part Numbers	PN	BOOT S/W x..x OPER S/W x..x DL S/W x..x XIC F/W x..x COMPAT NUM x..x UNIT H/W x..x UNIT SER x..x
Start Software Upload (on ground only)	UL	None if the command succeeded, otherwise an appropriate error message is displayed.
Start download of maintenance log	DL	Maintenance Log Downloaded

Table 1-32: WebEDDIT User Commands

Test	Input	Output
Start Data Output for Recording	DR	ARINC, Extended Squitter, and Discrete Data
Stop Data Output for Recording	"ESC" key	
Display Configuration Data	DC	CONFIG VALID *Note: For Valid Configurations* **** CONFIG INVALID **** *Note: For Invalid Configurations* GPS ANT OFF = d AC L/W = d *Note: (Display LSB-MSB)* NACV = d SDA = d ADS-B FAIL DISABLE = d AC CAT = d PARITY = d *Note: Validity* ADS-B RCV CAP = d VFOM ADJ = d SDI = d BARO CORRECT/ALT TYPE = d TAS = d MODE S ADDR =aaaaaa ANT CBL DELAY = d ANT BITE/RMS 555/GAMA = d
Invalid command	any not listed above (including a blank line)	"INVALID COMMAND"

8. Software Data Uploading and Part Number Verification Procedures

The following paragraphs give the methods and procedures to do a software upload and verification that the upload was performed correctly. Prior to uploading software, verify the current Operational software loaded on the transponder unit. Refer to Software Part Number Verification procedures described in this section. Doing this will help compare the Part Numbers before and after the new software upload.

A. Software Loading Using a Stand-Alone PC with WebEDDIT

Verify the updated software part number using a stand-alone PC with WebEDDIT according to the following procedure:

1) Obtain WebEDDIT software Part No. 9000679-007 or later and install the software on the PC.

2) Obtain a commercially available RJ-45 to serial cable.

3) Shut off the PC.

4) Remove power from the NXT-600 Transponder.

5) Connect the serial cable from the PC to the RJ-45 front connector on the NXT-600 Transponder.

6) Apply power to the NXT-600 Transponder.

7) Power on the PC to Microsoft Windows operation.

8) Select WebEDDIT maintenance tool from the desktop.

9) Select “Connect with NXT Transponder” from the Menu Page.

10) Select “Select Upload File” Button

11) Choose the location of the software file to be loaded

12) Click “Open”

13) Select “Upload OP S/W File (UL)”

14) Once upload has completed and NXT has restarted, perform steps 10-16 in section B below.

B. Software Verification Using a Stand-Alone PC with WebEDDIT

Verify the updated software part number using a stand-alone PC with WebEDDIT according to the following procedure:

1) Obtain WebEDDIT software Part No. 9000679-007 or later and install the software on the PC.

2) Obtain a commercially available RJ-45 to serial cable.

3) Shut off the PC.

4) Remove power from the NXT-600 Transponder.

5) Connect the serial cable from the PC to the RJ-45 front connector on the NXT-600 Transponder.

6) Apply power to the NXT-600 Transponder.

7) Power on the PC to Microsoft Windows operation.

8) Select WebEDDIT maintenance tool from the desktop.

9) Select “Connect with NXT Transponder” from the Menu Page.

10) Select “Part Number”.

11) Verify displayed part numbers match what was loaded.

12) Select “S/W CRC”.

13) Verify S/W CRC’s match what was loaded.

14) Shut down the PC and remove power.

15) Remove power from the NXT-600 Transponder.

16) Disconnect the RJ-45 cable from the front connector on the NXT-600 Transponder.

9. Fault Log Downloading Procedures

Fault log downloading procedures are used for saving the contents of fault memory for analysis at a later time, or for aircraft maintenance personnel. Downloading the fault log has no effect on the operational software load.

A. Fault Log Downloading Using a Stand-Alone PC with WebEDDIT

Verify the updated software part number using a stand-alone PC with WebEDDIT according to the following procedure:

1) Obtain WebEDDIT software Part No. 9000679-007 or later and install the software on the PC.
2) Obtain a commercially available RJ-45 to serial cable.
3) Shut off the PC.
4) Remove power from the NXT-600 Transponder.
5) Connect the serial cable from the PC to the RJ-45 front connector on the NXT-600 Transponder.
6) Apply power to the NXT-600 Transponder.
7) Power on the PC to Microsoft Windows operation.
8) Select WebEDDIT maintenance tool from the desktop.
9) Select “Connect with NXT Transponder” from the Menu Page.
10) Select “Dump BITE Log (DL)”.
11) Locate BITE Log file in WebEDDIT_SESSIONS folder on C: drive.
12) Provide to ACSS Customer Service for analysis.
13) Shut down the PC and remove power.
14) Remove power from the NXT-600 Transponder.
15) Disconnect the RJ-45 cable from the front connector on the NXT-600 Transponder.

10. Mode S/ADS-B Configuration Verification Procedures

Mode S/ADS-B Configuration Verification procedures are used for ensuring the installation specific aircraft parameters are set correctly via the strapping/strobing aircraft wiring.

A. Configuration Verification Using a Stand-Alone PC with WebEDDIT

Verify the configuration strapping/strobing using a stand-alone PC with WebEDDIT according to the following procedure:

1) Obtain WebEDDIT software Part No. 9000679-007 or later and install the software on the PC.
2) Obtain a commercially available RJ-45 to serial cable.
3) Shut off the PC.

4) Remove power from the NXT-600 Transponder.

5) Connect the serial cable from the PC to the RJ-45 front connector on the NXT-600 Transponder.

6) Apply power to the NXT-600 Transponder.

7) Power on the PC to Microsoft Windows operation.

8) Select WebEDDIT maintenance tool from the desktop.

9) Select “Connect with NXT Transponder” from the Menu Page.

10) Select “Dump Config (DC)”

11) Verify configuration settings match installation requirements

12) Shut down the PC and remove power.

13) Remove power from the NXT-600 Transponder.

14) Disconnect the RJ-45 cable from the front connector on the NXT-600 Transponder.

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MECHANICAL INSTALLATION

1. General

This section contains information on how and where to mount each component of the NXT-600 Mode S/ADS-B Transponder System. For new installations, plan the installation in two stages. First, determine the location of the line replaceable units (LRU) in the aircraft. Next, determine the length of RF and electrical interconnections for the selected locations.

2. Equipment and Materials

For new transponder installations, refer to Table 1-1 for Mounting Tray information. For all other components, refer to the applicable Outline and Installation Diagram in this section for mounting and mating connector information.

Refer to the Aircraft Maintenance Manual (AMM) for materials necessary to install the omnidirectional antennas.

3. Mechanical Installation Design

A. Transponder Provisions

Mechanical installation data for the NXT-600 Mode S/ADS-B Transponder is shown in Figure 2-1. The transponder can be mounted in any convenient location in the aircraft. The exact location should allow the cabling between the unit, control panel, and antennas to be as short as possible.

This unit is mounted in an MT-600 Mounting Tray, ACSS Part No. 9516000-001.
Locate the mounting tray to allow adequate space for installation of the transponder and provide reasonable accessibility for servicing. Allow space on the top, sides, and rear of the transponder for adequate ventilation. Provide a solid mechanical mount to prevent vibration amplification. In addition, the location must provide protection from rain, condensation, solvents, and hydraulic fluid.
Electrically bond the mounting tray to the aircraft airframe by a low resistance path of less than 2.5 milliohms.

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NOTES: (UNLESS OTHERWISE SPECIFIED):

1. UNIT WEIGHT:
   UNIT PART NUMBER 9006000-55XXX (28 VOLT DC UNIT)
   NOMINAL 5.10±0.10 POUNDS (2.31±0.05 KILOGRAMS).
   UNIT WEIGHT:
   UNIT PART NUMBER 9516000-001 (MOUNTING TRAY)
   NOMINAL 1.19±0.02 POUNDS (0.54±0.01 KILOGRAMS)

2. WHEN INSTALLING, MOUNT ON A FLAT SURFACE WHERE THUMBNUTS CANNOT DROP BELOW HOOK (SEE DETAIL F, SHEET 2)
   USE SPACER KIT 7510351-901 TO ALLOW REMOVAL OF UNIT FROM MOUNTING TRAY.

3. TO ASSURE PROPER GROUNDING OF THIS SYSTEM, THE AIRCRAFT SURFACE TO WHICH ALL MOUNTINGS OR UNITS ARE ATTACHED MUST BE CLEAN BARE METAL. MOUNT TO AIRCRAFT RESISTANCE SHALL BE 2.5 MILLIOHMS MAX. WITHOUT WIRING INSTALLED.

4. =DENOTES APPROXIMATE CENTER OF GRAVITY.

5. FOR ASSEMBLIES, KITS AND ACCESSORIES SEE:
   9516000-001 MOUNTING TRAY ASSEMBLY, NXT-600
   7510359-910 CONNECTOR KIT, ARINC 404

6. UNIT FINISH: CHEM FILM TREATED OVER BARE ALUMINUM.

7. CONNECTOR J1 MUST FLOAT. ALLOW 6 INCHES MIN OF CABLE LENGTH FROM REAR OF CONNECTOR J1 TO ANY CABLE CLAMPING DEVICE.

8. THE INDIVIDUAL RF CABLES BETWEEN THE ANTENNA AND THE TRANSPONDER UNIT (INCLUDING CONNECTORS) SHALL HAVE A NOMINAL CHARACTERISTIC IMPEDANCE OF 50 OHMS WITH A TOTAL INSERTION LOSS OF 2±1dB OVER THE 1030 TO 1090 MHz FREQUENCY BAND.

   THE FOLLOWING TABLE SHOULD BE USED FOR MINIMUM/MAXIMUM TRANSPONDER CABLE LENGTHS FOR A GIVEN TYPE OF CABLE. THE PROPEGATION DELAY FACTOR IN NANO-SECONDS PER FOOT IS USED FOR DIVERSITY TRANSPONDER INSTALLATIONS:

CABLE TYPE	CABLE LENGTH (FEET)		PROPEGATION DELAY FACTOR (NSEC/FOOT)
	MIN	MAX	
RG-142/U	7	16	1.47
RG-214/U	10	25	1.54
RG-218/U	26	60	1.54
RG-225/U	13	34	1.47
RG-393/U	13	34	1.47

9. FOR TRANSPONDER INSTALLATIONS WHICH REQUIRE DIVERSITY ANTENNAS, THE FOLLOWING REQUIREMENTS APPLY.

   A. THE DISTANCE BETWEEN TOP AND BOTTOM ANTENNAS ON THE HORIZONTAL PLANE SHALL NOT EXCEED 25 FEET (7.6 METERS).
   B. THE LENGTHS OF THE TOP AND BOTTOM ANTENNA CABLES SHALL BE MATCHED SO THAT THE DIFFERENCE BETWEEN THE MEAN REPLY DELAYS OF SIGNALS AT THE TOP AND BOTTOM ANTENNAS SHALL NOT EXCEED 50 NANO-SECONDS. THE REPLY DELAY IS THE TIME BETWEEN THE INTERROGATION AND REPLY AS MEASURED AT THE ANTENNA OR THE ANTENNA END OF THE TRANSPONDER TO ANTENNA CABLE. DIFFERENCES IN THE ANTENNA CABLE DELAY MAY BE COMPENSATED BY ANTENNA CABLE PROGRAM PIN J1-67.

10. DIMENSIONS ARE IN INCHES.

11. INFORMATION CONTAINED IN THIS DRAWING IS INTENDED FOR INSTALLATION USE ONLY. IT IS NOT TO BE USED FOR DESIGN OR MANUFACTURING PURPOSES.

Figure 2-1: (Sheet 1): NXT-600 Mode S Transponder Outline and Installation Diagram

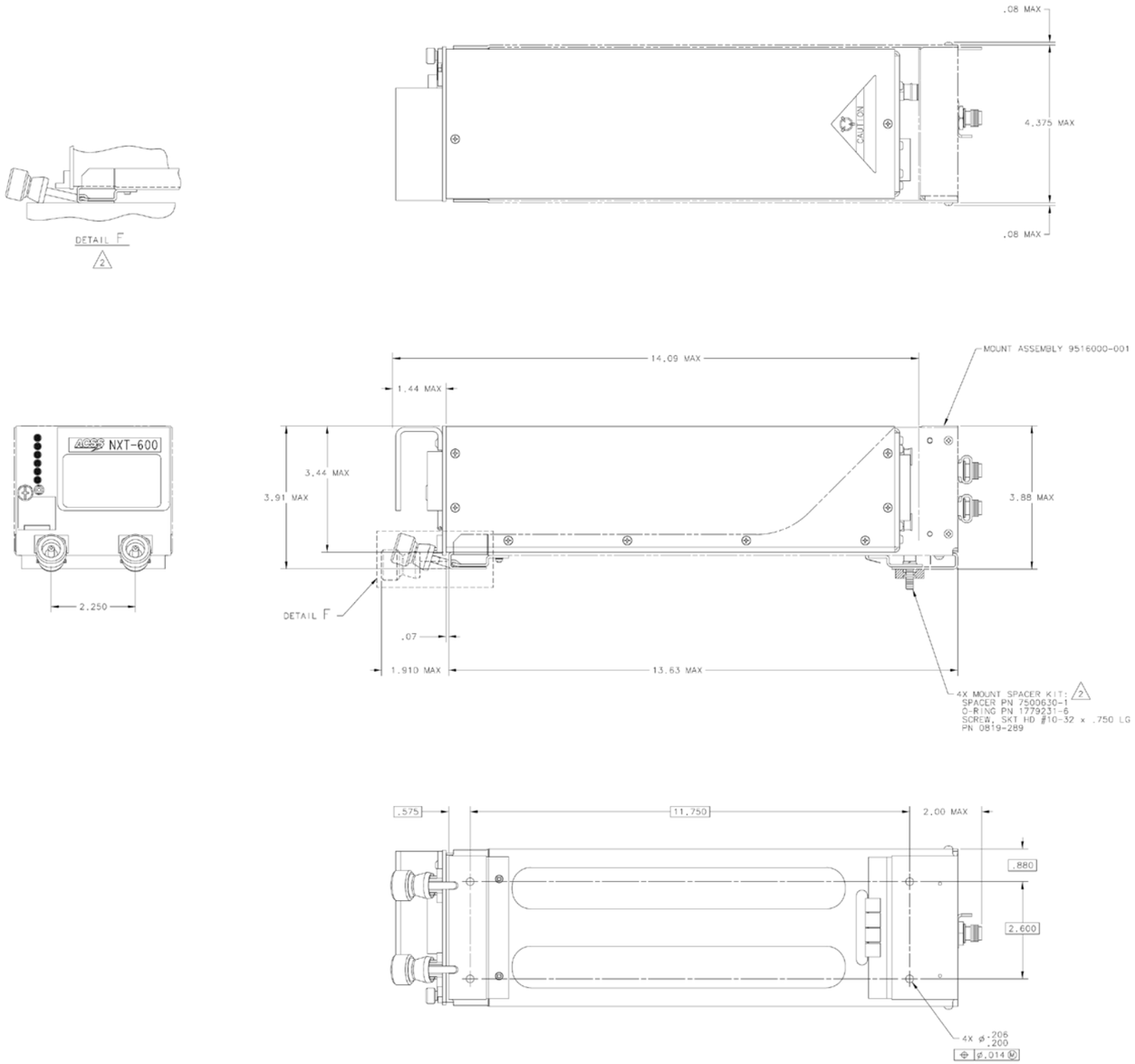

Figure 2-1: (Sheet 2) NXT-600 Mode S Transponder Outline and Installation Diagram

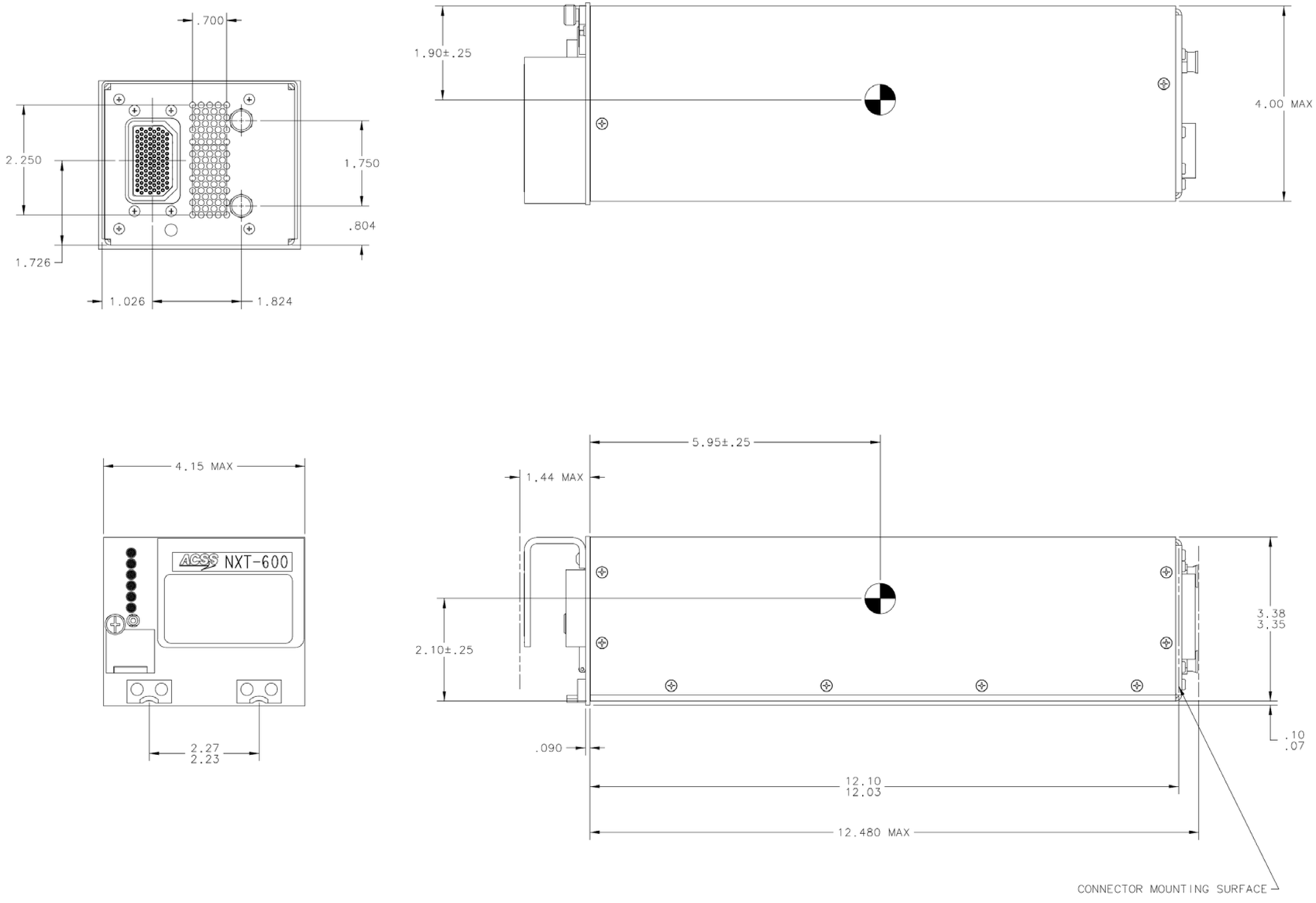

Figure 2-1: (Sheet 3) NXT-600 Mode S Transponder Outline and Installation Diagram

B. Controller Provisions

An illustration of the mechanical installation data for the ACSS Control Panel is shown in Figure 2-2. The Control Panel can be purchased in either a dual Mode S transponder configuration (when two Mode S transponders are to be included in the installation) or a Mode S/ATCRBS configuration (when only one of the existing ATCRBS transponders is to be replaced).

Various types of controllers (Radio Management Units or FMS Controllers) can also be used to control the transponder. The Gables G7491 is a dedicated Flight ID control panel that can be added to meet ELS requirements without replacing the existing ATC/TCAS control panel. Refer to that particular unit's Installation Manual for installation data.

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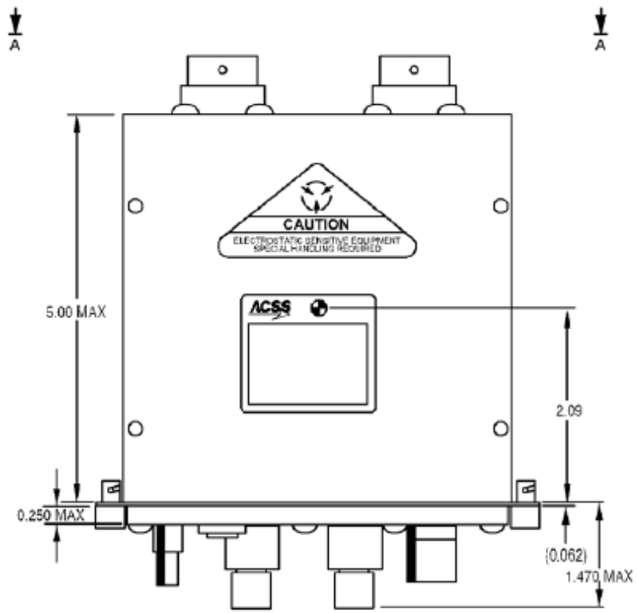
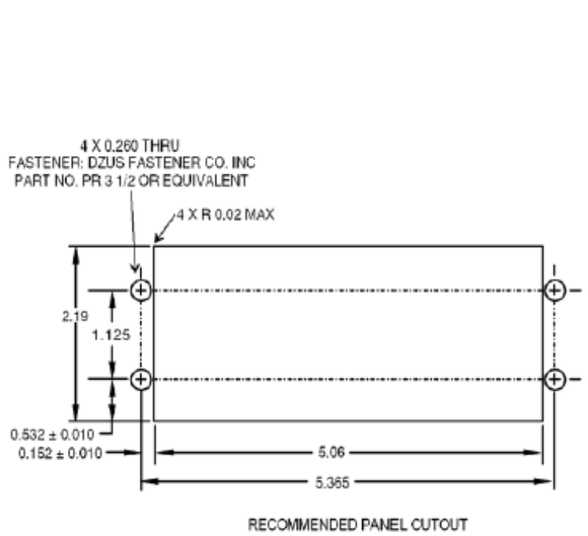
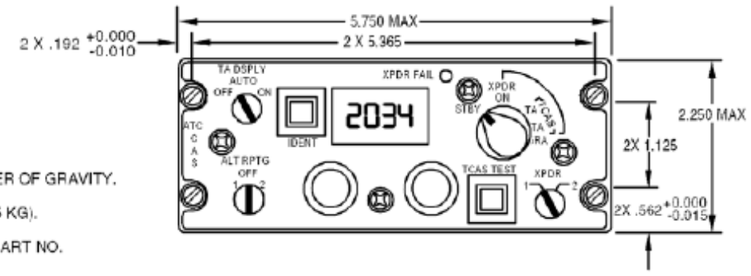
METRIC CONVERSION TABLE	
INCHES	MILLIMETERS
0.010	0.254
0.015	0.380
0.020	0.519
0.030	0.769
0.062	1.575
0.152	3.861
0.192	4.877
0.250	6.350
0.375	9.530
0.532	13.510
0.562	14.280
1.040	26.416
1.110	28.190
1.125	28.575
1.240	31.486
1.470	37.340
2.050	53.050
2.125	53.980
2.190	55.626
2.250	57.150
2.500	63.500
2.510	63.750
5.000	127.000
5.060	128.524
5.365	163.271
5.750	146.050







NOTES:
1. ⊕ DENOTES APPROXIMATE CENTER OF GRAVITY.
2. MAXIMUM UNIT WEIGHT 2.1 LB (0.95 KG).
3. THIS DRAWING APPLIES TO ACSS PART NO. 4052190-902,-904,-906,-908.
4. DIMENSIONS ARE IN INCHES. SEE METRIC CONVERSION TABLE FOR CORRESPONDING DIMENSIONS IN MILLIMETERS.

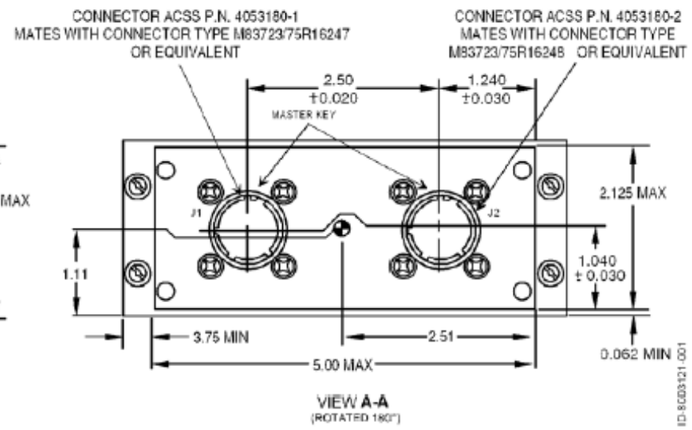


Figure 2-2: ACSS Control Panel (Dual Mode S Outline and Installation Diagram)

C. Transponder Antenna Provisions

When installing the transponder antennas, a TSO-C112 antenna should be selected. The antenna must be vertically polarized and operate in the frequency range of 960 to 1220 MHz. Antenna impedance must be 50 ohms. Selection of a grounded or lightning-protected type antenna is required to pass the transponder bite continuity detection circuitry, if enabled.

In dual transponder antenna installations, it is important to provide adequate isolation from each other to prevent receiver front-end damage. A 30-inch desired, 20-inch minimum, separation of Mode S antennas from other L-band antennas (including TCAS antennas) must be maintained. The maximum cable length for RG-214/U is 30 feet (9.144 meters). Allow adequate cable length so bends in the cable have a minimum 3-inch (76 mm) radius. Selection of coax cable assemblies with moisture barrier protection is highly recommended to minimize the effects of humidity and corrosion.

When air traffic control (ATC) antennas are installed, the mounting area must provide a solid mechanical base for the antenna and clearance for the connector. A doubler plate is usually required when the antenna is mounted on an unsupported large fuselage area. The aircraft structure should never be weakened for the sake of a good location. Refer to the aircraft manufacturer's specifications; reinforcements for antennas are often built into the aircraft structure.

Doubler plates or shims (if used) must be metallic and shaped to interface the antenna base with the contour of the aircraft fuselage. All antenna installations should be in accordance with the manufacturer's installation instructions.

A weather sealing compound should be applied around the perimeter of the antenna base to prevent seepage of water and condensation, and to prevent corrosion. If a sealant or aerodynamic smoother is used, it should be applied after the antenna has been secured to the fuselage.

D. Antenna Coaxial Cable Requirements

RG-214/U was the classic coaxial cable for transponder applications. However, new technology coaxial cables are now available that have less signal attenuation per foot, are smaller in diameter, have a smaller bending radius, weigh less, and are less flammable.

It is very important that the connectors are correctly installed on the cable to ensure reliable performance. For this reason, ACSS recommends that installers purchase antenna cable assemblies, with connectors attached, from reputable cable specialty suppliers. The cable assemblies are tested for loss and Voltage Standing Wave Ratio (VSWR) at the operating frequency to ensure proper operation.

Diversity transponder antenna cables have the following requirements:

- The individual RF cables between the antenna and the transponder mounting tray (including connectors) must have a nominal characteristic impedance of 50 ohms with a total insertion loss of 2.0 ±1.0 dB at 1030 MHz.
- Maximum antenna cable length is 30 feet.

- Top and bottom antenna cable lengths do not have to be equal in length. However, the distance between top and bottom antennas on the horizontal plane cannot exceed 25 feet (7.6 meters).
- Coaxial cable must be double shielded.
- A male equivalent of the antenna connector must be attached to the antenna end and a TNC coax connector must be attached to the transponder mounting tray end.

E. Aircraft Configuration Requirements

The NXT-600 Mode S/ADS-B Transponder has 14 Mode S and 11 ADS-B configuration pins that must be set to either OPEN, GROUND or 1 of 6 STROBE states specific to each aircraft. One means of accomplishing this requirement is to use a remotely located, 32 pin or more, connector. Refer to the aircraft AMM/IPL for an approved connector series to be used. Refer to Section 4 Loading/Gradient of this SDIM for a definition of these pins.

ELECTRICAL INSTALLATION

1. General

This section gives electrical installation procedures, power distribution, and interconnect information for each component of the NXT-600 Mode S/ADS-B Transponder System installation.

2. Equipment and Materials

Refer to the Outline and Installation Diagrams in Section 2 for mating connector part number information when doing a new installation.

3. Electrical Installation Procedure

The information necessary to supply the electrical interconnects is shown in Table 3-1 and Table 3-2. Refer to Section 4, Loading/Gradient Specifications, for a list of all the signal names used in the interconnect diagrams and tables.

NOTE: Refer to ACSS Technical Newsletter 8001227-001, Rev 1 if antenna BITE program implementation is required for functionality.

4. Electrical Installation

A. NXT-600 Mode S/ADS-B Transponder

The various installation options require different electrical connections as described on the interconnect diagram and the paragraphs that follow.

The transponder uses air data supplied in one of the following formats:

ARINC 429/575 Air Data

- J1-32/33
- J1-46/47

Air data from one of these source types must be connected to the transponder.

All Mode S transponders require a unique 24-bit code (Mode S address) that is assigned to each aircraft. The aircraft Mode S (ICAO) address for US (**N**) registered can be obtained from the Federal Aviation Administration, Mike Monroney Aeronautical Center, Aircraft Registration Information, AVN-450, PO Box 25082, Oklahoma City, OK 73125, Telephone: (405) 680-3116.

If the aircraft is registered in a country other than the United States, contact the aviation authority of the country in which the aircraft is registered.

The Mode S address is usually issued as an 8-digit octal number. To strap the address code correctly, each digit must be converted to a corresponding binary number. (For example: 7 octal = 111 binary, 1 octal = 001 binary.)

Once the 8-digit octal code is converted to a 24-bit binary number, the address pins must be grounded, left open, or strobed according to this binary number representation. Refer to Section 4, Loading/Gradient Specifications for a definition of these settings.

An example of an octal code number being converted to a binary number is shown below:

Octal address code = 1 2 3 4 5 6 7 0

In binary this number is: (MSB) 001 010 011 100 101 110 111 000 (LSB)

The assignment of the correct Mode S address is CRITICAL to the proper operation of the ATC System. If dual Mode S transponders are installed, both transponders must be programmed to the same Mode S address.

The transponder also uses programming pins to select or deselect various functions and settings for Mode S and ADS-B functionality. Refer to Section 4, Loading/Gradient Specifications section to determine applicable installation wiring.

Where more than one pin is shown for 28 volts input, these pins should be connected in parallel. Also, handle dc ground in the same manner.

Table 3-1: NXT-600 Mode S/ADS-B Transponder Interconnect Data

I/O	Description	Connector Pin	Connects To	Notes
	Spare	J1-1		
	Spare	J1-2		
I/O	Mutual Suppression	J1-3 (22) ----S ------S------- | | GND GND	L-Band Suppression Bus	1
(I)	ADS-B Receive Capability	J1-4 (22)----------	Gnd/Open/Strobe	4
(I)	A/V Length/Width A	J1-5 (22)----------	Gnd/Open/Strobe	4
(I)	A/V Length/Width B	J1-6 (22)----------	Gnd/Open/Strobe	4
(I)	XPDR +28 V RTN	J1-7 (22)----------	Acft dc Ground	
(I)	XPDR +28 V PWR	J1-8 (22)----------	Acft 28 V Supply	
(I)	XPDR +28 V PWR	J1-9 (22)----------	Acft 28 V Supply	
(I)	Reserved Discrete #1	J1-10		
(I)	GPS Antenna Longitudinal Offset A	J1-11 (22)----------	Gnd/Open/Strobe	4
(I)	GPS Antenna Longitudinal Offset B	J1-12 (22)----------	Gnd/Open/Strobe	4
(I)	Navigation Accuracy Category for Velocity (NAC_V)	J1-13 (22)----------	Gnd/Open/Strobe	4
(I)	System Design Assurance (SDA)	J1-14 (22)----------	Gnd/Open/Strobe	4
(I)	ADS-B FAIL Disable	J1-15 (22)----------	Gnd/Open	4
(I)	Aircraft Category	J1-16 (22)----------	Gnd/Open/Strobe	4
(I)	+28 V dc Return	J1-17 (22)----------	Acft dc Ground	
(I)	+28 V dc Return	J1-18 (22)----------	Acft dc Ground	
(I)	Ground	J1-19 (22)----------	Acft dc Ground	
(I)	Ground	J1-20 (22)----------	Acft dc Ground	
(I)	Configuration Program Pin Common	J1-21 (22)----------	dc Ground	
	Spare	J1-22		
(O)	XPDR Fail Discrete Output #1	J1-23 (22)----------	Control Panel (28V/Open)	
(I)	Reserved Discrete #2	J1-24		
	Spare	J1-25		
(O)	XT Coordination XPDR to TCAS 429 (A)	J1-26 (22)--------S--T—S---- | | GND GND | |	TCAS Computer	2
(O)	XT Coordination XPDR to TCAS 429 (B)	J1-27 (22)--------S--T—S---- | | GND GND	TCAS Computer	2
(O)	MSP/ATSU/CMU Out #1 or Comm A/B 429 (A)	J1-28 (22)--------S--T—S---- | |	Airborne Data Link Processor	2

Table 3-1: NXT-600 Mode S/ADS-B Transponder Interconnect Data (cont)

I/O	Description	Connector Pin	Connects To	Notes
(O)	MSP/ATSU/CMU Out #1 or Comm A/B 429 (B)	J1-29 (22)--------S--T—S---- | | GND -- -- GND	Airborne Data Link Processor	2
(O)	General Output #1 or Comm C/D 429 (A)	J1-30 (22)--------S--T—S---- | |	Airborne Data Link Processor	2
(O)	General Output #1 or Comm C/D 429 (B)	J1-31 (22)--------S--T—S---- | | GND -- -- GND	Airborne Data Link Processor	2
(I)	Air Data Input #1 429 (A)	J1-32 (22)--------S--T—S---- | |	ARINC 429 or 575 ADC#1	2
(I)	Air Data Input #1 429 (B)	J1-33 (22)--------S--T—S---- | | GND -- -- GND	ARINC 429 or 575 ADC#1	2
(I)	Control Panel 429 (A)	J1-34 (22)--------S--T—S---- | |	Control Panel	2
(I)	Control Panel 429 (B)	J1-35 (22)--------S--T—S---- | | GND -- -- GND	Control Panel	2
(I)	FMC #1 429 (A)	J1-36 (22))-------S--T—S---- | |	Communication Management Unit	2
(I)	FMC #1 429 (B)	J1-37 (22))-------S--T—S---- | | GND -- -- GND	Communication Management Unit	2
(I)	FCC/MCP #1 420 (A)	J1-38 (22))-------S--T—S---- | |	Flight Management System	2
(I)	FCC/MCP #1 429 (B)	J1-39 (22))-------S--T—S---- | | GND -- -- GND	Flight Management System	2
(I)	TX Coordination 429 (A)	J1-40 (22)--------S--T—S---- | |	TCAS Computer	2
(I)	TX Coordination 429 (B)	J1-41 (22))-------S--T—S---- | | GND -- -- GND	TCAS Computer	2
(I)	FMC/GNSS #1 In #1 or Comm A/B 429 (A)	J1-42 (22)--------S--T—S---- | |	Airborne Data Link Processor	2
(I)	FMC/GNSS #1 In #1 or Comm A/B 429 (B)	J1-43 (22)--------S--T—S---- | | GND -- -- GND	Airborne Data Link Processor	2
(I)	IRS/FMS/Data Concentrator In #1 or Comm C/D 429 (A)	J1-44 (22)--------S--T—S---- | |	Airborne Data Link Processor	2
(I)	IRS/FMS/Data Concentrator In #1 or Comm C/D 429 (B)	J1-45 (22)--------S--T—S---- | | GND -- -- GND	Airborne Data Link Processor	2

Table 3-1: NXT-600 Mode S/ADS-B Transponder Interconnect Data (cont)

I/O	Description	Connector Pin	Connects To	Notes
(I)	Air Data Input #2 429 (A)	J1-46 (22))------S--T—S---- | |	ARINC 429/575 Digital ADC	2
(I)	Air Data Input #2 429 (B)	J1-47 (22))------S--T—S---- | | GND‾‾ ‾‾GND	ARINC 429/575 Digital ADC	2
(I)	Control Data Port B 429 (A)	J1-48 (22)--------S--T—S---- | |	Control Panel	2
(I)	Control Data Port B 429 (B)	J1-49 (22)--------S--T—S---- | | GND‾‾ ‾‾GND	Control Panel	2
(0)	Control Data Out 429 (A)	J1-50 (22)--------S--T—S---- | |	Control Panel	2, 3
(0)	Control Data 429 (B)	J1-51 (22)--------S--T—S---- | | GND‾‾ ‾‾GND	Control Panel	2, 3
(I)	VFOM Adjust	J1-52 (22)----------	Gnd/Open	4
(I)	Reserved Discrete #3	J1-53		
(I)	Reserved Discrete #4	J1-54		
(I)	Reserved Discrete #5	J1-55		
(I)	Reserved Discrete #6	J1-56		
(I)	Reserved Discrete #7	J1-57		
(I)	DLP	J1-58 (22) ----------		
(I)	Extended Squitter Disable	J1-59 (22) ----------	Gnd/Open	4
(I)	Alt Data Source Select Discrete Input	J1-60 (22) ----------	Gnd/Open	4
(I)	Control Data Port Select Discrete Input	J1-61 (22) ----------	Gnd/Open	4
I/O	RS-232 A	J1-62		
I/O	RS-232 B	J1-63		
(I)	FMC/GNSS #2 In #1 429 (A)	J1-64 (22))-------S--T—S---- | |	Flight Management System	2
(I)	FMC/GNSS #2 In #1 429 (B)	J1-65 (22))-------S--T—S---- | | GND‾‾ ‾‾GND	Flight Management System	2
(I)	Configuration Parity (2 states)	J1-66 (22) ----------	Gnd/Open	4
(I)	Ant Cable / Reserved (8 states)	J1-67 (22) ----------	Gnd/Open/Strobe	4
(I)	Antenna BITE/RMS 555/GAMA (8 states)	J1-68 (22) ----------	Gnd/Open/Strobe	4
(I)	Reserved Discrete #13	J1-69		
(I)	Reserved Discrete #8	J1-70		
(I)	Reserved Discrete #9	J1-71		
(I)	Standby/On Discrete Input	J1-72 (22) ----------	Control Panel	
(I)	Air/Ground Discrete Input #1	J1-73 (22) ----------	Control Panel or Acft Air/Ground Switch	
(I)	Transponder OFF	J1-74 (22) ----------	Gnd/Open	

Table 3-1: NXT-600 Mode S/ADS-B Transponder Interconnect Data (cont)

I/O	Description	Connector Pin	Connects To	Notes
(I)	Air/Ground Discrete Input #2	J1-75 (22) ----------	Control Panel or Acft Air/Ground Switch	
I/O	GPS Time Mark #2A (Provisioned)	J1-76 ----------NC		
I/O	GPS Time Mark #2B (Provisioned)	J1-77 ----------NC		
I/O	GPS Time Mark #1A (Provisioned)	J1-78 ----------NC		
I/O	GPS Time Mark #1B (Provisioned)	J1-79 ----------NC		
(I)	Mode S Addr A13-A15	J1-80 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A16-A18	J1-81 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A19-A21	J1-82 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A22-A24	J1-83 (22) ----------	Gnd/Open/Strobe	4
(I)	Squat Switch / Alt Source	J1-84 (22) ----------	Gnd/Open/Strobe	4
(I)	Tuning Source / Parity	J1-85 (22) ----------	Gnd/Open/Strobe	4
(I)	Reserved Discrete #10	J1-86		
(I)	Reserved Discrete #11	J1-87		
(I)	Reserved Discrete #12	J1-88		
(I)	Range Trigger (NO) – RMS 555 Controller Only	J1-89 (22) ----------	Gnd/Open	4
	Spare	J1-90		
	Spare	J1-91		
	Spare	J1-92		
	Spare	J1-93		
(I)	Max TAS	J1-94 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A1-A3	J1-95 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A4-A6	J1-96 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A7-A9	J1-97 (22) ----------	Gnd/Open/Strobe	4
(I)	Mode S Addr A10-A12	J1-98 (22) ----------	Gnd/Open/Strobe	4
(O)	XPDR Active (Strobe Output Discrete #1)	J1-99 (22) ----------	Antenna Switching Relay	4
(O)	XPDR Fail Discrete Output #2 (Strobe Output Discrete #2)	J1-100 (22) ----------	Control Panel/Strobe	4
(O)	ADS-B Function Fail Output (Strobe Output Discrete #3)	J1-101 (22) ----------	Control Panel/Strobe	4
(O)	Altitude Valid Discrete Output (Strobe Output Discrete #4)	J1-102 (22) ----------	Control Panel/Strobe	4
	Spare	J1-103		
(O)	Strobe Output Discrete #5	J1-104 (22) ----------	Strobe	4
(O)	Strobe Output Discrete #6	J1-105 (22) ----------	Strobe	4
-		J1-106		

Table 3-1: NXT-600 Mode S/ADS-B Transponder Interconnect Data (cont)

I/O	Description	Connector Pin	Connects To	Notes
(I)	Bottom Antenna RF Input	J2 coax ----------	Bottom Antenna	
(I)	Top Antenna RF Input	J3 coax ----------	Top Antenna	
NOTES: 1. Use single conductor, shielded wire coax. Connect the shield to aircraft ground. 2. Two-wire shielded cable. Connect shields to aircraft ground. 3. This ARINC 429 output is required on some Collins Control Panels that require a feedback loop to make sure the transponder is working properly. 4. Refer to interface descriptions in Section 4, LOADING/GRADIENT SPECIFICATIONS.				

B. Control Panel

(1) Table 3-2 contains the interconnect data for the Gables G7130 series control panels.

Table 3-2: Gables G7130-XX ATC/TCAS Control Panel Interconnect Data

I/O	Description	Connector Pin	Connects To	Notes
(I)	5 V ac Pnl Lighting (H)	J1-1 (20) ----------	Acft Lighting Source	
(I)	5 V ac Pnl Lighting (L)	J1-2 (20) ----------	Acft Lighting Source	
(I)	+28 V dc Input Power (H)	J1-3 (20) ----------	Acft +28 V dc Power	
(I)	+28 V dc Return (L)	J1-4 (20) ----------	Acft dc Ground	
(O)	Antenna Transfer Discrete	J1-5 (22) ----------	Antenna Relay	1., 2.
(I)	dc Ground	J1-6 (22) ----------	Acft dc Ground	
(O)	Standby/On Output Disc	J1-7 (22) ----------	Transponder No. 1	
(I)	Chassis Ground	J1-8 (22) ----------	Airframe Ground	3.
(I)	Functional Test	J1-9 (22) ----------	Remote Test Switch	
(O)	Warning & Caution	J1-10 (22) ----------	Remote Warning Sys	2.
	Reserved	J1-11		
(I)	XPDR Fail Logic No. 2	J1-12 (22) ----------	Transponder No. 1	
(I)	Ident Input	J1-13 (22) ----------	Remote IDENT Switch	2.
(I)	XPDR Fail (high Level)	J1-14 ------NC		2., 4.
(O)	Air/Gnd Switched Discrete	J1-15 ------NC		
(O)	Alt Source Select Discrete	J1-16 (22) ----------	Transponder No. 1	2.
	Reserved	J1-17		
(I)	Monitor Lamp Power	J1-18 (20) ----------	Acft 28 V dc Power	
	Reserved	J1-19		
(I)	XPDR Configuration	J1-20 NC		2.
(I)	Lamp Test	J1-21 (22)	Rmt Lamp Test SW	2.

Table 3-2: Gables G7130-XX ATC/TCAS Control Panel Interconnect Data

I/O	Description	Connector Pin	Connects To	Notes
(O)	ARINC 429 (A) Out	J1-22 (22)-------S--T—S----	Transponder No. 1	5.
(O)	ARINC 429 (B) Out	J1-23 (22)-------S--T—S---- GND GND	Transponder No. 1	5.
(I)	Air/Gnd Discrete	J1-24 (22) ----------	Air/Gnd Switch	2.
	Reserved	J2-1		
	Reserved	J2-2		
(I)	+28 V dc Input Power (H)	J2-3 (20) ----------	Acft 28 V dc Power	
(I)	+28 V dc Return (L)	J2-4 (20) ----------	Acft dc Ground	
(O)	Antenna Transfer Discrete	J2-5 (22) ----------	Antenna Relay	1., 2.
(I)	dc Ground	J2-6 (22) ----------	Acft dc Ground	
(O)	Standby/On Discrete	J2-7 (22) ----------	Transponder No. 2	
		J2-8 (22) ----------		
(I)	Functional Test	J2-9 (22) ----------	Remote Test SW	
(O)	Warning & Caution	J2-10 (22) ----------	Remote Warning Sys	2.
	Reserved	J2-11		
(I)	XPDR Fail Logic No. 2	J2-12 (22) ----------	Transponder No. 2	
(I)	Ident Input	J2-13 (22) ----------	Remote Ident SW	
(I)	XPDR Fail (High Level)	J2-14 -------NC		2., 4.
(O)	Air/Gnd Switched Discrete	J2-15 (22)-------NC		
(O)	Alt Source Select Discrete	J2-16 (22) ----------	Transponder No. 2	2.
	Reserved	J2-17		
(I)	Monitor Lamp Power	J2-18 (20) ----------	Acft 28 V dc Power	2.
	Reserved	J2-19		
(I)	XPDR Configuration	J2-20 (22)-------NC	Gnd/Open	2.
(I)	Lamp Test	J2-21 (22) ----------	Rmt Lamp Test SW	2.
(O)	ARINC 429 (A) Out	J2-22 (22) -------S--T—S----	Transponder No. 2	5.
(O)	ARINC 429 (B) Out	J2-23 (22)-------S--T—S---- GND GND	Transponder No. 2	5.
(I)	Air/Gnd Discrete	J2-24 (22) ----------	Acft Air/Gnd Switch	2.

NOTE:

1. Connect either J1-5 or J2-5 to an antenna switching relay if one set of ATC antennas is used in a dual transponder installation.
2. Refer to Section 4, LOADING/GRADIENT SPECIFICATIONS.
3. Connect chassis ground to aircraft frame.
4. 28 V dc discrete input from Collins TDR-94D Transponder.
5. Two-wire shielded cable. Connect shields to aircraft dc ground.

C. ATC Antennas

(1) Refer to the manufacture's documentation for electrical installation information for the antennas.

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LOADING/GRADIENT SPECIFICATIONS

1. General

This section contains the loading and gradient specifications for the input and output signals of each component of the system. The input/output discrete; default to an open state when power is removed.

2. Loading and Gradient Specifications

Component	Table No.
ACSS NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications	Table 4-1
Gables ATC/TCAS Control Panel Loading/Gradient Specifications	Table 4-2
Mode S Configuration Data Program Inputs	Table 4-3
ADS-B OUT Configuration Data Program Inputs	Table 4-4
Example of Mode S/ADS-B OUT Configuration Encoding	Table 4-21

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications

Connector Pin Designation	Functional Description
J1-1, 2	**XPDR +28 V FAN PWR AND +28V FAN RTN: (J1-1 RTN, J1-2 PWR)** The fan discrete outputs supply a switched, filtered +28 volts for a dc fan. The NXT-600 Transponder has an internal fan built into the unit, so external cooling is not required. Pins J1-1 and J1-2 should not be connected.
J1-3	**MUTUAL SUPPRESSION BUS I/O:** This bus is a single conductor, shielded bidirectional line that connects to all aircraft L-Band equipment. It is used to desensitize the associated receiver inputs while transmitting.
J1-7	**XPDR +28 V RTN:** See pins 8, 9, and 20.
J1-8 **J1-9**	**XPDR +28 V PWR:** These pins along with two return lines (J1-7 and J1-20) provide the +28 volt power requirements for the transponder.

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-11, 12, 21	**Configuration Data Program Inputs:** Reference subsection 3 for the functional descriptions.
J1-17 thru J1-20	**DC GROUND:** To be connected to aircraft dc ground.
J1-23	**XPDR VALID (PO) OUTPUT:** This discrete outputs the status of the transponder continuous monitor tests. A +28 V dc (200 mA maximum) is provided when the transponder is operational and an active transponder mode is selected. An OPEN (>100k ohms resistance to GROUND) output is provided when the transponder has failed. This pin should be connected to the control panel XPDR FAIL input for installations requiring a positive/open logic.
J1-26, J1-27	**ARINC 429 XT Coordination Bus Output: (J1-26 [A], J1-27 [B])** See pins J1-40/41 for ARINC 429 TX Coordination Bus Input. The following labels are outputs to TCAS: Label Description
	013 TCAS Display Mode and Range Control 015 TCAS Altitude Limit Control 016 Transponder and TCAS Control 203 Pressure Altitude 204 Baro Corrected Altitude 270 BDS Register Data 271 TCAS Coordination Data Word 1 272 TCAS Coordination Data Word 2 273 Mode S Ground Uplink 274 TCAS Coordination Data Word 3 275 Mode S Address Word 1 276 Mode S Address/Max TAS Word 2 277 ACK/NAK of Non-Periodic Message 350 TCAS Bit Mapped Error Word 356 TCAS Text Data

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

<table>
<tr><th>Connector Pin Designation</th><th>Functional Description</th></tr>
<tr><td>J1-28, 29</td><td>ARINC 429 XPDR to DLP A/B Output: (J1-28 [A], J1-29[B])

This differential pair output is a high speed ARINC 429 bus (100k bits/second nominal) that sends data to an airborne data link processor (ADLP) system. The data bus is used to transfer COMM-A and COMM-B messages between the two systems and conforms to the ARINC 718A-4 standard for ADLP to transponder interface.</td></tr>
<tr><td>J1-30, 31</td><td>ARINC 429 XPDR to DLP C/D Output: (J1-30 [A], J1-31 [B])

This differential pair output is a high speed ARINC 429 bus (100k bits/second nominal) that sends data to an airborne data link processor (ADLP) system. The data bus is used to transfer COMM-C messages between the two systems and conforms to the ARINC 718A-4 standard for ADLP to transponder interface.</td></tr>
<tr><td>J1-32, 33</td><td>ARINC 429/575 Air Data Computer #1 Input: (J1-32 [A], J1-33 [B])

This ARINC 429 bus can be used to input (low speed) the following labels used by the transponder to transmit the EHS Heading and Speed Report:

<table>
<tr><th>Label</th><th>Description</th><th>Type</th></tr>
<tr><td>203</td><td>Uncorrected Barometric Altitude</td><td>A429/A575</td></tr>
<tr><td>204</td><td>Corrected Barometric Altitude</td><td>A429/A575</td></tr>
<tr><td>205</td><td>MACH No.</td><td>A429/A575</td></tr>
<tr><td>206</td><td>Indicated Airspeed</td><td>A429/A575</td></tr>
<tr><td>210</td><td>True Airspeed</td><td>A429/A575</td></tr>
<tr><td>212</td><td>Barometric Vertical Rate</td><td>A429/A575</td></tr>
<tr><td>234</td><td>Barometric Correction</td><td>A429</td></tr>
</table>

The standards for this interface are defined in ARINC 706. The input accepts either ARINC 429 or 575 data format, which is selected by the altitude type program pin J1-84. The ALT SRC SEL2 (NO) discrete, pin 60, selects either ADC1 or ADC2.</td></tr>
</table>

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-34, 35	**ARINC 429 Control Data Port A Bus Input: (J1-34 [A], J1-35 [B])** Control data can be input into the transponder on either of two low-speed ARINC 429 buses (Ports A and B). The port is selected by the Control Data Port Select Input (pin J1-61). This ARINC 429 bus can be used to input (low speed) control and flight identification information contained in the following labels. Also reference pins J1-48/49 for ARINC 429 Control Data Port B Bus Input. Label — Description 013 — TCAS Display Mode and Range Control 015 — TCAS Altitude Limit Control 016 — Transponder and TCAS Control 031 — Mode S Control Panel Data 233 — Flight ID Characters 1 and 2 234 — Flight ID Characters 3 and 4 235 — Flight ID Characters 5 and 6 236 — Flight ID Characters 7 and 8
J1-36/37	**ARINC 429 FMC Input: (J1-36 [A], J1-37 [B])** This ARINC 429 bus can be used to input (high or low speed) the following labels from an FMC: Label — Description 101 — FMS Selected Heading 102 — FMS Selected Altitude 377 — Equipment ID 233 — Flight ID Characters 1 and 2 234 — Flight ID Characters 3 and 4 235 — Flight ID Characters 5 and 6 236 — Flight ID Characters 7 and 8 NOTE: FMS Selected Altitude (Label 102) will only be accepted on the IRS/FMS bus if the Equipment Id (Label 377) is valid and not indicating IRS (04H).

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-38/39	**ARINC 429 FCC/MCP Input: (J1-36 [A], J1-37 [B])** This ARINC 429 bus can be used to input (high or low speed) the following labels from an FCC/MCP: Label — Description 101 — MCP Selected Heading 102 — MCP Selected Altitude 233 — Flight ID Characters 1 and 2 234 — Flight ID Characters 3 and 4 235 — Flight ID Characters 5 and 6 236 — Flight ID Characters 7 and 8
J1-40/41	**ARINC 429 TX Coordination Bus Input: (J1-40 [A], J1-41 [B])** This high speed ARINC 429 input bus is provided to interface with a TCAS computer. The standards for this interface are defined in ARINC 735. This input bus also processes label 354 per ARINC 718A-4. See pins J1-26/27 for ARINC 429 XT Coordination Bus Output. The following TCAS labels are inputs to the transponder: Label — Description 270 — TCAS RA Segment 2 270 — TCAS RA Segment 3 270 — TCAS Data Link Capability Segment 0 270 — TCAS Data Link Capability Segment 1 270 — TCAS Data Link Capability Segment 2 270 — TCAS Request for BDS Register Data 276 — Mode S Address/Max TAS Word 2 305 — Version 1, 260B Config Word 0 305 — Version 1, 260B Config Word 1 305 — Version 1, 260B Config Word 2 273 — TCAS Resolution Advisory 274 — TCAS Output 275 — TCAS ACK / NAK

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-42/43	**ARINC 429 GPS #1 Input: (J1-42 [A], J1-43 [B])** This ARINC 429 bus must be used to input (high or low speed) GPS label information directly from a qualified source, as specified in FAA AC 20-165A, for ADS-B OUT enabled aircraft (J1-59 open). When dual qualified GPS sources are available in a dual NXT-600 transponder installation connect the GPS 1 ARINC 429 bus to J1-42/43 on both transponders and connect the GPS 2 ARINC 429 bus to J1-64/65 on both transponders. Reference pins J1-64/65 for ARINC 429 GPS #2 input. Reference the table below for the list of required GPS labels.

Label	Description
76	GPS MSL Altitude
103	GPS Track Angle
110	GPS Latitude Coarse
111	GPS Longitude Coarse
112	GPS Ground Speed
120	GPS Latitude Fine
121	GPS Longitude Fine
130	GPS HPL
136	GPS Vertical Figure of Merit (VFOM)
140	UTC Fine
145	Horizontal Velocity Figure of Merit
150	UTC Time
165	GPS Vertical Velocity
166	GPS N/S Velocity
174	GPS E/W Velocity
247	GPS Horizontal Figure of Merit (HFOM)
273	GPS Sensor Status
370	Height Above Ellipsoid

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-44, 45	**ARINC 429 IRS/FMS Input: (J1-44 [A], J1-45 [B])** This ARINC 429 bus can be used to input (high or low speed) the following labels used by the transponder to transmit the EHS Heading and Speed Report: Label — Description 101 — FMS Selected Heading 102 — FMS Selected Altitude 104 — Selected Vertical Speed 233 — Flight ID Characters 1 and 2 234 — Flight ID Characters 3 and 4 235 — Flight ID Characters 5 and 6 236 — Flight ID Characters 7 and 8 237 — Flight ID Characters 9 and 10 312 — Ground Speed 313 — True Track Angle 314 — True Heading 320 — Magnetic Heading 325 — Roll Angle 335 — Track Angle Rate 365 — Vertical Velocity 377 — Equipment ID **NOTE:** FMS Selected Altitude (Label 102) will only be accepted on the IRS/FMS bus if the Equipment ID (Label 377) is valid and not indicating IRS (04H).
J1-46,47	**ARINC 429/575 Air Data Computer #2 Input: (J1-46 [A], J1-47 [B])** See pins J1-32, 33.
J1-48, 49	**ARINC 429 Control Data Port B Bus Input: (J1-48 [A], J1-49 [B])** See pins J1-34, 35.

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

<table>
<tr><th>Connector Pin Designation</th><th>Functional Description</th></tr>
<tr><td>J1-50, 51</td><td>ARINC 429 Control Data Port A Bus Output: (J1-50 [A], J1-51 [B])

This low speed ARINC 429 bus (12.5k bits/second) transmits control panel input data back to the control panel for verification purposes. These output pins are connected only on some Collins control panels that require feedback from the transponder to make sure it is operating properly. The following labels are sent:

Label Description
013 TCAS Display Mode and Range Control
015 TCAS Altitude Limit Control
016 Transponder and TCAS Control
031 ATCRBS Control
200 Mode C Code Feedback
203 Pressure Altitude
233 Flight ID Characters 1 and 2
234 Flight ID Characters 3 and 4
235 Flight ID Characters 5 and 6
236 Flight ID Characters 7 and 8
350 Maintenance Label</td></tr>
<tr><td>J1-53 thru 57, J1-69 thru 71</td><td>Reserved</td></tr>
</table>

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-58	**DLP Installed** The DLP Installed program pin specifies whether the transponder is connected to an airborne data link processor system. The pin is set as follows: Ground = DLP is installed Open = DLP is not installed
J1-59	**Extended Squitter Disable Discrete Input:** This discrete is used to disable extended squitters, that is, disable the ADS-B OUT function. When this pin is grounded, ADS-B OUT is disabled, and when it is open, ADS-B OUT is enabled. Note : If replacing an existing RCZ-852 and activating ADS-B functionality, ensure this pin is open.
J1-60	**Air Data Source Select Discrete Input:** This discrete input specifies which of the two air data sources is used to obtain altitude information. Reference the ARINC 429 and ARINC 575 digital air data inputs. Ground = Altitude Source No. 2 Open = Altitude Source No. 1.
J1-61	**Control Data Port Select Input:** See pins J1-34/35. This discrete input is used to select which port is used to input control data to the transponder. This input uses a ground/open logic as follows: Ground = Port A Open = Port B
J1-64, 65	**ARINC 429 GPS #2 Input: (J1-64 [A], J1-65 [B])** See J1-42/43.
J1-66 thru 68	**Configuration Data Program Inputs:** Reference subsection 3 for the functional descriptions.
J1-72	**STANDBY/ON Discrete Input:** This discrete input is connected to the Control Panel STANDBY/ON output. The input selects the active or standby status of the transponder. A ground causes the transponder to be in standby and an open causes the transponder to be active.

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-73	**Air/Ground #1 Discrete Input:** This pin and Air/Ground #2 Discrete Input (pin J1-75) provide a method for the transponder to automatically determine the Air/Ground status of the aircraft. Only one air/ground input is required. The status is used in replies to Mode S interrogations and to inhibit replies to certain types of interrogations. Both inputs use ground/open logic, the polarity is determined by J1-84. Reference subsection 3 for the functional description of J1-84. When this pin is connected to the Air/Ground Relay (Squat Switch), the transponder does not reply to ATCRBS, ATCRBS/Mode S All Call, or Mode S All Call when the input is set for On the Ground. This input should be connected to the Air/Ground Relay for normal operation. The Air/Ground discrete On the Ground condition is overridden and set to In Air if the Ground Speed (Label 112) from Selected ADS-B Position Source or Indicated Airspeed (Label 206) from selected Altitude Source >100 knots.
J1-74	**XPDR OFF (NO) Input:** This discrete input is used to turn the transponder power supply OFF. It should not be connected in aircraft installations.
J1-75	**Air/Ground #2 Discrete Input:** See pin 73.
J1-76 thru 79	**Reserved**
J1-80 thru 85	**Configuration Data Program Inputs:** Reference subsection 3 for the functional descriptions.
J1-86 thru 88	**Reserved**
J1-89	**Range Trigger (NO):** The Range Trigger discrete (J1-89) is used to toggle the range data sent in Label 013 when an RMS-555 Control Panel is installed.
J1-94 thru 98	**Configuration Data Program Inputs:** Reference subsection 3 for the functional descriptions.
J1-99	**XPDR Active (NO) Output/Strobe Output #1:** This discrete output can be connected to an RF relay for systems that use a single antenna connected to two transponders for the purpose of switching the antenna to the active transponder. A GROUND (200 mA maximum) output is provided when an Active transponder mode is selected. An OPEN (>100k ohms to GROUND) output is provided when Standby mode is selected. This pin also functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J1-100	**XPDR Valid (NO) Output/Strobe Output #2:** This discrete outputs the status of the transponder continuous monitor tests. A GROUND (200 mA maximum) output is provided when the transponder is operational and an active transponder mode is selected. An OPEN (>100k ohms resistance to GROUND) output is provided when the transponder has failed. This pin should be connected to the control panel XPDR FAIL input for installations requiring a ground/open logic. This pin also functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.
J1-101	**ADS-B OUT Function Fail Discrete Output/ Strobe Output #3:** This output discrete is used to annunciate that the GPS position input that is required by the ADS-B OUT function is failed. A discrete ground signal capable of sinking 200 mA is output when the ADS-B OUT GPS position source is operating normally and a discrete open signal is output when failed. This pin also functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.
J1-102	**ALT Valid (NO) Output/Strobe Output #4:** This discrete outputs the status of the altitude source when the transponder is in an active mode and altitude reporting is enabled. A GROUND (200 mA maximum) is output when the selected altitude source is valid and the transponder is in an altitude reporting mode. An OPEN (>100k ohms resistance to GROUND) output is provided when the selected altitude source is invalid or the transponder is in standby or not in an altitude reporting mode. This pin should be connected to the control panel ALT FAIL input, if applicable. This pin also functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.
J1-103	**Spare**
J1-104	**Strobe Output #5:** This pin functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.
J1-105	**Strobe Output #6:** This pin functions as a strobe discrete output for configuration data on unit power up. Reference subsection 3 for the functional description.

Table 4-1: NXT-600 Mode S/ADS-B Transponder Loading/Gradient Specifications (cont)

Connector Pin Designation	Functional Description
J2	**Bottom Antenna RF Port:** Maintain coax cable insertion loss of 2 ±1 dB in the 1030 to 1090 MHz frequency band per RTCA DO-181E. See J1-67 for top and bottom coax cable propagation delay difference program pin strapping.
J3	**Top Antenna RF Port:** Maintain coax cable insertion loss of 2 ±1 dB in the 1030 to 1090 MHz frequency band per RTCA DO-181E. See J1-67 for top and bottom coax cable propagation delay difference program pin strapping.

Table 4-2: Gables ATC/TCAS Control Panel Interface Description

Connector Pin Designation	Functional Description
J1-1	**Panel and Display Lighting Input: (J1-1 HIGH, J1-2 LOW):**
J1-2	5 V ac 400 Hz lighting input for front panel and display lighting control. Lighting is provided by LEDs
J1-3	**115 V ac Input Power (J1-3 HIGH, J1-4 LOW):**
J1-4	The control panel is powered from a 115 V ac power bus. Two identical but isolated power supplies supply the power requirements to each individual electronic module that independently controls transponder 1 and 2.
J1-5	**Antenna Transfer Discrete Output:** These discrete outputs are used to switch a RF relay for a dual transponder installation that have one set of antennas. The outputs from J1 and J2 are lined to the XPNDR1-2 switch. The output is OPEN when the transponder is in STANDBY (Inactive) mode and GROUND when the transponder is in an active operational mode.
J1-6	**dc Ground Input:** Reference for all discrete inputs/outputs. Connected to aircraft dc ground.
J1-7	**STANDBY/ON Output: (J1-7 and J2-7):** These discrete outputs (STANDBY/ON) mimic the XPNDR switch position, placing one transponder in STANDBY and the other in the ON (active) mode. Both transponders are never in the ON mode simultaneously. This output can sink 100 mA maximum. Connect pin to transponder STANDBY/ON Discrete Input.
J1-8	**Chassis Ground Input:** Connected to airframe. Also used to connect ARINC 429 cable shields to the chassis.
J1-9	**Functional Test Input/FCDE:** Functional test can also be initiated by this discrete input. When J1-9 or J2-9 is grounded, a functional test similar to pushing the TCAS TEST button on the front panel is initiated. If this input is grounded while cycling power to the control panel, then the Fault Code Display Enable mode is enabled. This mode provides failure codes should a failure be detected in the control panel. It also provides software version and revision number.

Table 4-2: Gables Flight ID/ATC/TCAS Control Panel Interface Description (cont)

Connector Pin Designation	Functional Description
J1-10	**Warning and Caution Output:** This discrete output supplies a low signal to a remote master warning system when the control panel receives a Monitor Lamp fault indication from the active transponder. Otherwise it supplies +7 to +30 V dc or a resistance of >100k ohms to ground. This output can sink 20 mA maximum.
J1-11	**AIR/GND SWITCH #1 Discrete Output**
J1-12	**TRANSPONDER FAIL LOGIC #2 input (J1-12 and J2-12)** The control panel transponder fail annunciator is controlled by this input. When a transponder is operating normally, this input remains grounded. Otherwise the transponder opens this input to indicate a transponder failure. The control panel turns the annunciator ON to alert the user of a transponder malfunction. The transponder fail annunciator turns on only when the failed transponder is selected by the XPNDR 1-2 switch. It is turned OFF when STANDBY is selected. Connect this pin to the XPNDR FAIL #2 Discrete Output.
J1-13	5 V ac HI Indicator Lighting (AIRBUS) (J1-13 HIGH, J1-14 LOW)
J1-14	5 V ac 400 Hz lighting input for front panel annunciators. These inputs are used for control panels installed in Airbus aircraft.
J1-15	**AIR/GND SWITCH #2 Output (J1-15 and J2-15)** This output is directly connected to J1-24 Air/Ground input. J1-15 is connected to J1-24, and J2-15 is connected to J2-24. Ground/Open signal is directly routed to J1-15 or J2-15.
J1-16	**Air Data Source Output (J1-16 and J2-16)** Ground/Open output is dependent on the front panel ALT RPTG, XPNDR and ALT SOURCE (air data source) selection. This discrete output is enabled when altitude reporting is selected in the On mode. When altitude reporting is selected OFF, the J1/J2-16 outputs remains in the OPEN state. When ALT RPTG is ON, then altitude source output is dependent on the altitude source selection in the control panel. If ADC 1 is selected, then J1-16 is Open and J2-16 is Ground. If ADC 2 is selected, then J1-16 is Ground and J2-16 is Open. This discrete output is connected to the transponder AIR DATA SOURCE SELECT discrete input.
J1-17	**Flight ID Disable Input (J1-17 only)** A ground in this input disables the Flight ID mode of operation. The control panel displays INOP when the Flight ID mode is selected. An Open in this input enables the Flight ID mode which allows the Flight ID code to be entered and transmitted to the transponder.

Table 4-2: Gables Flight ID/ATC/TCAS Control Panel Interface Description (cont)

Connector Pin Designation	Functional Description
J1-18	**Monitor Light Power:** This input is used as the input power source for the XPNDR FAIL, ATC, and FID annunciators on the front of the control panel. The input supply voltage is used for control purpose only, and the supply voltage is dimmable 26 V dc at 200 mA maximum.
J1-19	**ALT Fail Input**
J1-20	**Transponder FAIL Logic #1 Discrete Input: (J1-20 and J2-20)** The control panel FAIL indicator can also be controlled by this input which is mainly used in Airbus installations. When this input is Open, then the transponder fail annunciator should be OFF. If 5 V dc is provided to this Discrete Input by the transponder, then the transponder fail annunciator should be turned On.
J1-21	**Lamp Test: J1-21 and J2-21)** To initiate a lamp test, J1 or J2-21 must be grounded through a remote test switch. All segments in the control panel LCD display, as well as the annunciators, are ON for as long as this input is grounded. ARINC 429 labels are not affected by the activation of the lamp test mode.
J1-22, -23	**ARINC 429 Bus Output: J1-22 (A), J1-23 (B)** Communication between the control panel and the transponder is done over a two-wire low speed, odd parity, ARINC 429 compatible bus. Selected ATC, Flight ID codes, operating mode, and system parameters are communicated to the transponder over these lines. Transmission of labels 013, 015, 016, 031, 233, 234, 235, and 236 is done every 150 milli-seconds. Connect these pins to one of the two transponder ARINC 429 CONTROL DATA input Ports.
J1-24	**Air/Ground Discrete Input (J1-24 and J2-24)** The weight-on-wheels switch output is connected to this input which is directly connected to J1/J2-15 Discrete Output. When weight-on-wheels is grounded, then this signal is transmitted to the transponder to inhibit replies while on ground. If this input is Open, then aircraft is airborne.
J2-1	**Reserved (ARINC 429 RX Input Port A)**
J2-2	**Reserved (ARINC 429 RX Input Port B)**
J2-3	**115 V ac HI Power Input**
J2-4	**115 V ac LO Power Input**
J2-5	**Antenna transfer Output Discrete**
J2-6	**Chassis Ground**

Table 4-2: Gables Flight ID/ATC/TCAS Control Panel Interface Description (cont)

Connector Pin Designation	Functional Description
J2-7	STBY/ON Discrete Output
J2-8	DC Ground
J2-9	Functional Test Input/FCDE
J2-10	Warning and Caution Output Discrete
J2-11	Air/Ground #1 Discrete Output
J-12	Transponder Fail Logic #2 Input
J2-13	Reserved (ARINC 429 RX Input Port A)
J2-14	Reserved (ARINC 429 RX Input Port B)
J2-15	Air/Ground #2 Discrete Output
J2-16	Air Data Source Output Discrete
J2-17	Reserved
J2-18	ATC Fail Indicator Power Input
J2-19	ALT Fail Input
J2-20	Transponder Fail Logic #1 Input
J2-21	Lamp Test Input
J2-22	ARINC 429 TX Output Port A
J2-23	ARINC 429 TX Output Port B
J2-24	Air/Ground Discrete Input

3. Mode S/ADS-B OUT Configuration Data

This section contains aircraft parameters that are required to be populated in order for the transponder to send correct Mode S and ADS-B data. ARINC 718A-4 defines a method to strobe transponder inputs in order to set values for the required parameters.

When available, the NXT-600 transponder can receive the necessary ADS-B OUT Configuration Data from the Surveillance Processor via A429 Label 305 on the TX bus.

Table 4-21 and Figure 4-1 provide an example of ADS-B OUT Configuration Encoding.

A. Configuration Data Program Pin Strapping

The NXT-600 configuration program inputs are listed in Table 4-3 and Table 4-4.

Table 4-3: Mode S Configuration Data Program Inputs

Connector Pin Designation	Function	State
J1-85	SDI	Ground/Open/Strobed
J1-84	Baro Correction Type /Alt Source	Ground/Open/Strobed
J1-94	Max True Airspeed (TAS)	Ground/Open/Strobed
J1-95	Mode S Address A1-A3	Ground/Open/Strobed
J1-96	Mode S Address A4-A6	Ground/Open/Strobed
J1-97	Mode S Address A7-A9	Ground/Open/Strobed
J1-98	Mode S Address A10-A12	Ground/Open/Strobed
J1-80	Mode S Address A13-A15	Ground/Open/Strobed
J1-81	Mode S Address A16-A18	Ground/Open/Strobed
J1-82	Mode S Address A19-A21	Ground/Open/Strobed
J1-83	Mode S Address A22-A24	Ground/Open/Strobed
J1-67	Antenna Cable Delay	Ground/Open/Strobed
J1-68	Antenna BITE/RMS 555/GAMA	Ground/Open/Strobed

Table 4-4: ADS-B OUT Configuration Data Program Inputs

Connector Pin Designation	Function	State
J1-11	GPS Antenna Longitudinal Offset A	Ground/Open/Strobed
J1-12	GPS Antenna Longitudinal Offset B	Ground/Open/Strobed
J1-5	Aircraft/Vehicle Length/Width A	Ground/Open/Strobed
J1-6	Aircraft/Vehicle Length/Width B	Ground/Open/Strobed
J1-13	Navigation Accuracy Category_Velocity (NAC_V)	Ground/Open/Strobed
J1-14	System Design Assurance (SDA)	Ground/Open/Strobed
J1-15	ADS-B FAIL Disable	Ground/Open
J1-16	Aircraft Category	Ground/Open/Strobed
J1-66	Configuration Parity	Ground/Open
J1-4	ADS-B Receive Capability	Ground/Open/Strobed
J1-52	VFOM Adjust	Ground/Open

B. Configuration Data Program Pin States

The Configuration Data Program Inputs can be in one of three states: Ground, Open, or Strobed. The Configuration Data Program Inputs are connected to one of the following NXT-600 program pin outputs:

Table 4-5: Configuration Data Program Outputs

Connector Pin Designation	Function
J1-21	Program Pin Common (ground)
J1-99	Strobe Output #1
J1-100	Strobe Output #2
J1-101	Strobe Output #3
J1-102	Strobe Output #4
J1-104	Strobe Output #5
J1-105	Strobe Output #6

C. Configuration Data Program Inputs Parity Check

Pin J1-66 provides the means to program strap each transponder's parity. Valid parity is even and is determined by the number of Configuration Data Program Inputs that are grounded. If an even number of discretes are grounded then the Configuration Parity Discrete (J1-66) is left open. If an odd number of discretes are grounded then the Configuration Parity Discrete (J1-66) is connected to ground. Refer to Tables 4-3 and 4-4 for the list of Configuration Data Program Inputs to be counted.

D. Configuration Data Discrete Decoding

The transponder decodes the Configuration Data Program Inputs per ARINC 718A-4 and DO-260B. Reference the following tables:

(1) **Source Destination Identifier (SDI)**

Pin J1-85 provides the means to program strap each transponder's SDI. Refer to Table 4-6.

Table 4-6: SDI Encoding

J1-85 State	SDI	Definition
Open	0	No SDI Encoded (SDI = 00)
J1-21	1	LRU System #1 (SDI = 01)
J1-99	2	LRU System #2 (SDI = 10)
J1-100	3	LRU System #3 (SDI = 11)

(2) **Baro Correction Type/Alt Source**

Pin J1-84 provides the means to program strap each transponder's Baro Correction Type and Air Data Type. The Baro Correction Type is used to identify the processing of Label 234 SSM as either a BCD or BNR type. BCD is standard per ARINC 706. Refer to Table 4-7.

Table 4-7: Baro Correction Type/Alt Source

J1-84 State	Baro Correction Type	Alt Type
J1-21	0	429
J1-99	0	575
J1-102	1 - (Label 234 is BNR)	429
J1-104	1 - (Label 234 is BNR)	575

(3) **Max True Airspeed (TAS)**

Pin J1-94 provides the means to program strap each transponder's Max True Airspeed. Refer to Table 4-8.

Table 4-8: Max True Airspeed (TAS)

J1-94	Definition
Open	No Max Airspeed Available
J1-21	Max Airspeed ≤75 knots
J1-99	Max Airspeed >75 and ≤150 knots
J1-100	Max Airspeed >150 and ≤300 knots
J1-101	Max Airspeed >300 and ≤600 knots
J1-102	Max Airspeed >600 and ≤1200 knots
J1-104	Max Airspeed >1200

(4) **Mode S Address**

Pins J1-80 through J1-83 and J1-95-98 provide the means to program strap each transponder's Mode S Address. A_x, A_y, and A_z comprise a 3-bit group that corresponds to 3 of the 24 Mode S address bits depending on the input pin as defined in the below table. A1 is the Most Significant Bit (MSB), A24 is the Least Significant Bit (LSB). Refer to Table 4-9.

Table 4-9: Mode S Address

Pin State	A_x	A_y	A_z
Open	0	0	0
J1-21	0	0	1
J1-99	0	1	0
J1-100	0	1	1
J1-101	1	0	0
J1-102	1	0	1
J1-104	1	1	0
J1-105	1	1	1

Pin	A_x	A_y	A_z	State
J1-95	A1	A2	A3	
J1-96	A4	A5	A6	
J1-97	A7	A8	A9	
J1-98	A10	A11	A12	
J1-80	A13	A14	A15	
J1-81	A16	A17	A18	
J1-82	A19	A20	A21	
J1-83	A22	A23	A24	

(5) **Antenna Cable Delay**

Pin J1-67 provides the means to program strap each transponder's Antenna Cable Delay. Cable delay is the difference between the top antenna and bottom antenna cables. States 0 and 4 are redundant. If there was a difference in antenna cable length leading to a 100ns delay on the bottom antenna, then state 1 would be applied to the top antenna to compensate. Refer to Table 4-12.

Table 4-10: Table 4-10

J1-67 State	Delay (nsec)	Transponder Adjustment
Open	0-50	Dual Antenna, No Change
J1-21	51-150	Add Delay to Top Channel
J1-99	151-250	Add Delay to Top Channel
J1-100	251-350	Add Delay to Top Channel
J1-101	0-50	Single (Bottom) Antenna, No Change
J1-102	51-150	Add Delay to Bottom Channel
J1-104	151-250	Add Delay to Bottom Channel
J1-105	251-350	Add Delay to Bottom Channel

(6) **Antenna BITE/RMS 555/GAMA**

Pin J1-66 provides the means to program strap each transponder's Antenna BITE/RMS 555/GAMA settings. Refer to Table 4-11.

Table 4-11: Antenna BITE/RMS 555/GAMA

J1-68 State	Antenna BITE (Note 1)	RMS 555 (Note 2)	GAMA Installation (Note 3)
Open	0	0	0
J1-21	0	0	1
J1-99	0	1	0
J1-100	0	1	1
J1-101	1	0	0
J1-102	1	0	1
J1-104	1	0	1
J1-105	1	1	1

Note 1: A “0” (no bite) will not log a fault if the continuity check of the antenna, cabling and connectors has failed by indicating a resistance to ground >500 ohms. A “1” (bite enabled) will log a fault if the continuity check of the antenna, cabling and connectors has failed. This check is performed on ground and in air. If TCAS II equipment is installed, a failure of the continuity check on one antenna will drive a TCAS FAIL and ATC FAIL if the sensitivity level is equal to something other than standby or TA ONLY. Anytime both antennas fail the continuity check, the ATC FAIL discrete will be set to FAIL. Failures are also indicated on the front panel lamps when on ground.

Note 2: The RMS-555 installed setting allows the transponder to accept control from an RMS-555 control panel. A “1” indicates that RMS-555 is installed (perform control label feedback and range control discrete).

Note 3: The GAMA installed strap controls the usage of label 335 as Track Angle Rate. The strap also controls the usage of label 102 Selected Altitude on the ADC buses (J1-32/33 and J1-46/47) when accompanied by a valid GAMA Equipment ID Label 371. A “1” indicates that GAMA is installed.

(7) **Aircraft/Vehicle Length/Width**

Pins J1-5 and J1-6 provide the means to program strap each transponder's length and width. Refer to Table 4-12.

Table 4-12: Aircraft/Vehicle Length/Width Encoding

J1-6	J1-5	Aircraft Length/Width Code Value	Upper bound Length (meters)	Upper bound Width (meters)
Open	Open	0	No Data or Unknown	
Open	J1-21	1	≤15	≤23
Open	J1-99	2		≤28.5
Open	J1-100	3	≤25	≤34
Open	J1-101	4		≤33
Open	J1-102	5	≤35	≤38
Open	J1-104	6		≤39.5
Open	J1-105	7	≤45	≤45
J1-21	Open	8		≤45
J1-21	J1-21	9	≤55	≤52
J1-21	J1-99	10		≤59.5
J1-21	J1-100	11	≤65	≤67
J1-21	J1-101	12		≤72.5
J1-21	J1-102	13	≤75	≤80
J1-21	J1-104	14		≤80
J1-21	J1-105	15	≤85	≤90
NOTE:		If the Aircraft / Vehicle is longer than 85 meters, or wider than 90 meters, then the pin configuration and bit encoding shall be set to that indicated for State 15.		

(8) **GPS Antenna Longitude Offset Encoding**

Pin J1-11 and J1-12 provide the means to program strap each transponder's GPS Antenna Offset from the nose of the aircraft.

Aircraft manufacturers and operators have indicated that dual GPS antennas are typically installed such that there is not more than 2 to 3 meters distance between the two antennas. Therefore, the midpoint distance between the two antennas along the longitudinal axis of the aircraft should be used to encode the antenna position from the aircraft's nose in accordance with Table 4-13.

Table 4-13: GPS Antenna Longitudinal Offset Encoding

J1-11	J1-12	GPS Antenna Longitudinal Offset Value	Upper Bound of the GPS Antenna Offset along Longitudinal Axis Aft from Aircraft Nose (meters)
Open	Open	0	0 or No Data
Open	J1-21	1	Position Offset Applied by Sensor
Open	J1-99	2	2
Open	J1-100	3	4
Open	J1-101	4	6
Open	J1-102	5	8
Open	J1-104	6	10
Open	J1-105	7	12
J1-21	Open	8	14
J1-21	J1-21	9	16
J1-21	J1-99	10	18
J1-21	J1-100	11	20
J1-21	J1-101	12	22
J1-21	J1-102	13	24
J1-21	J1-104	14	26
J1-21	J1-105	15	28
J1-99	Open	16	30
J1-99	J1-21	17	32
J1-99	J1-99	18	34
J1-99	J1-100	19	36
J1-99	J1-101	20	38
J1-99	J1-102	21	40
J1-99	J1-104	22	42
J1-99	J1-105	23	44
J1-100	Open	24	46
J1-100	J1-21	25	48
J1-100	J1-99	26	50
NOTE:		If the GPS Antenna Longitudinal Offset from the nose of the aircraft is in excess of 50 meters, then the Pin Configuration and bit encoding shall be set to 50 meters.	

(9) **Navigation Accuracy Category for Velocity (NAC_V) Encoding**

Pin J1-13 provides the means to program strap each transponder's the Navigation Accuracy Category for Velocity (NACV) of the installation in accordance with Table 4-14. NACv is set dynamically from label 145 from GPS, if it is not received, then the program pin is read.

Set the NACV encoding based on the design data provided by the position source manufacturer.

Table 4-14: Navigation Accuracy Category for Velocity (NAC_V) Encoding

J1-13 State	NACv Value	Horizontal Velocity Error
Open	0	Unknown or ≥10 meters/sec
J1-21	1	<10 meters/sec
J1-99	2	<3 meters/sec

NOTES:
1. Encoding is only provided through State 2 as it will be well into the future before navigation sources will be capable of providing NAC_V values approaching 1 meter/second.
2. If the NAC_V value to be encoded is less than 1 meter/second or better, then the Pin Configuration and bit encoding shall be set to <3 meters/sec.

(10) **System Design Assurance (SDA) Encoding**

Pin J1-14 provides the means to program strap each transponder's System Design Assurance (SDA) of the installation in accordance with Table 4-15.

Table 4-15: System Design Assurance (SDA) Encoding

J1-14 State	SDA Value	Supported Failure Condition (Note 3)	Probability of Undetected Fault causing transmission of False or Misleading Information (Note 4, 5)
Open	0	Unknown / No Safety Effect	$>1x10^{-3}$ per flight hour or unknown
J1-21	2	Major	$>1x10^{-5}$ per flight hour
J1-99	3	Hazardous	$>1x10^{-7}$ per flight hour

NOTES:

1. It is expected that all GPS/GNSS and ADS-B OUT transmitting equipment associated with DO-260B will support a minimum design assurance of 10^{-5}. Therefore, the 10^{-3} case having an SDA = "1" is NOT allowed and there is no encoding provision made with J1-14.
2. Software Design Assurance per RTCA DO-178B (EUROCAE ED-12B). Airborne Electronic Hardware Design Assurance per RTCA DO-254 (EUROCAE ED-80).
3. Supported Failure Classification defined in AC 23.1309-1E, AC 25.1309-1A, and AC 29-2C.
4. Because the broadcast position can be used by any other ADS-B OUT equipped aircraft or by ATC, the provisions in AC 23-1309-1C that allow reduction in failure probabilities and design assurance level for aircraft under 6,000 pounds do not apply.
5. Includes probability of transmitting false or misleading latitude, longitude, velocity, or associated accuracy and integrity metrics.

(11) **ADS-B OUT Fail Disable Encoding**

J1-15 provides the means to program strap the annunciation of an ADS-B OUT function fail via the Fail Warn Discrete outputs (J1-100 and J1-101) in accordance with Table 4-16.

Table 4-16: ADS-B OUT Fail Disable Encoding

J1-15 State	ADS-B FAIL Disable Value
Open	0 (Note 1)
J1-21	1 (Note 2)

NOTES:

1. Failures of the ADS-B Function are declared via the Fail Warn Discrete outputs (J1-100 and J1-23) as well as via any output 429 diagnostic words, (diagnostic words are not implemented in this release of the Transponder for the ADS-B Function Fail).
2. Failures of the ADS-B Function are NOT be declared via the Fail Warn Discrete outputs (J1-100 and J1-23) but are declared via any output 429 diagnostic words, (diagnostic words are not implemented in this release of the Transponder for the ADS-B Function Fail).

(12) **Aircraft Category Encoding**

Pin J1-16 provides the means to program strap each transponder's Aircraft Category information in accordance with Table 4-17.

Table 4-17: Aircraft Category Encoding

J1-16	Aircraft Category Value	Aircraft Category Selection
Open	0	No Ads-B Emitter Category Information
J1-21	1	Light (<15,5000 lbs.)
J1-99	2	Small (15,500 -to- 75,000 lbs.)
J1-100	3	Large (75,000 -to- 300,000 lbs.)
J1-101	4	High-Vortex Large
J1-102	5	Heavy (>300,000 lbs.)
J1-104	6	High Performance (>5G acceleration and >400 knots)
J1-105	7	Rotorcraft

(13) **ADS-B Receive Capability Encoding**

Pin J1-4 provides the means to program strap each transponder's ADS-B Receive Capability in accordance with Table 4-18.

Table 4-18: ADS-B Receive Capability Encoding

J1-4 State	1090-In Value	UAT-In Value	Selection / Meaning
Open	0	0	Aircraft installation has no capability to receive either 1090-IN or UAT-IN
J1-21	1	0	Aircraft installation has capability to receive 1090-IN ONLY
J1-99	1	1	Aircraft installation has capability to receive both 1090-IN and UAT-IN
NOTE:	It is expected that future implementations with TCAS or the Traffic Function will have additional capability to communicate the state of 1090 ES IN and UAT IN. Presently, no such method is identified.		

(14) **Vertical Figure of Merit (VFOM) Adjust Encoding**

Pin J1-52 provides the means to program strap each transponder's VFOM adjust status in accordance with Table 4-19.

The VFOM adjust discrete should be set to ground, when the installed GPS (in support of ADS-B OUT) does not provide Height Above Ellipsoid (HAE) geometric attitude on ARINC Label 370 (As defined in ARINC 743A-5), and does provide Mean Sea Level GNSS Altitude on ARINC Label 076 using something other than the WGS84 Ellipsoid in its altitude algorithm.

Table 4-19: Vertical Figure of Merit (VFOM) Adjust Encoding

J1-52 State	VFOM Adjust Value	Selection / Meaning
Open	0	Installed GPS provides Height Above Ellipsoid (HAE) geometric attitude on ARINC Label 370
J1-21	1	Installed GPS provides Mean Sea Level (MSL) GNSS Altitude Label 076 using something other than the WGS84 Ellipsoid in its altitude algorithm

(15) **Configuration Settings Parity**

Pin J1-66 provides the means to program strap each transponder's Configuration Data Program Pin Parity in accordance with Table 4-20.

The Parity is calculated based on the total of all ADS-B and Mode S program pins connected to J1-21. Refer to Tables 4-3 and 4-4 for a list of Configuration Program Inputs.

Table 4-20: Configuration Setting Parity Encoding

J1-66 State	Parity Value	Selection / Meaning
Open	0	The number of Configuration Data Program Pins connected to J1-21 is even.
J1-21	1	The number of Configuration Data Program Pins connected to J1-21 is odd.

Table 4-21: Example of Configuration Encoding (N6754H)

Function	Setting	Connector Pin #	Open	Ground J1-21	Strobe #1 J1-99	Strobe #2 J1-100	Strobe #3 J1-101	Strobe #4 J1-102	Strobe #5 J1-104	Strobe #6 J1-105
SDI	Transponder #2 (SDI = 10)	J1-85		X						
Baro Correction Type/Alt Source	Baro Alt = BNR, A429 Alt Type	J1-84						X		
Max True Airspeed (TAS)	Max Airspeed = 180 knots	J1-94				X				
Mode-S Address A1-A3	101	J1-95					X			
Mode-S Address A4-A6	010	J1-96			X					
Mode-S Address A7-A9	001	J1-97		X						
Mode-S Address A10-A12	111	J1-98								X
Mode-S Address A13-A15	000	J1-80	X							
Mode-S Address A16-A18	101	J1-81					X			
Mode-S Address A19-A21	110	J1-82							X	
Mode-S Address A22-A24	111	J1-83								X
Antenna Cable Delay	Dual Antenna, No delay	J1-67	X							
Antenna BITE/RMS 555/ GAMA	Bite enabled, RMS 555 and GAMA disabled	J1-68					X			
GPS Antenna Longitudinal Offset A	Distance from nose of aircraft = 3.6m	J1-11	X							
GPS Antenna Longitudinal Offset B		J1-12				X				
Aircraft/Vehicle Length/Width A	Length = 10.8 meters	J1-5		X						
Aircraft/Vehicle Length/Width B	Width = 15.3 meters	J1-6	X							
Navigation Accuracy Category_Velocity (NACV)	< 10 meters/sec	J1-13		X						
System Design Assurance (SDA)	> $1x10^{-5}$ per flight hour	J1-14		X						
ADS-B FAIL Disable	Not disabled for J1-100 and J1-23	J1-15	X							
Aircraft Category	Weight = 4387 kg	J1-16		X						
Configuration Parity	Ground Count = Even	J1-66								
ADS-B Receive Capability	1090-In only	J1-4		X						
VFOM Adjust	GPS provides HAE	J1-52	X							

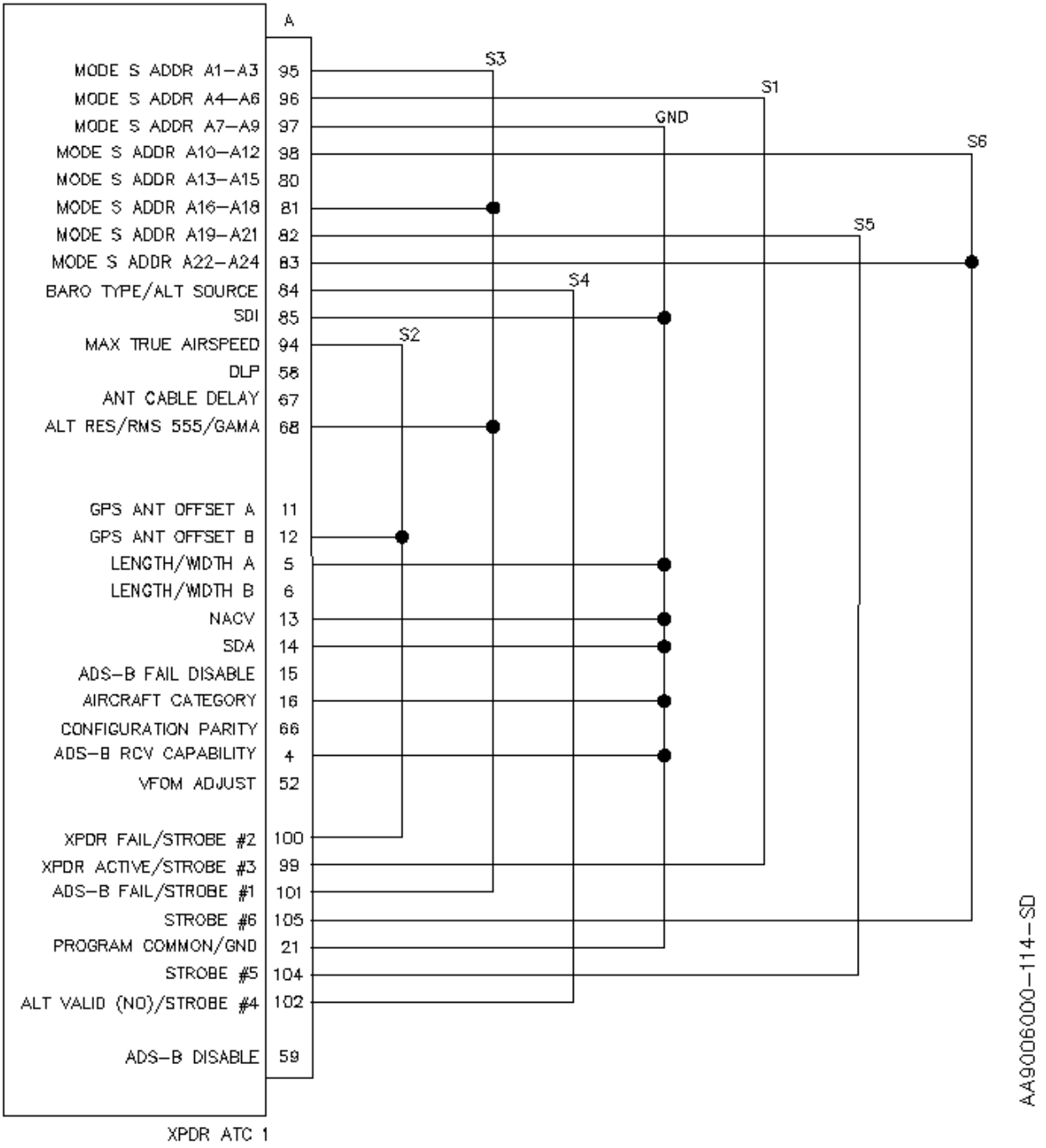

Figure 4-1: Example of Configuration Encoding Pinout (N6754H)

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ADJUSTMENT/TEST

1. General

The procedures that follow are designed to check for proper operation and satisfactory installation of the NXT-600 Transponder System while the aircraft is on the ground. These procedures describe a single and/or a dual Mode S transponder installation. For dual transponder installations, the same procedure can be used to check each transponder individually.

2. Equipment and Materials

Equipment and materials required to test and checkout the transponder are given in Table 5-1.

Table 5-1: Equipment and Materials

Equipment	Description	Source
Digital Multimeter	Fluke Model 29 Digital Multimeter	John Fluke Mfg Co Inc, Everett, WA
Transponder Ramp Tester	IFR-601 Transponder Test Set	Aeroflex Inc., Plainview, NY
	IFR 6000 ATC/TCAS/DME Test Set	Aeroflex Inc., Plainview, NY
	TB-2100 ATC/DME Test Set	Tel-Instrument Electronics Corp, Carlstadt, NJ
	APM-424 Transponder Test Set	JcAir Test Systems, New Century, KS
Air Data Test Set	Pilot/static test set	Any Commercial Source
NOTE: Equivalent alternatives are permitted for equipment in this list.		

3. Initial Harness Checkout (New Installations Only)

A. Transponder and Control Panel Harness Checkout

Refer to the applicable transponder and control unit interconnect diagrams to do continuity measurements and to ensure confidence in wiring for these units.

B. LRU Pre-installation Power Check

Before doing any operational tests, a power-on check is recommended to reduce the possibility of damage to newly installed system components, due to miswired power leads.

(1) Make sure all transponder components are removed from their mounting tray or that their aircraft mating connector(s) are disconnected.

(2) Connect external power to aircraft.

(3) Close all transponder 28 V dc circuit breakers, if applicable, and check for 28 V dc at the appropriate LRU mating connector pins. Refer to the applicable interconnect diagrams for LRU pin numbers.

(4) If power is misapplied on any connector pin, open the circuit breaker and rework miswired harness.

(5) Remove aircraft power.

C. Initial System Installation Operational Test

The initial checkout of a newly installed system should start with a system self-test and then be followed by a ramp test. The system self-test procedures are referenced in paragraph 4. The ramp tests should include an altitude reporting on/off test, a power and frequency test, an ATCRBS-only test, and a test to check the 4096 codes. For ADS-B installations ensure an ADS- B capable ramp tester is used to test the ADS-B registers. Refer to the applicable transponder ramp tester operation manual for procedures to do these tests.

4. Transponder Self-Test

A. With all power off, reinstall the transponder in its mounting tray. Make sure the control panel is also installed.

B. Apply aircraft power and close all applicable transponder circuit breakers.

C. Set control unit mode switch to STANDBY mode.

D. Press and release the PUSH TO TEST button on the transponder front panel. The test sequence that follows should occur.

- All transponder front panel annunciators come on for a 3-second lamp test.
- If the transponder is operational, the green XPDR PASS annunciator comes on for a 10-second display period and then goes off.
- If the transponder is not operational, one or more of the red fault annunciators comes on for a 10-second display period.

E. Make sure that transponder is operational. If failures are indicated, refer to the FAULT ISOLATION section of this manual; otherwise, proceed.

F. For a dual Mode S installation, repeat steps D. and E. for second transponder. Make sure the second transponder is selected on the control panel before repeating test.

NOTE: When the aircraft is on the ground, the lamps on the front panel of the transponder are active and represent the current status of subsystems. While in the air, all intermittent and hard failures are logged in the internal fault memory and are displayed for that flight leg when fault data is reviewed on the ground. This means while in the air, if an antenna fails for a short time and recovers for an unknown reason that particular flight leg results in an antenna fault that displays on the front lamps of the transponder. The exception is the off-side transponder (stand-by) does not run antenna BITE on the top/bottom antenna, so antenna failures are not recorded in the fault log of the off-side (stand-by) transponder.

5. Return-To-Service

Any time a transponder LRU has been removed and replaced following repair or maintenance, a return-to-service test is required. Refer to Section 7, MAINTENANCE PRACTICES, for applicable procedures.

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FAULT ISOLATION

1. General

The NXT-600 Mode S/ADS-B Transponder has a Built-In Test function that contains a continuous performance monitor and self-test monitor. The continuous performance monitor function monitors critical system parameters and records faults found during normal operation.

The self-test monitor function is activated upon command from the system controller, external discrete input, front test panel switch, maintenance computer, or a power-on cold start. The self-test function will annunciate active failures of the system, and provide historical data from previous flight legs.

The faults recorded by the performance monitor or self-test monitor are contained in a non-volatile fault log, which may be downloaded to a file using the WebEDDIT software tool.

Additionally, the NXT-600 Transponder has self-test capability that is activated and displayed on its front panel. This self-test function also indicates subsystem failures. For instance, if a control panel failure is annunciated, that specific unit can be replaced instead of unnecessarily removing a the NXT-600 Transponder.

2. Equipment

None.

3. Monitor Fault Logging

Faults detected by either the performance monitor or self-test monitor are logged in nonvolatile memory, and may be extracted from the transponder by maintenance personnel by downloading it to the WebEDDIT software tool.

4. Power-On Test

Power-On Test is always executed on a cold start, on ground only. When the transponder is powered on, all lamps on a front panel lit up (XPDR P/F- Green, all others - Red). After Power-On Test finishes successfully, all lamps turn off. If there is any failure diagnosed during Power-On Test, lamps indicate the failure for 10 seconds per Table 6-1.

5. Self-Test Monitor

The self-test monitor function is activated upon command from the system controller, external discrete input, front panel test switch, maintenance computer, or a power-on cold start.

There are no specific monitors exercised during self-test. The self-test function will annunciate active failures of the system, and provide recorded data from previous flight legs.

Functions that are monitored are as follows:

- Memory integrity
- Hardware, Firmware, and Software health and integrity
- ARINC 429 Transmitter and Receiver
- Discrete I/O
- Weight-On-Wheels Discrete Monitor
- RF Transmitter and Receiver

While on the ground, the status of the front panel test switch (Figure 6-1), is checked every 200 milliseconds by software. Front panel lamps do not come on if the transponder is in the air mode. Upon sensing a single momentary switch activation, all front panel lamps come on for a period of 2 to 3 seconds to test lamp function. The next available performance monitor results are then used to drive the front panel lamps for the next 10 seconds.

Table 6-1 indicates the interface or LRU that is invalid when the indicated lamp is lit, and possible corrective actions to be taken to solve the problem.

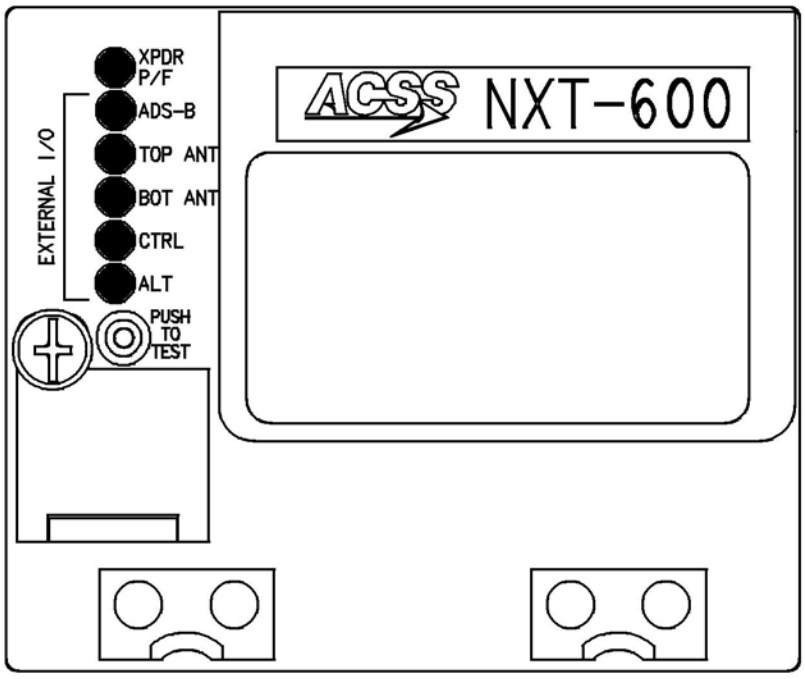

Figure 6-1: NXT-600 Transponder Front Panel

Table 6-1: Interface/LRU Possible Corrective Actions

Lamp	Failure	Possible Action
XPDR P/F	A green lamp indicates no failures. A red lamp indicates the transponder's internal performance monitors and BITE circuitry has detected a failure.	None Remove and replace transponder (See note).
ADS-B	This lamp is used to annunciate that the GPS position input that is required by the ADS-B OUT function is failed or unavailable.	Check GPS position source.
TOP ANT	Top antenna, or cabling and connectors to top antenna, has failed by indicating a resistance to ground >500 ohms.	Verify antenna cabling and connections (after removing transponder). Repair cabling or replace antenna as required.
BOT ANT	Bottom antenna, or cabling and connectors to bottom antenna, has failed by indicating a resistance to ground >500 ohms.	Verify antenna cabling and connections (after removing transponder). Repair cabling or replace antenna as required.
CTRL	Control panel has failed.	Select correct control panel source. Verify control panel cabling and signal presence. Replace control panel, if necessary.
ALT	The transponder systems ARINC 429 or 575 digital altitude sources SSM may be indicating FAIL WARNING or the bus may be inactive.	Verify altitude source is selected. Check altitude source.
NOTE: If the Mode S address is all 1's or all 0's, the XPDR P/F lamp will indicate red.		

A. Self-Test Initiation from Test Button

The transponder front panel test button initiates a self-test and retrieves data from past flight legs for display on the panel. The self-test monitor has the following requirements when initiated by the front panel test button.

(1) The self-test monitor is initiated when the test button is pushed when the aircraft is on the ground.

(2) The self-test monitor completes the self-test sequence once initiated, even if the test button is released. All front panel lamps come on and remain on while the self-test sequence is running.

(3) After the self-test sequence has completed, the transponder displays the results of the test on the front panel lamps for approximately 10 seconds. Any faults that become active during this time are displayed.

(4) If the button is released and then pushed after the self-test sequence has been completed, but before the 10 seconds have timed out, the transponder turns on all lamps for approximately 1 second, then displays the results for all failures (whether currently active or not) for the current flight leg.

(5) Continuing to push and release the test button displays contents for previous flight legs, as described in step (4), for up to 10 flight legs, or the maximum number of stored flight legs (if less than 10). If the button is pushed on the tenth or last flight leg, the lamps flash at a 5 Hz rate for 3 seconds. The flight leg display mode then terminates.

(6) If 10 seconds expire without the test button being pushed, the front panel lamps go off and the self-test display mode or the flight leg display mode terminates.

(7) The self-test monitor cannot be initiated if the aircraft is in the air.

B. Front Panel Lamp Display

The front panel lamp display annunciates failures in the transponder unit or failures of systems that are connected to the transponder as follows.

(1) Faults that are annunciated are a result of the continuous performance monitor and the self-test monitor.

(2) Faults that are displayed as a result of self-test are combined with faults that have been detected by the performance monitor. These faults are currently active. Faults that were detected previously by the performance monitor and have been cleared at the time the test is initiated are not annunciated.

(3) Faults that are displayed for the current or previous flight leg are faults detected as a result of self-test or the performance monitor. Faults that were intermittent are displayed.

(4) These results are only displayed following a self-test initiated by the front panel self-test button. There is no display during or following a self-test initiated by other means or during non self-test operation.

NOTE: When the aircraft is on the ground, the lamps on the front panel of the transponder are active and represent the current status of subsystems. While in the air, all intermittent and hard failures are logged in the internal fault memory and are displayed for that flight leg when fault data is reviewed on the ground. This means while in the air, if an antenna fails for a short time and recovers for an unknown reason, that particular flight leg results in an antenna fault that displays on the front lamp of the transponder. The exception is the off-side transponder (stand-by) does not run antenna BITE on the top/bottom antenna, so antenna failures are not recorded in the fault log of the off-side (stand-by) transponder.

6. Continuous Performance Monitor

The continuous performance monitor function is used to monitor the system condition under normal operation and annunciate faults as required. The function monitors circuitry internal to the transponder and also monitors interfaces to other systems and subsystems. If a fault is detected in either internal circuitry or external systems, the fault is recorded in an internal fault log.

Depending on the severity of the fault or the impact on system operation, the fault may also be annunciated to the flight crew by the transponder control panel failure annunciator.

All failures are logged into non-volatile memory for later analysis by maintenance personnel. The following functions are tested by the continuous performance monitor on a once per second cyclic basis (except for power-on test functions):

- Flash EPROM Memory
- Calibration RAM Memory
- Hardware Watchdog Monitor
- RAM SEU Monitor
- FPGA SEU Monitor
- RAM Software CRC Monitor
- DAPS Input Monitor
- ARINC 429 TCAS Bus Monitor
- ARINC 429/575 Altitude Bus Monitor
- ARINC 429 ADLP Bus Monitor
- ARINC 429 Control Panel Bus Monitor
- ARINC 429 Maintenance Bus Monitor
- Discrete Output Monitor
- WOW Input Discrete Monitor
- Invalid Mode S Address Monitor
- Mutual Suppression Monitor
- Mode S Address Change Monitor

- RF Forward Power
- Squitter Monitor
- Local Oscillator Synthesizer Monitor
- RF Receiver Monitor
- Antenna Monitor
- TCAS Dispatch Failure
- Power Supply Voltages
- Ambient Temperature Monitor
- Unexpected Cold Start
- Software Fault Monitor.

A. Fault Indications

Table 6-2 provides a list of fault indications for all failures that can be diagnosed in field. The rest of the failures, such as power supply monitor faults or Local Oscillator fault, are not indicated, but are recorded in internal non-volatile memory and can be accessed if unit is returned to the factory for service. See Table 6-1 for recommended corrective actions.

Coding used in the various table columns is as follows:

- In the transponder Front Panel Lamps column, the following letters correspond to setting the specified lamps:

  X - XPDR P/F

  S - ADS-B

  T - TOP ANT

  B - BOT ANT.

  C - CTRL

  A - ALT
- Y in the Standby column indicates that Transponder will go into Standby mode
- Y in LRU Reset column indicates that Transponder will perform a Reset.
- Y in the TCAS Fail column indicates whether a failure is indicated on the TCAS display.
- X in Discretes Column indicates “XPDR FAIL” on Control Panel
- Z in Discretes Column indicates “ADS-B FAIL” on Control Panel

Table 6-2: XPDR Failure Indications

Description	Front Panel Lamps[1]	Standby	TCAS Fail	LRU Reset	Discretes	CTRL L350 BIT/Fault Code
Calibration RAM Memory CRC Fault	X	Y	Y		X	Code 70
RAM SEU Not Corrected Fault	X	Y	Y	Y	X	
FPGA SEU Not Corrected Fault	X	Y	Y	Y	X	
Hardware Watchdog Fault	X	Y	Y		X	
RAM Software CRC Fault	X	Y	Y		X	
TCAS Bus Failure						BIT 28 Code B2
ARINC 429/575 Altitude Bus #1 Class 1 Fault	A				X	BIT 25 Code 91
ARINC 429/575 Altitude Bus #2 Class 1 Fault	A				X	BIT 26 Code 92
Control Panel Port A Fault	C	Y			X	Code 82
Control Panel Port B Fault	C	Y			X	Code 83
Invalid Mode S Address Fault	X		Y	Y	X	Code F0
WOW Input Discrete Fault	X	Y			X	
ADS-B System Fail with Light Fault	S				X, Z[2]	BIT 29
ADS-B System Fail with No Light Fault	S				Z[3]	BIT 29
Forward Power Fault Bot antenna	X		Y		X	Code 23
Forward Power Fault Top antenna	X		Y		X	Code 22
Forward Power Isolation Fault Bot antenna	X		Y		X	
Forward Power Isolation Fault Top antenna	X		Y		X	
Squitter Fault	X	Y			X	
Top RCVR Listen Fault	X	Y			X	
Top RCVR Isolate Fault	X	Y			X	
Bot RCVR Listen Fault	X	Y			X	
Bot RCVR Isolate Fault	X	Y			X	
RF ATCRBS Receiver Fault	X	Y			X	
Bot Antenna Fault	B					

Table 6-3: XPDR Failure Indications (cont)

Description	Front Panel Lamps[1]	Standby	TCAS Fail	LRU Reset	Discretes	CTRL L350 BIT/Fault Code
Top Antenna Fault	T					
TCAS Dispatch Fault Bottom			Y		X	
TCAS Dispatch Fault Top			Y		X	
Operational Software Fault				Y		
Boot ARINC RCVR Fault	X	Y			X	
Boot_ARINC_XMTR_Fault	X	Y			X	
Boot_XIC_FPGA_CRC_Fault				Y[5]		
Boot_XIC_FPGA_Load_Fault				Y		
Boot_BOOT_CRC_Fault				Y		
Boot_DL1_CRC_Fault				Y[4]		
Boot_DL2_CRC_Fault				Y[4]		
Boot_APP_CRC_Fault				Y[5]		
Boot_Calibration_CRC_Fault	X	Y			X	
Boot_RAMADDR_Fault				Y		
Boot_RAMPAT_Fault				Y		
Boot_ECC_Fault				Y		
Boot_DLRAM_CRC_Fault				Y		
Boot_Exception_Fault				Y		
Boot_Image_Compatible_Fault	X	Y			X	
Boot LRU Type Compare Fault	X	Y			X	
Boot Discrete Input Test Fault	X	Y			X	
Boot_XICFPGA_SEM_Fault				Y		
Synthesizer Lock detect failure	X	Y	Y		X	Code 31

Notes:

1. *If no errors corresponding to XPDR FAIL are detected, the XPDR P/F Green lamp is to be lit.*
2. *If Extended Squitters are disabled the XPDR FAIL discretes and ADS-B Function Fail discrete are not activated.*
3. *If Extended Squitters are disabled the ADS-B Function Fail discrete is not activated.*
4. *This fault may or may not cause a reset depending on a Request for Data Load.*
5. *If unable to force a data load, LRU reset is triggered.*

MAINTENANCE PRACTICES

1. General

This section provides instructions for removing, reinstalling, and adjusting each Line Replaceable Unit (LRU) of the NXT-600 Mode S/ADS-B Transponder that has been previously installed by the aircraft manufacturer or completion center.

CAUTION: SHOULD ANY INSTALLATION CRITICAL CASES ARISE WITH THE REINSTALLATION OF ANY UNIT, INSTRUCTIONS MUST BE FOLLOWED 100 PERCENT.

CAUTION: WHEN REMOVING OR INSTALLING ANY LRU, PREPARE THE AIRCRAFT FOR SAFE GROUND MAINTENANCE. OPEN AND TAG ALL APPLICABLE SYSTEM CIRCUIT BREAKERS.

2. Equipment and Materials

Refer to the Aircraft Maintenance Manual (AMM) for materials required to install necessary components.

NOTE: No special equipment or materials other than those commonly used by line maintenance technicians are required to remove and install the units. Do not over tighten the mounting screws and hold-down knobs. Where torque values are not given, it is acceptable to hand tighten the mounting screws and finger tighten the equipment hold-down knobs.

3. Procedure for the NXT-600 Mode S/ADS-B Transponder

A. Removal and Installation Procedure

(1) Remove the NXT-600 Transponder.

(a) Loosen the mounting tray hold-down knobs.

(b) Slowly pull on the transponder's handle to separate the unit from its mounting tray connector. The transponder is now free to be removed from its mounting tray.

(c) Place electrostatic protective cover on the transponder's connector.

(2) Reinstall the NXT-600 Transponder.

(a) Remove the electrostatic protective cover from the transponder's connector.

(b) Slide the transponder into its mounting tray.

CAUTION: DO NOT FORCE FIT. IF MATING IS DIFFICULT, REMOVE THE UNIT AND EXAMINE THE CONNECTORS FOR CONTACTS THAT ARE BENT OR OUT OF ALIGNMENT. ALSO CHECK THE ALIGNMENT OF THE CONNECTORS' POLARIZATION KEYS AND POSTS.

(c) Carefully apply firm pressure until the transponder connector mates with the tray connector.

(d) Tighten mounting tray hold-down knobs to make sure that the connectors are fully engaged.

B. Adjustment Procedure

Not Applicable.

C. Repair Procedure

Not Applicable.

D. Return to Service Procedures

For installations using serial data bus (ARINC 429) or analog altitude data, do the transponder self-test procedures referenced in Section 5, Adjustment/Test. After the transponder passes these tests, the appropriate logbook entries can be made and the unit is ready for use.

4. Procedure for the Omnidirectional Antenna

A. Removal and Installation Procedure

(1) Prior to removing the Mode S antenna, put the transponder into stand-by mode or pull and collar the ATC circuit breaker before commencing with maintenance.

(2) Remove the omnidirectional antenna.

(a) If applicable, use a phenolic scraper to remove aerodynamic sealant around periphery of antenna baseplate.

(b) If applicable, remove sealant from antenna mounting screw holes.

(c) Remove retaining screws used to secure antenna to aircraft fuselage.

(d) Carefully pull antenna from fuselage.

(e) Disconnect the coaxial cable connector from the antenna.

(f) Put protective covers on the aircraft coaxial cable connector and the antenna connector.

(3) Reinstall the omnidirectional antenna.

(a) If applicable, remove any existing aerodynamic sealant from antenna mounting surface and clean antenna mounting area.

(b) Remove and clean sealant from baseplate and baseplate cutout.

(c) Remove protective covers from antenna and coaxial cable connectors.

(d) Examine antenna and coaxial cable connectors to make sure that they are clean and secure.

(e) Connect aircraft coaxial cable to antenna connector.

(f) Position the antenna on the fuselage mounting surface and secure the antenna with the appropriate screws.

(g) Apply an aerodynamic sealant around the periphery of the antenna baseplate.

B. Adjustment Procedure

Not Applicable

C. Repair Procedure

Most omnidirectional antennas are non-repairable. If the antenna is damaged or faulty, it must be replaced with a new antenna.

D. Return to Service

Do the transponder Return to Service Test Procedures referenced in paragraph 3.D. of this section.

5. Procedure for the Control Panel

A. Removal and Installation Procedure

(1) Remove the control panel.

(a) Disengage Dzus fasteners on control panel.

(b) Pull control panel out of aircraft mounting location and disconnect aircraft cable connectors. Control panel is now free to be removed from aircraft.

(c) Put electrostatic protective covers on control panel and aircraft mating electrical connectors.

(2) Reinstall the control panel.

(a) Remove protective covers from control panel and aircraft mating connectors.

(b) Connect aircraft cables to control panel connectors.

(c) Insert control panel into mounting location.

(d) Engage Dzus fasteners on the control panel to secure it to aircraft structure.

B. Adjustment Procedure

Not Applicable

C. Repair Procedure

Any repair procedures should be in accordance with manufacturer's repair instructions.

D. Return to Service Procedures

Do the transponder Return to Service Test Procedures referenced in paragraph 3.D. of this section.

6. Instruction for Continued Airworthiness, 14 CFR Part 25.1529

Maintenance requirements and instructions for Continued Airworthiness of the NXT-600 Mode S/ADS-B Transponder components are contained in the paragraphs that follow:

Installation of the transponder on an aircraft by Supplemental Type Certificate or Form 337 obligates the aircraft operator to include the maintenance information supplied by this manual in the operator's Aircraft Maintenance Manual and the operator's Aircraft Scheduled Maintenance Program.

The Airworthiness Limitations Section is FAA approved and specifies maintenance required under 14 CFR Part 43.16 and 14 CFR Part 91.403 of the Federal Aviation Regulations, unless an alternative program has been FAA approved.

A. Installation and maintenance information for the transponder is contained in this manual. Refer to the Sections System Description, Mechanical Installation, Electrical Installation, Adjustment/Test and Maintenance Practice; sub-section Removal and Installation Procedure, Inspection/Check, Cleaning/Painting, etc.

B. There are no special tools required for the removal and installation of the NXT-600 Transponder other than commonly used Line Maintenance support equipment.

C. Required information on the NXT-600 interfaces is detailed in Section 1 System Description and Section 4 Loading/Gradient Specifications.

D. Basic control and operating information are included in this installation manual. Refer to Section 1 System Description sub-sections Component Descriptions and Functional Description and Operation.

E. Line Replaceable Unit (LRU) part numbers and other necessary part numbers contained in this manual should be placed into the aircraft operator's appropriate aircraft Illustrated Parts Catalog (IPC).

F. Wiring diagram information contained in this manual should be placed into the aircraft operator's appropriate aircraft Wiring Diagram Manuals. Refer to Figure 2-1 NXT-600 Mode S/ADS-B Transponder Outline and Installation Diagram.

G. The transponder is considered an on-condition unit and no additional maintenance is required other than a check for security and operation at normal inspection intervals.

H. If a system component is inoperative, remove unit, secure cables and wiring, collar applicable switches and circuit breakers, and placard them inoperative. Revise equipment list and weight and balance as applicable prior to flight and make a log book entry that unit was removed (refer to 14 CFR Part 91.213 or the aircraft's Minimum Equipment List [MEL]).

I. The transponder system LRUs can be repaired only at a factory-authorized repair center or an appropriately rated 14 CFR Part 145 repair station.

J. Once repaired, reinstall the LRU in the aircraft in accordance with the original Form 337 approved data or instructions in this manual. Do a Return to Service test of the system and approve it for return to service with a log book entry in accordance with the requirements specified in 14 CFR Part 43.9.

K. Scheduled Maintenance Program tasks to be added to the aircraft operator's appropriate aircraft maintenance program are as follows:

(1) Recommended periodic scheduled servicing tasks: none required.

(2) Recommended periodic inspections are as follows.

- The NXT-600 Mode S/ADS-B Transponder has tests and inspections that are required by 14 CFR Part 91.413 to be completed every 24 calendar months.
- The ATC antennas used with the NXT-600 Mode S/ADS-B Transponder should be removed and the underlying structure inspected for deterioration and corrosion every 60 months or 12,000 hours, whichever occurs first.

(3) Recommended periodic scheduled preventative maintenance tests (tests to determine system condition and/or latent failures).

- The NXT-600 Mode S/ADS-B Transponder is designed to detect its own failures as well as failures external to the transponder itself. This BIT is continuously being executed on a periodic basis. Refer to Section Fault Isolation.
- No formal periodic maintenance is required for the transponder or the control panel other than the 24 calendar month re-certification test required by 14 CFR Part 91.413.

L. If there are changes to the Instructions for Continued Airworthiness, the installation manual will be revised accordingly. When document revisions are approved, the ACSS Customer Services extranet website is automatically updated. The extranet site then notifies the affected customers automatically by email, and on next login of the documentation change. This process is documented in ACSS INS-13.8-1, Distributing Publications via the ACSS Customer Services Extranet.

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INSPECTION/CHECK

1. General

The visual check procedures that follow are recommended for the transponder and associated LRUs after they have been installed in the aircraft.

2. Procedure

CAUTION: MAKE SURE THAT THE TRANSPONDER SYSTEM CIRCUIT BREAKERS ARE OPEN BEFORE DOING ANY OF THE PROCEDURES THAT FOLLOW.

A. Check Transponder

(1) Visually examine all external surfaces for possible damage. Check dust cover and external connectors for dust, corrosion, or damage.

(2) Check external parts for loose or damaged hardware.

(3) Make visual check of wiring and connectors for damage.

B. Check Antenna

(1) Visually examine all external surfaces for possible damage.

(2) Check coaxial cables for breaks, burned areas, and damaged insulation.

C. Check Control Panel

(1) Visually examine all external surfaces for possible damage.

(2) Check external parts (connectors, control knobs, annunciators) for looseness or damage.

(3) Check controls for smooth, positive action.

(4) Check that control panel is securely mounted (Dzus fasteners properly engaged).

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CLEANING/PAINTING

1. General

While the NXT-600 System is installed in the aircraft, cleaning is limited to the procedures given below. Painting and more extensive cleaning should be done during maintenance when the LRUs can be disassembled. Detailed instructions are presented in each applicable component-level maintenance manual.

2. Equipment and Materials

Refer to Table 9-1 for equipment and materials necessary to clean the transponder and associated LRUs.

WARNING: KNOW THE HAZARD CODE AND GET THE NECESSARY PROTECTION BEFORE USING A MATERIAL. REFER TO THE PAGE ABOUT HAZARD CODES FOR MATERIALS IN THE FRONT OF THIS MANUAL.

Table 9-1: Equipment and Materials

Name	Description	Source
60-086-76	Lint free cloth — Bluewipes, No. TX512	Texwipe Co, Upper Saddle River, NJ
Cleaning Brush	Soft, natural-bristle (camel's hair)	Optional source
11-1 15-78 HAZARD CODE 130D	Solvent, alcohol, ethanol, denatured (O-E-760, Type lll)	Optional source
Glass Cleaner	Ammoniated	Optional source
Lens Tissue	Non-linting	Optional source
Air Supply	Air ionizing nozzle gun attachment for compressed air (20 psi)	Optional source
Abrasive Paper	No. 600, nonconductive abrasive	Optional source
NOTE: Equivalent alternatives are permitted for equipment and materials in this list.		

3. Cleaning

CAUTION: IF YOU CLEAN ELECTROSTATIC SENSITIVE COMPONENTS WITH PRESSURIZED AIR, MAKE SURE THE HOSE HAS AN AIR IONIZING NOZZLE OR GUN. AN ELECTROSTATIC CHARGE CAN CAUSE DAMAGE TO THE LRU COMPONENT PARTS IF THE NOZZLE OR GUN ATTACHMENT IS NOT USED.

A. Clean Transponder and Mounting Tray

(1) Loosen hold-down clamps and pull transponder out of mounting tray.

(2) Clean mounting tray with cloth or brush dampened in solvent; dry with cloth or compressed air.

(3) Clean all dust and foreign matter from front panel and air vents on bottom and top of transponder using either cloth or brush dampened in solvent; dry with cloth or compressed air.

B. Clean Antenna

Use cloth or brush dampened in solvent to clean; dry with cloth or compressed air.

C. Clean Control Panel

(1) Clean dust and foreign matter from connectors with cloth or brush dampened in solvent. Dry with cloth or compressed air.

(2) Clean front of control panel with mild glass cleaner and soft cotton cloth.

4. Painting

Except for minor retouching, painting should be done after equipment has been removed from the aircraft or during maintenance.

REPAIRS

1. General

Major repairs to the NXT-600 System components are made only during maintenance when the equipment is removed from the aircraft. Detailed instructions for repair and adjustment of each of the repairable LRUs are presented in the applicable component maintenance manuals given below.

Table 10-1: ACSS Component Maintenance Manual Reference

LRU	ACSS Component Maintenance Manual Pub. No.	ATA Number
NXT-600 Mode S/ADS-B Transponder Part No. 9006000-55YYY	8009103-001	34-52-14
Control Panel Part No. 4052190-902, -904, -906, -908	15-3841-01	34-43-01
Control Panel Part No. 4052190-903, -905, -907, -909	15-3841-03	34-43-05

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