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# Introduction and Description

## Purpose of this Document

This document describes the Airborne Collision Avoidance System X (ACAS X) functionality and provides the necessary interface definitions and protocols to accommodate the requirements of RTCA DO-385**:** *Minimum Operational Performance Standards for Airborne Collision Avoidance System X (ACAS X) ACAS Xa and ACAS Xo)* (latest version applies) and the requirements of RTCA DO-386: Minimum Operational Performance Standards for Airborne Collision Avoidance System X (ACAS X) ACAS Xu (latest version applies)*.*

Additionally, this document describes interfaces and protocols necessary to accommodate Cockpit Display of Traffic Information (CDTI) based on reception of Automatic Dependent Surveillance – Broadcast (ADS-B) data and Traffic Information Services – Broadcast (TIS-B) data. The equipment becomes ACAS X with ADS-B IN applications added, as defined by RTCA DO-317C: *Minimum Operational Performance Standards for (MOPS) for Aircraft Surveillance Applications (ASA) Systems* (latest version applies).

ACAS X hybrid surveillance is an integral part of RTCA DO-385/386 MOPS.

ARINC 735C compliance requires conformity to the relevant RTCA MOPS for the prescribed application.

COMMENTARY

The control and Human Machine Interface (HMI) for CDTI and ADS-B IN have not been standardized. Therefore, this characteristic attempts to provide interfaces which could potentially support many different options for control and interfacing. It is expected that actual aircraft installations will use a subset of these.

Older TCAS equipment (ARINC Characteristic 735 and ARINC Characteristic 735A compliant) was designed to be backward compatible with Mode S transponders defined by ARINC Characteristic 718, which are only compatible with RTCA DO-185. ARINC 735A equipment is compatible with Mode S transponders defined by ARINC Characteristics 718 and 718A, which are compatible with both RTCA DO-185 and RTCA DO-185A.

ARINC 735B TCAS equipment was intended to be compatible with ARINC 718A transponders that provide extended squitter (i.e., ADS-B OUT, DO-260/A/B) capability, which are compatible with RTCA DO-185B.

An ARINC 735C ACAS X traffic computer is intended to be compatible with transponders that support the XGD / TGD protocol; it is not expected that an ARINC 735C ACAS X traffic computer would support the older ARINC 735 protocol. An ARINC 735C ACAS X traffic computer is also intended to be compatible with RTCA DO-260B/C compliant transponders which will transmit squitters with Resolution Advisory (RA) data.

## System Description

The U.S. National Aviation Standard on TCAS, FAA Order 6367.1, describes the “signal-in-space” standards for TCAS. RTCA DO-385 provides a complete technical description of ACAS Xa/Xo. RTCA DO-386 provides a complete technical description of ACAS Xu. RTCA DO-317C provides the technical description for ADS-B In applications.

## Traffic Surveillance Functions

### ACAS X

The function of the ACAS X is to determine the range, altitude, and bearing of other cooperative (aircraft equipped with Mode S/Air Traffic Control Radar Beacon System (ATCRBS)/ADS-B transponders) and noncooperative (ACAS Xu only) (aircraft detected using Air to Air Radar or other noncooperative surveillance) aircraft with respect to the location of own aircraft. The system monitors the trajectory of these aircraft for the purpose of determining if any of them constitute a potential collision risk. The system is responsible for estimating the time to closest approach. If a potential conflict exists, the system will display an advisory to the pilot. In cases defined in this document, the system should also provide guidance for the optimum vertical and/or horizontal avoidance maneuver. The avoidance maneuver is provided following coordination of mutual intentions with the other CAS equipped aircraft through the Mode S transponder or via passive (ADS-B) coordination methods.

The Traffic Computer function uses the extended range capability of ADS-B technology. Aspects of this functionality can include a number of different ADS-B IN applications as defined in RTCA   
DO-317C.

COMMENTARY

Much of the functionality defined by this document is based on ARINC Characteristic 735B. Therefore, significant portions of ARINC Characteristic 735B and ARINC Characteristic 735C are identical. Users of these documents should consider the need for commonality when planning future revisions to these documents.

Within this document, the Traffic Computer functions described represent the combined ACAS X and ADS-B IN applications. The term “TCAS computer” is widely used in ARINC Characteristic 735B, and is replaced with ACAS X in ARINC Characteristic 735C. In this document (ARINC Characteristic 735C), the term “ACAS X traffic computer” is used to refer to ACAS X or ACAS X with ADS-B IN applications. Therefore, any instances of “ACAS X Unit” or “ACAS X Computer” can be interpreted as also meaning Traffic Computer.

#### ACAS X Mode Selection

ACAS X has three selectable modes: For ACAS Xa these include TA/RA (Traffic Alert/Resolution Advisory), Traffic Advisory (TA) Only and Standby. For ACAS Xu the modes are RWC/CA (Remain Well Clear/Collision Avoidance), Surveillance-Only, and Standby.

COMMENTARY

ACAS X does not use sensitivity level for advisory determination as was the case for DO-185() TCAS systems, however the sensitivity level parameter is carried forward to maintain interoperability with these systems. ACAS X will never indicate operation at a sensitivity level greater than 3 so as not to affect advisory determination of legacy TCAS systems. Ground station SL commands are ignored by ACAS X systems.

## Unit Description

The following sections describe each of the units that comprise the ACAS X traffic computer system. These include the ACAS X traffic computer, Control Unit, Displays and Antenna.

### ACAS X Traffic Computer

The ACAS X traffic computer should include all components incident to the functioning of the ACAS X installation other than those necessary to affect the display of collision avoidance, traffic advisories and Remain Well Clear (RWC) guidance to the crew, for crew control of system operation, and electronics necessary at the antenna.

### Control Unit

Flight deck controls for ACAS X should be provided on the control panel of its associated Mode S transponder unit. As there is no direct link between this control panel and the ACAS X traffic computer, control information will be delivered to the ACAS X via the Mode S transponder. The control panel should provide the needed interface to the Mode S transponder required for the ACAS X installation. Communications links from the Mode S transponder unit to the ACAS X should be the two-wire serial digital system described by **ARINC Specification 429**: *Digital Information Transfer System (DITS).* Details of the Mode S Transponder control panel are contained in **ARINC Characteristic 718A**: *Mark 4 Air Traffic Control Transponder (ATCRBS/Mode S).*

### ACAS X Displays

The ACAS X traffic computer includes ACAS X (DO-385) traffic display capability. With the integration of other traffic computer functionality, the unit may have the ability to display both traditional TCAS traffic and multi-source traffic comprising of TCAS, ADS-B, TIS-B, Automatic Dependent Surveillance – Re-Broadcast (ADS-R) and noncooperative sources such as ATAR (for ACAS Xu only).

Resolution advisories, traffic advisories, and remain well clear guidance (for ACAS Xu) may be displayed to the crew on one or more dedicated displays, or on displays integrated with other instruments such as an Instantaneous Vertical Speed Indicator (IVSI).

### Antennas

The installation should provide two L-band transmit/receive antennas for each ACAS X Traffic Computer on the aircraft, one located on the underside of the fuselage and the other on top. The upper antenna will provide the ACAS X traffic computer with signals for an estimation of the signal angle-of-arrival. The lower antenna may be an omni-directional blade antenna or directional antenna at the option of the user.

These antennas also provide reception of 1090 MHz ADS-B, TIS-B, and ADS-R information in support of ADS-B IN applications.

COMMENTARY

This document assumes that the minimum configuration will use the omni-directional blade for the lower antenna.

### Relationship to ARINC 735B TCAS

ACAS X systems, as described in this document, share many similarities with the TCAS/Traffic Computer defined by ARINC Characteristic 735B. ACAS Xa is intended as a drop in replacement for most legacy TCAS II systems and so ACAS Xa interfaces are consistent with those of TCAS II. To the extent possible ACAS Xu, which is intended for remotely piloted large UAS, is also consistent with TCAS II but does require some additions.

## Altitude Reporting Data

Barometric altitude data is not provided directly to the TCAS computer. Instead, altitude data is provided to the TCAS computer through the Mode S transponder from appropriate aircraft computing devices, such as air data system, altitude computer system, or other part of the aircraft altimeter system. Refer to RTCA DO-385/386 for a more detailed discussion and guidance on the altimetry system inputs necessary to support ACAS X operation.

## Interchangeability

### General

One of the primary functions of an ARINC Characteristic is to designate, in addition to certain performance parameters, the interchangeability in an aircraft of equipment produced by various manufacturers. The manufacturer is referred to **ARINC Report 607:** *Design Guidance for Avionic Equipment*, for definitions of terms and general requirements for the airline industry for interchangeability. As explained in that report, the degree of interchangeability considered necessary and attainable for each particular system is specified in the pertinent ARINC Characteristic for that system.

### Interchangeability Desired for ARINC 735C ACAS

Airlines desire unit interchangeability for the ARINC 735C ACAS X traffic computer, regardless of the manufacturing of individual items.

The TCAS connector definition and interface protocols defined herein should be backward compatible with a TCAS designed to ARINC Characteristic 735A and ARINC 735B. This backward compatibility should be such that, with few exceptions for interfaces that are no longer used in modern aircraft, an ARINC 735C ACAS X traffic computer can be used in an installation designed for an ARINC 735B and ARINC 735A TCAS computer.

### Generation Interchangeability Considerations

Unchanged is the industry’s traditional desire that future evolutionary equipment improvements and the inclusion of additional functions in new equipment during the next few years, do not violate the interwiring and form factor standards set forth in this document. Provisions to ensure forward looking “generation interchangeability” (as best can be predicted) are included in this document to guide manufacturers in future developments.

## Regulatory Approval

The ACAS equipment should meet all applicable Federal Aviation Administration (FAA) Technical Standard Order (TSO) requirements and Federal Communications Commission (FCC) requirements. The manufacturers are urged to obtain all necessary information from the FAA and FCC on such regulatory approval. This information is not contained in this ARINC Characteristic, nor is it available from ARINC.

# Interchangeability Standards

## Introduction

This section sets forth the specific form factor, mounting provisions, interwiring, input and output interfaces, and power supply characteristics desired for the complete ACAS X system. These standards are necessary to ensure the continued independent design and development of both the equipment and the airframe installations.

Manufacturers should note that although this document does not preclude the use of different form factors and interwiring features, the practical problem of redesigning what will then be a standard aircraft installation to accommodate some special system could very well make the use of that other design prohibitively expensive for the customer. They should recognize, therefore, the practical advantages of developing equipment in accordance with the form factor, interwiring and signal standards of this document.

The ACAS X traffic computer (ARINC 735C) and the Mode S transponder (ARINC 718A) are each intended to be unit interchangeable. The design of these two units should be such that ACAS X and Mode S transponders purchased from different suppliers will be completely interoperable. The FAA TCAS Advisory Circular 20-151C requires demonstration of this interoperability by ACAS Xa equipment manufacturers.

COMMENTARY

The form and fit of the control panel is a customer option and is not required to be supplied by the ACAS X traffic computer manufacturer.

## Form Factor, Connectors and Index Pin Coding

### ACAS X Traffic Computer

The ACAS X traffic computer should comply with the dimensional standards in ARINC Specification 600: *Air Transport Avionics Equipment Interfaces*, for the 6 MCU form factor. The computer should also comply with ARINC 600 standards in respect of weight, racking attachments, front and rear projections, and cooling.

The traffic computer should be provided with a low insertion force, size 3 shell ARINC 600 service connector. It should be located on the center grid of the computer unit’s rear panel. Index pin code 40 should be used. The left top (LTP) and left middle (LMP) inserts should provide four each size 1 RF coaxial contacts. The left bottom (LBP) insert should provide 11 pin type contacts and two each size 5 coaxial contacts. The right top (RTP) insert should be blank but may be used for purposes other than ACAS X traffic computer functionality. The right middle (RMP) insert should provide 150 #22 socket type contacts. The right bottom (RBP) insert should provide 100 #22 socket type contacts. ATTACHMENT 2 to this document shows the connector arrangement and ATTACHMENT 3A shows the pin assignments.

COMMENTARY

A smaller form factor, e.g., 4 MCU, may be acceptable in some installations provided that the size 3 ARINC 600 service connector is retained.

### Antenna

The physical characteristics, mounting dimensions, and connectors shown in ATTACHMENT 9A, ATTACHMENT 9B, and ATTACHMENT 9C are considered typical for the antennas. While the airframe manufacturer may have some perfectly valid reasons for using another style or type of antenna, he should take note of the airline wishes regarding avoidance of the spares problem introduced by the use of any antenna which does not conform to these standards. Section 5.0 of this document provides further information on the antenna system.

### Relationship of ARINC 735C to ARINC 718A

As described in Section 1.3, ACAS X performs the function of gathering position data of other aircraft in the immediate vicinity using one or more position sources. ACAS X computes the potential for conflict and provides situational awareness to the flight crew. The ACAS X works cooperatively with its associated ARINC 718A Mode S transponder to provide an air-to-air communication for coordination and display of Resolution Advisories (RA). Control commands are passed to the ACAS X computer unit from the control panel via the transponder as shown in ATTACHMENT 1A.

## Interwiring

The standard interwiring to be installed for the ACAS X is set forth in ATTACHMENT 3A. This interwiring is designed to provide the degree of interchangeability specified in Section 1.6. Manufacturers are cautioned not to rely upon special wires, cabling, or shielding for use with particular units because they will not exist in the standard installation.

COMMENTARY

Standardized interwiring is perhaps the heart of all ARINC Characteristics. It is this feature which allows the airline customer to complete its negotiations with the airframe manufacturer so that the latter can proceed with engineering and initial fabrication prior to airline commitment on a specific source of equipment. This provides the equipment manufacturer with many valuable months in which to put the final “polish” on his equipment in development.

The reader should give due consideration to the specific notes in ATTACHMENT 3B as they apply to the standard interwiring.

## Power Circuitry

### Primary Power Input

The aircraft power supply characteristics, utilization, equipment design limitations, and general guidance material are set forth in **ARINC Report 413A:** *Guidance for Aircraft Electrical Power Utilization and Transient Protection*, **ARINC Report 609:** *Design Guidance for Aircraft Electrical Power Systems*, and **RTCA DO-160:** *Environmental Conditions and Test Procedures for Airborne Equipment.*

#### AC Power Input

The equipment should be designed to use 115 Vac 400 Hz single phase Vac power. This primary power will be protected by a single circuit breaker, situated in the aircraft power distribution center. Refer to ATTACHMENT 1D.

#### DC Power Input

As an option, provisions may be made for powering the unit with +28 Vdc. If Vdc power is provided, the power source will be protected by a circuit breaker in the aircraft power distribution center. Refer to ATTACHMENT 1D.

### Power Control Circuitry

Primary power should be delivered to the ACAS traffic computer in the manner shown in ATTACHMENT 1D and ATTACHMENT 3A and as described in Note 10 of ATTACHMENT 3B to this document.

### The Common Ground

The wire connected to the ACAS X traffic computer connector pin labeled “Chassis Ground” should be employed as the +28 Vdc ground return to aircraft structure. It is not intended as a common return for circuits carrying heavy Vac currents, and equipment manufacturers should design their equipment accordingly.

### The AC Common Cold

The wire connected to the TCAS computer connector pin labeled “115 Vac Cold” will be grounded to the same structure that provides the +28 Vdc chassis ground but at a separate ground stud. Airframe manufacturers are advised to keep 115 Vac ground wires as short as possible in order to minimize noise pickup and radiation.

### Internal Circuit Protection

The basic master power protection means for the ACAS X computer will be external to the unit and utilize a standard circuit breaker rating. Within the equipment, no master power protection means is to be provided, although subdistribution circuit protection is acceptable where the set manufacturer feels this would improve the overall reliability of the equipment.

If internal protection by fuses is employed, these fuses should not be accessible when the set is installed in the aircraft radio rack but should be replaceable only when the equipment goes through the service shop.

If such subdistribution circuit protection is by means of circuit breakers, the majority prefer that these be accessible on the front panel of the equipment so that they can be reset in service.

## Environmental Conditions

The ACAS X traffic computer should be specified environmentally in terms of the requirements of **RTCA DO-160:** *Environmental Conditions and Test Procedures for Airborne Equipment*. ATTACHMENT 12 to this document tabulates the relevant environmental categories.

## Cooling

The ACAS X traffic computer unit should be designed to accept, and airframe manufacturers should configure the installation to provide, forced air cooling as defined in Section 3.5 of ARINC Specification 600. The airflow rate provided to the computer unit in the aircraft installation should be 33 Kg/hr. The pressure drop of the coolant flow through the equipment should be 5 ±3 mm of water at this rate. The unit should be designed to dissipate less than 150 watts and to expend the pressure drop to maximize the cooling effect. Adherence to the pressure drop standard is needed for interchangeability of the equipment.

COMMENTARY

Equipment failures in aircraft due to inadequate thermal management have plagued the airlines for many years. Section 3.5 of ARINC Specification 600 includes information that airframe and equipment suppliers need to know to prevent such problems in the future. Airlines regard this material as “required reading” for all potential suppliers of ACAS X equipment and aircraft installations.

Equipment designers should be aware that many ACAS X installations will be made in aircraft that provide ARINC 404A cooling rather than ARINC 600 cooling. Consideration should be given to this fact during the mechanical design phase of equipment planning.

## Grounding and Bonding

The attention of equipment and airframe manufacturers is drawn to the guidance material in Section 3.2.4 of ARINC Specification 600 and Appendix 2 of ARINC Specification 404A on the subject of equipment and radio rack grounding and bonding.

COMMENTARY

A perennial problem for the airlines is the location and repair of airframe ground connections whose resistances have risen as the airframe aged. A high resistance ground usually manifests itself as a system problem that resists all usual approaches to rectification, and invariably consumes a wholly unreasonable amount of time and effort on the part of maintenance personnel. Airframe manufacturers are urged, therefore, to pay close attention to assuring the longevity of ground connections. Close attention to the above-referenced specification material should be their first step.

## Standardized Signaling

The standard electrical inputs and outputs from the systems should be in the form of a digital format or switch contact. Standards should be established exactly to assure the desired interchangeability of equipment.

Certain basic standards established herein are applicable to all signals. Unless otherwise specified in Section 3.5, the signals should conform to standards set forth in the sections below.

### ARINC 429 DITS Data Bus

**ARINC Specification 429:** *Digital Information Transfer System (DITS)* is the controlling document for data word formats, refresh rates, resolutions, etc. Material in this document on these topics is included for reference purposes only. In the event of conflict between this document and ARINC Specification 429, the latter should be assumed to be correct.

### Standard Open

The standard open signal is characterized by a resistance of 100,000 ohms or more with respect to signal common.

COMMENTARY

In many installations, a single switch is used to supply a logic input to several Line Replaceable Units (LRUs). One or more of these LRUs may utilize a pull-up resistor in its circuitry. The result is that an open may be accompanied by the presence of +27.5 Vdc nominal. The signal could range from 12 to 35 Vdc.

### Standard Ground

A standard ground signal may be generated by either a solid state or mechanical type switch. For mechanical switch-type circuitry, resistance of 10 ohms or less to signal common would represent the ground condition. Semiconductor circuitry should exhibit a voltage of 3.5 Vdc or less with respect to signal common in the ground condition.

### Standard “Applied Voltage” Output

The standard applied voltage is defined as having a nominal value of +27.5 Vdc. This voltage should be considered to be applied when the actual voltage under the specified load conditions exceeds 18.5 (+36 Vdc maximum) and should be considered to be “not applied” when the equivalent impedance to the voltage source exceeds 100,000 ohms.

### Standard Discrete Input

A standard discrete input should recognize incoming signals having two possible states, open and ground. The characteristics of these two states are defined in Sections 2.8.2 and 2.8.3 of this standard. This maximum current flow in the ground state should not exceed 20 milliamperes.

The maximum input capacitance to ground should be less than 1 microfarad.

COMMENTARY

The maximum input capacitance is specified because excessive input capacitance can cause current spikes of over 1 amp.

The logic sources for the discrete inputs to the ACAS X traffic computer are expected to take the form of switches mounted on the airframe component (flap, including gear, etc.) from which the input is desired. These switches will either connect the discrete input pins on the connector to airframe Vdc ground or leave them open circuit as necessary to reflect the physical condition of the related components.

The ACAS X traffic computer is expected to provide the Vdc signal to be switched. Typically, this is done through a pull-up resistor. The ACAS X traffic computer unit input should sense the voltage on each input to determine the state (open or closed) of each associated switch.

The values of voltages (and resistances), which define the state of an input, are based on the assumption that the discrete input will utilize a ground-seeking circuit. When the circuit senses a low resistance or voltage of less than 3.5 Vdc, the current flow from the input will signify a ground state. When a voltage level between 18.5 and 36 Vdc is present or a resistance of 100,000 ohms or greater is presented at the input, little or no current should flow. The input may utilize an internal pull-up to provide for better noise immunity when a true “open” is present at the input. This type of input circuit is favorable among both manufacturers and users.

Because the probability is quite high that the sensors (switches) will be providing similar information to a number of users, unwanted signals may be impressed on the inputs to the ACAS X traffic computer unit, especially when the switches are in the open condition. For this reason, equipment manufacturers are advised to base their logic sensing on the ground state of each input. Manufacturers should ensure adequate signal isolation to prevent sneak circuits from contaminating the logic. Typically, diode isolation is used in the avionics equipment to prevent this from happening.

### Standard Discrete Output

A standard discrete output should exhibit two states, open and ground as defined in Sections 2.8.2 and 2.8.3. In the open state, provision should be made to present an output resistance of at least 100,000 ohms. In the ground state, provision should be made to sink at least 20 milliamperes of current. Non-standard current sinking capability may be defined.

COMMENTARY

Not all discrete output needs can be met by the standard discrete output defined above. Some discrete outputs may need to sink more current than the standard value specified above.

Discrete outputs that need to source current should utilize the standard Applied Voltage output defined in Section 2.8.4. These special cases are noted in the text describing each applicable discrete output function and in the notes to interwiring.

Although defined here, discrete outputs which provide a current output rather than a current sink are not “Standard Discrete Outputs.”

### Standard Program Pin Input

Program pins may be assigned on the ACAS X traffic computer unit’s hardware service connector for the purpose of identifying a specific aircraft configuration or to select (enable) optional performance. The optional operational function may be in effect at all times or only under certain conditions, such as when the aircraft is on the ground (identified by the enabling of the Air/Ground discrete input).

COMMENTARY

Program pins may be used for a variety of purposes. Program pins enable a piece of equipment to be used over a greater number of airframe types. One way this is done is by identifying the unique characteristics of the airframe in which the unit is installed. Often program pins are used to enable (turn on) options for alternate or extended performance characteristics.

The encoding logic of the program pin relies upon two possible states of the designated input pin. One state is an open as defined in Section 2.8.2 of this standard. The other state is a connection (short circuit, i.e., 10 ohms or less) to the pin designated as the “program common” pin.

COMMENTARY

Normally, the “primary” location or usual, common, or standard function is defined by the open logic and the optional response is programmed (encoded) by connection to program common.

# ACAS X Functional Description

## Voice and Visual Annunciator Outputs

A primary function of the ACAS X traffic computer is to provide alerts for a flight crew. Any alert (TA, RWC, or RA) will be annunciated via a synthesized voice aural advisory. RA / RWC guidance is required to be shown to the flight crew via a visual annunciation in addition to an aural

### Aural Advisory Signals

See Section 3.5.2.1 for the description of aural advisory discrete outputs.

### Synthesized Voice Output

The audio output volume level should be determined by the coding set by the audio output level program pins. See Section 3.6.6 of this document.

Two audio outputs should be provided, one supplying up to 4 watts RMS at 1000 Hz into 8 ohms, the second supplying low-level signals of up to 40 milliwatts at 1000 Hz into a 600 ohm audio distribution system.

### Visual Annunciator

Visual annunciator discrete outputs are provisioned, but are not typically connected on an aircraft. See Section 3.5.2.2 for the description of visual annunciator outputs.

## Aircraft Interfaces

### Radio Altimeter/Barometric Altimeter

The ACAS X traffic computer uses data derived from radio altimetry for such functions as to inhibit “descend” advisories when the aircraft is in close proximity to the ground, and to inhibit aural annunciations when the aircraft is in close proximity to the ground. The ACAS X traffic computer also uses the radio altitude data in conjunction with (uncorrected) barometric altitude to reject replies from on-ground Air Traffic Control Radar Beacon System (ATCRBS) capable aircraft, thus avoiding false advisories. Radio altimeter altitude data will be supplied from a digital source such as an ARINC 707 radio altimeter or be provided in analog form by an ARINC 552/552A radio altimeter.

### Crew Control Means Inputs

Two ARINC 429 input ports are reserved for implementation of crew control means, such as Multi-Purpose Control and Display Unit (MCDU).

### GPS Interface

Ownship position, trajectory, and position accuracy can be determined through a variety of Global Positioning System (GPS) Labels shown in ATTACHMENT 6 PART 6A. The GPS source could be Multi-Mode Receiver (MMR) (ARINC 755), GNSS Navigation and Landing Unit (GNLU) (ARINC 756), GNSS Navigation Unit (GNU) (ARINC 760), or Global Navigation Satellite System (GNSS) Receiver (ARINC 743A). Two ARINC 429 data bus receivers should be dedicated for this function. See ATTACHMENT 3A for interwiring pin assignments.

### FMS/EFIS Interface

Flight Plan information, Wind conditions, and Minimum Speeds can be acquired through either the Flight Management System (FMS)/Electronic Flight Instrument System (EFIS) bus or the FMS general purpose bus. The combination of this data can be used for long range conflict detection and resolution. FMS data should be supplied from a digital source per ARINC Characteristic 702A over an ARINC 429 data bus. See ATTACHMENT 3A for interwiring pin assignments.

### IRS Interface

Pitch angle, roll angle, track, heading and ground speed information can be obtained from an Inertial Reference System (IRS) source for use in determination of ownship trajectory and attitude. This signal is provided using an ARINC 429 data bus. A single source of IRS is typically used. See ATTACHMENT 3A for interwiring pin assignments.

### ADC Interface

Barometric altitude rate, static air temperature, Mach, and computed and true airspeed parameters may be used for ADS-B IN applications where speed awareness is needed (e.g. FIM). These signals are provided using a pair of ARINC 429 data busses. See ATTACHMENT 3A for interwiring pin assignments (RMP 11J/11K & RMP 15A/15B).

If there is a requirement for the traffic computer to use the same ADC source as the active transponder (i.e., to use the same source of ADC data from which the pressure altitude is taken), it is possible to determine this source based on the SDI of the 203 label - assuming that the transponder adheres to the definition in PART 6O of ATTACHMENT 6 of this specification. A transponder adhering to this specification inserts the port it is using into the SDI of this label; if the transponder is using Air Data Input #1, the SDI is 01. If the transponder is using Air Data Input #2, the SDI is 10.

It is necessary for the traffic computer to have some knowledge of the system on which it is being installed. Typically the left transponder input is on the XT #1 bus and the right transponder input is on XT #2 bus. A right transponder may have ADC #2 (its onside Air Data source) connected to its Air Data #1 input (e.g., in a single sided install); alternatively it may have ADC #1 (its cross side Air Data source) connected to its Air Data #1 input. How the air data sources are wired to the transponders, how the transponders are wired to the traffic computer, and how the traffic computer determines that the transponders are adherent to this specification are outside the scope of this specification.

### ATAR Interface

ACAS Xu accepts tracked radar inputs from an ATAR. The ATAR is another surveillance source with the primary goal of tracking non-cooperative targets. The data provided by the ATAR is defined in DO-366. The protocol for the ATAR Interface is not defined in this document and may vary with ATAR equipment. The Ethernet interface should be used for this interface. See ATTACHMENT 3A for interwiring pin assignments.

### FIM Interface

TBD

## ACAS X Interface with Mode S Transponder

### Physical Interface

The physical interface between a Mode S transponder and an ACAS X traffic computer consists of two high-speed ARINC 429 data buses. These buses are used to transmit and receive data necessary for ACAS X surveillance and resolution coordination.

### Compatibility of TCAS/Mode S Transponder Interface Definitions

ACAS X systems are not compatible with FAA TSO-C119A TCAS/Transponder interface definitions. ACAS X systems are compatible with the RTCA DO-185A/B TCAS/XPDR interface definitions and include interface provisions defined in DO-385 for ACAS Xa/Xo and DO-386 for ACAS Xu.

#### ACAS X Annunciation of System Compatibility

ARINC 429 Label 274, TXWORD2, should be used during bus start-up procedures specified in ATTACHMENT 11 to indicate the capability of the ACAS X computer to the transponder. The Version Indicator (VI) field of ARINC 429 Label 274 advises the transponder that the ACAS X traffic computer is RTCA DO-185A/185B/385/386 compatible. Encoding for the VI field is provided in ATTACHMENT 6, PART 6T, Note 2.

#### Transponder Annunciation of System Compatibility

ARINC 429 Label 276, XTWORD6, should be used during bus start-up procedures specified in ATTACHMENT 11 to indicate the capability of the transponder to ACAS X. The version indicator field in Label 276 advises ACAS X as to whether or not the transponder is RTCA DO-185A/B compatible. Encoding for the VI field is provided in ATTACHMENT 6, PART 6Q, Note 2.

#### Compatibility Determination

If the transponder is compatible with RTCA DO-185A/B, then the ACAS X traffic computer and the transponder should communicate in accordance with the interface definitions and protocols set forth in ATTACHMENT 11. Otherwise the ACAS X traffic computer should declare the transponder to be incompatible and annunciate a failure of the transponder.

### ACAS X Traffic Computer / Transponder Data Transfers

The ACAS X traffic computer and its transponder should communicate in accordance with the interface definitions and protocols set forth in ATTACHMENT 6. PART 6Q contains the format for Label 276 and PART 6T contains the format for Label 274. The VI field in these Labels encodes the capability of the equipment. The TCAS to Transponder Protocol (TGD) is shown in ATTACHMENT 14A and the Transponder to TCAS Protocol (XGD) is shown in ATTACHMENT 14G. (Note that the term “TCAS” is kept in this definition as that is the name of the protocol.) Reports transmitted using the TGD protocol are shown in the following attachments:

ATTACHMENT 14B – Resolution Advisories Report

ATTACHMENT 14C – Data Link Capability Report

ATTACHMENT 14D – ACAS X Request for GICB Data

ATTACHMENT 14E – Unit and Part Number

ATTACHMENT 14F – Operational Coordination Message (ACAS Xu Only)

#### ACAS X to Transponder Transfers

##### TGD Protocol

The TGD protocol is used by the ACAS X traffic computer to deliver 56 bit “MB/MV” data messages to the transponder. This protocol implements a segmented Label 270 data transfer. The generalized format for the TGD protocol is specified in ATTACHMENT 14A. Four segments (four transmissions of Label 270) are used to transfer the 56 bits of data plus an 8 bit Ground Initiated Comm-B (GICB) register address. The GICB register address is the number of the buffer in the transponder where the data is to be stored. Segments should be sent in numerical sequence and each segment must be acknowledged before the next segment is sent. Label 277 is used to Acknowledge (ACK) each Label 270 transfer. If the ACK is not received by the ACAS X traffic computer within 2.0 milliseconds, the segment should be retransmited up to a maximum number of two transmissions.

The protocol requires that the ACAS X traffic computer and transponder each monitor the data segment transmissions in order to maintain bus integrity as described in the following sections.

###### ACAS X Monitoring Requirements

Failure to receive an ACK after two transmissions of a segment should result in the traffic computer declaring a failure of the interface in accordance with the requirements set forth in ATTACHMENT 11.

###### Transponder Monitoring Requirements

Receipt of a segment that is out of sequence for the message being sent should result in the transponder declaring a failure of the interface in accordance with the requirements set forth in ATTACHMENT 11.

All segments of the message, or “data block”, should be received within the ONE second timeframe beginning at the starting transmission of the first segment and ending upon transponder transmission of the ACK to the last segment. Failure to receive the entire data block within the designated timeframe should result in the transponder declaring a failure of the interface in accordance with the requirements set forth in ATTACHMENT 11.

##### Resolution Advisories Report

The ACAS X traffic computer should use the TGD protocol, as described in Section 3.3.3.1.1, to send the non-periodic Resolution Advisories Report to the on-board transponder. The Resolution Advisories Report consists of two parts as described in the following subsections.

###### Resolution Advisories Report Part 1

Both ACAS Xa and ACAS Xu systems send the Resolution Advisories Report part 1 to the on-board transponder. The format of the report differs depending on the system. The format of the Resolution Advisories Report part 1 for ACAS Xa systems is provided in ATTACHMENT 14B-1. The format of the Resolution Advisories Report part 1 for ACAS Xu systems is provided in ATTACHMENT 14B-2

###### Resolution Advisories Report Part 2

Only ACAS Xu systems send the Resolution Advisories Report part 2 to the on-board transponder. The format of the Resolution Advisories Report part 2 is provided in ATTACHMENT 14B-3.

##### Data Link Capability Report

ACAS X traffic computer should use the TGD protocol to send the non-periodic Data Link Capability Report to the on-board transponder. ATTACHMENT 14C provides the format of the Data Link Capability Report.

##### TGD Request for GICB Data

The TGD Protocol provides a provision for the ACAS X traffic computer to request GICB data from the transponder. ATTACHMENT 14D provides the format for this request.

##### Unit and Software Part Number Reports

ACAS X traffic computer should use the TGD protocol to send the non-periodic Unit and Software Part Number Reports to the on-board transponder. The format of the Unit and Software Part Number Reports is provided in ATTACHMENT 14E.

##### Operational Coordination Message

An ACAS X traffic computer that has ACAS Xu functionality should use the TGD protocol to send the non-periodic Operational Coordination Message to the on-board transponder. The format of the Operational Coordination Message is provided in ATTACHMENT 14F.

#### Transponder to ACAS X Data Transfers

##### XGD Protocol

The XGD protocol implements a segmented Label 270 data request and transfer as specified herein and detailed in ATTACHMENT 14G. This protocol allows the transponder, upon request from the ACAS X traffic computer, to provide the contents of any of the 256 GICB registers in the transponder.

An ACAS X traffic computer initiates the XGD protocol by sending Label 270 to the transponder. The format of this label is shown in ATTACHMENT 14D. The GICB field will contain the register in the transponder whose contents is being requested. The continuation bit is set to zero. The “request/delivery” bit is set to 1. The transponder should respond by transmitting the contents of the requested GICB Register to the ACAS X traffic computer using the XGD protocol described in ATTACHMENT 14G. There is no requirement for the ACAS X traffic computer to acknowledge any part of the XGD message from the transponder. XGD data will be considered valid if and only if the entire sequence is received by the traffic computer in the proper order.

The XGD protocol data is considered to be non-periodic since it is performed on a request basis. As such, transfer of the contents of a GICB register via the XGD protocol may be interrupted between segments by either periodic or non-periodic data transfer requirements between the transponder and the ACAS X traffic computer. However, the transfer of an individual segment of a message should not be interrupted.

## ACAS X Displays

There are three types of ACAS X information which may be presented to the crew. ACAS Xa Traffic Advisory (TA) information designates the location of other aircraft in the immediate vicinity. Both ACAS Xa and ACAS Xu Resolution Advisory (RA) information indicates the action the aircrew should take (or avoid taking) to minimize the risk of collision. ACAS Xu Remain Well Clear (RWC) provides guidance to avoid potential conflicting traffic by applying adjustments to the current flight path.

The ACAS Xa traffic computer unit should supply TA and RA information to the aircraft displays as described in Sections 3.4.1 and 3.4.2. Two TA/RA high-speed ARINC 429 outputs are defined in ATTACHMENT 3A. The ACAS Xu traffic computer should supply RWC and RA information on the same output to be routed to the pilot on the ground.

Pins are reserved on the ACAS X traffic computer unit service connector for user defined functions. One use of the user defined pins could be the accommodation of unique interface needs of installations which cannot use these ARINC 429 outputs.

Program pins, used in a matrix provide unique identification of the needed interface configuration for each installation (up to seven) thus avoiding any limitation to the interchangeability of the ACAS traffic computer.

### ACAS Xa Resolution Advisory (RA) Display

The Resolution Advisory (RA) display should provide symbolic instructions for maneuvers necessary to assure safe vertical separation between ACAS X equipped aircraft and an intruder aircraft at their point of closest approach. The advisory displayed may be “corrective” or “preventive” in nature depending upon the current action of the aircraft at the time the advisory is displayed.

As stated in RTCA DO-385, the RA display should be capable of displaying resolution advisories. RTCA DO-385 should be considered the controlling document for resolution advisory display.

In addition, it should provide:

1. Means of displaying to the flight crew that own ACAS X equipment has failed.
2. Means of displaying to the flight crew that the ACAS X equipment has been inhibited either automatically or through flight crew action.

The RA display may be integrated with other instruments (e.g., IVSI) or be integrated with a Primary Flight Display (PFD).

### Traffic Display

The purpose of the traffic display is to assist the flight crew in visually locating an intruder. Aircraft maneuvers are not initiated from information contained on this display. As a minimum, the display should be capable of displaying the range, bearing, and relative altitude (if available) of at least eight intruders.

Traffic advisories may be displayed on the Weather Radar (WXR), Instantaneous Vertical Speed Indicator (IVSI), or Multi-Function Display (MFD) map. The user may wish to discontinue the normal display or the traffic display independently.

### ACAS Xu Display

ACAS Xu display requirements and functions are defined in RTCA/DO-365(). Guidance for both vertical maneuvers and for horizontal maneuvers must be provided.

### Normal and Failure Mode Annunciations

Normal and failure mode annunciations should be provided on the ACAS X displays. The following sections describe the interface and intended data usage for determining the ACAS X annunciations.

#### Resolution Advisory Display

The ACAS X traffic computer will provide all the data necessary for the display of ACAS X Resolution Advisories. The resolution advisory indicator can use this information, along with vertical speed input information and its own internal monitoring functions, to determine the correct annunciation.

The SSM field of Label 270 is intended to convey the following information to the indicators:

1. Normal Operation. ACAS X traffic computer is in normal operating mode and has not detected a system failure.
2. No Computed Data (NCD). ACAS X traffic computer is operating in a mode in which Resolution Advisories will not be issued. The ACAS X traffic computer is functioning properly, but may have detected an ACAS X system failure. Bit 20 of Label 350 can be used to determine if an ACAS X system failure exists. This information can be used in conjunction with the NCD state of Label 270 to determine if ACAS X traffic computer is operating in a normal mode with RAs inhibited, or if a system failure exists.
3. Functional Test. The ACAS X traffic computer is performing a Functional Test sequence. Refer to Section 4.2.
4. Failure Warning. The ACAS X traffic computer has detected an internal failure.

#### ACAS X Traffic Display

In addition to the information provided for a resolution advisory, the ACAS X traffic computer provides ACAS X mode information to indicators capable of displaying traffic information. The information is provided on Label 274. Refer to Attachment 6 PART 6T.

The Sensitivity Level (SL) and Reply Information (RI) information provided by Label 274 is intended to provide the following information to the indicators:

1. SL = 1. ACAS X traffic computer is in standby mode. This can be due to any reason, including pilot, priority/discrete or CAS logic selection, or based on Air/Ground logic if the ground display mode program pin is grounded. The ACAS X traffic computer will also set SL = 1 if an ACAS X system failure exists. Indicators should consider the RI field to be “Don’t Care” when SL = 1.
2. RI = 2. ACAS X traffic computer is in TA Only mode (ACAS Xa) or Surveillance Only mode (ACAS Xu). This can be due to any reason, including pilot, priority/discrete or CAS logic selection, or based on Air/Ground logic if the Ground display mode program pin is open. The SL field can equal 2 or 3 when RI = 2.
3. RI = 3. ACAS X computer is in TA/RA mode (ACAS Xa) or RWC/CA mode (ACAS Xu). This indicates that ACAS X computer is operating under normal conditions and that the system is capable of issuing RAs. The SL field equals 3 when RI = 3.

#### CDTI Traffic Display

A traditional ACAS traffic display shows the location of other aircraft, the altitude of those aircraft (relative or absolute), and whether or not the aircraft is climbing or descending. In addition to this functionality, ADS-B In traffic displays (per the AIRB function of DO-317C) may display additional information for the traffic, based on ADS-B information received from the traffic. For example, ground speed and flight identification can be displayed for ADS-B traffic on a CDTI Traffic Display.

### Display Status Discrete

For ACAS Xa, all indicators capable of displaying Resolution Advisory information should provide the ACAS X computer with RA display status information on their corresponding RA display status discrete outputs to the ACAS X traffic computer. This is to allow the ACAS Xa to determine if it has at least one RA display that is capable of displaying resolution advisories, as a minimum system. On these aircraft, the RA Display Status Driver is the RA display.

The RA display status discrete should indicate whether or not the indicator has the ability to display resolution advisory information. If the indicator is capable of displaying resolution advisory information, the RA Display status discrete output should be set to ground.

For ACAS Xu systems, the aircraft should provide feedback to the ACAS X traffic computer that the aircraft can follow the provided guidance. This indication should be provided to the aircraft via the Command and Control (C2) Link and subsequently provided via the RA display status discrete to the ACAS X traffic computer. The RA display status discrete should indicate whether or not the ACAS Xu guidance can be followed. The RA Display Status Driver on these aircraft is whatever piece of equipment is driving this discrete (i.e. the C2 link).

For some aircraft this may be that the proper communications with the ground system is established such that the pilot can follow the ACAS Xu guidance. For other aircraft this may be that the aircraft automation is able to follow the ACAS Xu guidance. The appropriate driver for this discrete must be determined for a given aircraft architecture.

The RA display status discrete output should be set to open if any of the following conditions exist:

1. Label 270 is absent from the ACAS X display bus.
2. The indicator has detected an internal failure that prevents it from displaying RA information.
3. The indicator is not receiving valid vertical speed information (Vertical Speed information with SSM = functional test should be considered valid).
4. The indicator has detected an internal failure that prevents it from displaying vertical speed information.
5. The ACAS X traffic computer has requested a functional test sequence. Refer to Section 4.2.

Note: If Label 270 is received with SSM = NCD or SSM = Failure Warn, the RA system valid discrete should not be set to open unless at least one of the above conditions exists.

The ACAS X traffic computer unit should report the status of these discretes to the Centralized Fault Data Interface Unit (CFDIU), if installed.

Note 12 of Attachment 3B defines the ACAS X traffic computer usage of the display status discrete inputs.

## Discrete Signals

In addition to the ARINC 429 output to the displays, the ACAS X should also provide “discrete” inputs and outputs as described in the following sections.

### Discrete Input Signals

The ACAS X traffic computer should accommodate the discrete inputs which appear in the interwiring list of ATTACHMENT 3A. The following sections contain descriptions of the function of these inputs. The logic to be used by discrete inputs is described in the notes of ATTACHMENT 3B.

The state of each discrete input is provided in Labels 362 through 364 as described in Attachment 6, PART 6W-5, PART 6W-6, and PART 6W-7, respectively.

#### Landing Gear Discrete Input

The ACAS X traffic computer unit should accept an input designating the position of the landing gear. This input may be used by the ACAS X traffic computer to compensate for the effects of the landing gear on the antenna beam pattern. This input should be wired to the appropriate logic source in the aircraft with appropriate regard for sneak circuits to indicate retracted or extended. The system should be designed such that the normal failure mode should be to the “retracted” condition. See Note 4 of Attachment 3B.

#### Air/Ground Discrete Input

One discrete input should be provided to accept a signal from the aircraft’s air/ground switch to indicate if the aircraft is on the ground or airborne.

#### Advisory Inhibit Discrete Inputs

Five pins are assigned to provide the capability for the ACAS X traffic computer to respond correctly to a situation in which another hazardous condition of higher priority, such as a windshear alert, exists. These conditions are presumed to have a more immediate possibility and higher probability of harm than the threat of a collision. Thus, ACAS X functions such as aural announcements and aural alerts and RA guidance are to be inhibited by placing the ACAS X computer unit in a mode which would preclude its issuing the unwanted information.

Depending on the mode of operation indicated by the input, no new voice, aural, or annunciator outputs should be activated by the ACAS X computer unit during the deferment period. No new RA information should be generated on the RA or the TA/RA data bus during the deferral period. If already activated, these outputs should be discontinued within 250 milliseconds. If an advisory condition is present when the deferment is removed, it should be annunciated.

One discrete input is provided to designate a situation in which the ACAS X traffic computer should go to the STBY mode until the other condition has been cleared.

Three other discrete inputs are provided to indicate that the ACAS X traffic computer should enter the TA Only mode (ACAS Xa) or Surveillance Only mode (ACAS Xu) of operation and inhibit aural outputs for the duration of the other condition.

Another discrete input is provided to put the ACAS X traffic computer into the TA Only / Surveillance Only mode of operation without inhibiting the aural outputs of the system. This input is intended to be used in installations that may not always be able to comply with RA guidance but still want the benefit of TAs or RWCs (such as helicopters while they are hovering).

In the event that more than one advisory inhibit discrete input is active simultaneously, the one calling for STBY operation should have precedence over the one calling for TA/Surveillance Only without aurals; the one calling for TA/Surveillance Only without aurals should have precedence for the one calling for TA/Surveillance Only with aurals. When the other condition is resolved as indicated by the removal of the active input, the ACAS X traffic computer should return to normal operation. See Note 16 of Attachment 3B for a description of the input logic to be used.

#### Traffic Selector Discrete Inputs

These inputs can be used by the ACAS X traffic computer to designate a given traffic among the list of traffic. This may be necessary when Display Traffic Information File (DTIF) is activated, and ADS-B traffic is available. This may be used to enable the flight deck crew to focus on a given traffic and to acquire detailed information on that traffic.

The following convention for Selected, ITP Reference, and Designated has been applied throughout this document. These definitions come from RTCA   
DO-317C, Aircraft Surveillance Applications System (ASAS) MOPS and are shown below.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Selected | Target for which additional information is requested by the flight crew. An example is an aircraft selected for which ownship desires position data (latitude, longitude, altitude). |
| ITP Reference | Target upon which an In Trail Procedure (ITP) maneuver is intended to be conducted. |
| Designated | Target upon which a procedure is intended to be conducted. An example is an aircraft selected which ownship intends to merge behind, in a merging and sequencing procedure. |

### Discrete Output Signals

The ACAS X computer unit should accommodate the discrete outputs which appear in the interwiring list of ATTACHMENT 3A. The following sections contain descriptions of the function of these outputs. The logic used by these outputs is described in the notes contained in ATTACHMENT 3B.

#### Aural Advisory Discrete Outputs

The ACAS X traffic computer should provide two advisory discrete outputs to be used for managing aural message priorities between various systems on the aircraft. Separate outputs should be used for Resolution Advisories, and Traffic/RWC Advisories which are described in Section 3.5.2.2.

The Aural Advisory Discrete (RA) output should be activated whenever a resolution advisory is issued to the RA display. The Aural Advisory Discrete (TA/RWC) Output should be activated whenever a traffic advisory (ACAS Xa) or RWC guidance (ACAS Xu) is issued. The activated state is defined as a ground (a resistance of 10 ohms or less or a voltage between 0 and +3.5 Vdc) at the pin for the duration of the aural alert plus a tolerance between 0 and 0.2 seconds. The maximum current flow through the discrete wire should not exceed 20 milliamperes.

COMMENTARY

One use of the Aural Advisory Discrete Outputs is as a “push to talk” for the audio system. If the ACAS X traffic computer is designed for such a system, the appropriate Aural Advisory Discrete Output should be set for at least the duration of the accompanied aural.

#### Visual Annunciator Discrete Outputs

The ACAS X traffic computer should provide two advisory/annunciation discrete outputs, (Resolution and Traffic/RWC) to activate the visual annunciator. There are, accordingly, two categories of advisories generated:

Resolution Advisory – A resolution advisory can be either a corrective advisory (a resolution advisory in which the flight crew is advised to alter (“correct”) the current flight path of the aircraft) or a preventive advisory (a resolution advisory in which the flight crew is advised to continue the current flight maneuver or to avoid making certain accelerations so as to prevent a near-miss from occurring). In either case, separation is predicted to be adequate if the flight crew heeds the advisory.

Traffic Advisory (for ACAS Xa) – Information given to the flight crew pertaining to other aircraft in the immediate vicinity that have the potential to generate a resolution advisory in the near future. The traffic advisory information contains no suggested maneuver.

Remain Well Clear (for ACAS Xu) – Information given to the system / flight crew to allow the aircraft to remain separated from other aircraft so they do not progress to being an RA.

The appropriate output should be activated whenever an advisory is issued. The activated state is defined as a ground and the inactivated state is defined as an open (a resistance of 100,000 ohms or greater) at the pin. Each pin should be capable of sinking 200 milliamperes when activated and withstanding up to +36 Vdc when not activated. Each output should remain in the activated state for the duration of the advisory. Only one visual annunciator discrete output should be activated at a time, with the RA discrete having priority.

#### System Status Discrete Output

The ACAS X traffic computer should provide one discrete output which should indicate the health of the ACAS X system. See Note 18 of Attachment 3B for a description of the logic used. The logic used by the ACAS X traffic computer for setting the system status discrete output will depend upon the manually selected ACAS X mode as described in the following subsections.

##### Standby Mode Selected

If the ACAS X traffic computer has been selected to Standby mode (SL = 1), the system status discrete output should be set to ground (indicating normal operation) when the following conditions exist:

1. The ACAS X traffic computer has power supplied to it and has not detected an internal failure.
2. Failure has not been detected in either top or bottom antennas.

##### TA/Surveillance Only Mode Selected

If the ACAS X traffic computer has been selected to TA Only (ACAS Xa) or Surveillance Only (ACAS Xu) mode (SL = 2), the system status discrete output should be set to ground (indicating normal operation) when the following conditions exist:

1. The ACAS X traffic computer has power supplied to it and has not detected an internal failure.
2. Failure has not been detected in either top or bottom antennas.
3. Selected Mode S transponder is working in altitude reporting mode (not in Standby) and transmitting valid altitude data.
4. At least one radio altimeter is working.

##### TA/RA Mode Selected

If the ACAS traffic computer has been manually selected to TA/RA (ACAS Xa) or RWC/CA (ACAS Xu) (SL = 0, or 3 to 7), the system status discrete output should be set to ground (indicating normal operation) when the following conditions exit:

1. The ACAS X computer has power supplied to it and has not detected an internal failure.
2. Failure has not been detected in either top or bottom antennas.
3. Selected Mode S transponder is working (not Standby) and transmitting valid altitude data. At least one radio altimeter is working.
4. At least one RA display is functional (based the RA display status discrete inputs).

If the ACAS X traffic computer does not receive a valid label on the Transponder to TCAS ARINC 429 data bus (XT), it should cause an ACAS X system failure to be indicated. The status of this discrete output should also be reflected in the ARINC 429 Label 350 output data word. Refer to ATTACHMENT 6 for the definition of Label 350.

COMMENTARY

Although ACAS X does not use sensitivity level (SL) for manuever selection logic the SL in the control label 016 will select the system to TA/RA or RWC/CA mode as indicated above.

#### Software Part Number Discrete Output

This pin is assigned to serve as a software part number enable discrete input. The ACAS X traffic computer should transmit its current software part number file no less than three times when this input is enabled (grounded).

The format for the software part number file is defined in Note 14 of Table 6B-1 of ATTACHMENT 6.

## Program Pins and Other Means of Determining Configuration

The ACAS X traffic computer can be configured to perform with certain functions set to be activated or de-activated. There is typically one or more of three methods employed to determine the configuration. The first method is through program pin grounding. When utilizing this method, a given program pin is grounded to activate the function described by the pin name. For example, to enable the output of the Digital Traffic Information File (DTIF), the corresponding pin is grounded. The pins taking advantage of this method are described in the following subsections.

The state of each program pin is provided in Labels 360, 361, and 365 as described in Attachment 6, PART 6W-3, PART 6W-4 and PART 6W-8, respectively.

Two additional methods are provided to better conserve pins. One such method is the strobing of program pins, described in Section 3.6.8. Strobing of pins produces the same effective result of recognizing user conditions at power on, but uses a fraction of the pins compared to program pin grounding.

Another means of determining the configuration is through the use of an Airplane Personality Module (APM) defined by ARINC Report 607. If this option is implemented, the ACAS X traffic computer should check for the presence of the APM before strobing program pins.

### Cable Delay

The ACAS X traffic computer should provide a means to recognize and compensate for differences in the length of RF cables to the upper antenna and the lower antenna. Program pins are assigned in the interwiring list (see ATTACHMENT 3A) to provide as much as 300 nanoseconds compensation. Note 24 of Attachment 3B contains an encoding table and example.

### Aural Advisory Discrete Enable Program Pin

One program pin has been provided to indicate that the ACAS X computer should output a one second duration signal on the appropriate Aural Advisory Discrete Output prior to an aural advisory annunciation. If enabled, the synthesized voice output will be delayed one second. Note 14 of Attachment 3B describes the logic state for this program pin. This is sometimes used to allow the audio system time to react to the Aural Advisory Discretes in allowing the aural to be heard by the flight crew.

### Ground Display Mode Program

One program pin has been provided for the ACAS X computer to be program pin configured to enter one of two display modes (“TA Only” mode or “Standby” mode for ACAS Xa; “Surveillance Only” mode or “Standby” mode for ACAS Xu) while the ACAS X air/ground discrete input logic sense that the aircraft is on the ground. See ATTACHMENT 3A for the connector interwiring. Note 22 of Attachment 3B describes the two logic states of this program pin.

### TA Display Intruder Limit

Five program pin inputs are used to encode, via aircraft wiring, the maximum number of intruder symbols to be presented on certain TA displays. The range is from 1 to 30, where 31 (all open) is no limit. Note 25 of Attachment 3B describes the logic of these program pins, and Note 2 of Table 6B-1 in Attachment 6 describes the method of transmitting the status of these program pins to the displays.

Note that the setting of these pins do not limit the number of tracks being sent to the display; it is simply a method to provide certain displays the maximum number of aircraft to be shown on a traffic display at a given time on the 357 Request to Send word. If the setting of this is less than eight, the display should set the maximum number of targets to eight; all traffic displays should support the display of at least eight targets.

### Display All Traffic/Threat Traffic

One program pin has been provided for the ACAS X computer to define to the displays whether traffic (including RA, TA, PROX, and optionally OTHER) should: 1) always be displayed, or 2) be displayed only when a TA or RA is present. Note 2, of Table 6B-1, in Attachment 6 defines the method of transmitting the status of this Program pin to the displays. Note 23 of Attachment 3B defines the two states of this program pin.

Note that the setting of this pin does not limit the traffic that is sent to the display; it is simply a method to provide certain displays the desired behavior of when to display traffic on the 357 Request to Send word.

### Audio Output Level

Six program pins are assigned to designate the audio output volume (power) level. The logic for these three pins is defined in Notes 29 and 30 of Attachment 3B to this document.

### DTIF Enable Program Pin

One program pin, RMP-5E, is defined for activation of ADS-B functions. It is used for the activation of the transmission of the DTIF in addition to the Transponder Interface Function (TIF).

### Program Pin Strobe

A set of 11 discrete inputs, 4 discrete outputs, and a program pin common are reserved for a strobed program pin function. At power up when on the ground, each discrete output is sequentially pulled low exclusive of the other discrete outputs. For example, a pattern of NO output low, OUT1 low, OUT2 low, OUT3 low, and concluding with OUT4 low is produced by the ACAS X traffic computer. During the time when each of these five conditions is present, each discrete input is read to determine which output, if any, it may be connected to. The state of each input is defined to be:

1. Not connected
2. Connected to OUT1
3. Connected to OUT2
4. Connected to OUT3
5. Connected to OUT4
6. Connected to Program Pin Common (Ground)

TCAS Prog Pin OUT1 OUT2 OUT3 OUT4  
Computer Common RMP-1G RMP-1H RMP-2E RMP-3E

Discrete Inputs

**RMP-3H Input 1**

**RMP-3J Input 2**

**RBP-2A Input 3**

**RBP-2B Input 4**

**RBP-2C Input 5**

**RBP-2D Input 6**

**RBP-2E Input 7**

**RBP-2F Input 8**

**RBP-2G Input 9**

**RBP-3F Input 10**

**RBP-3G Input 11**

**Odd Parity**

These seven pins may be used as strobed discrete inputs or as connections to an APM.

At this time, only Input 1 (RMP-3H) is defined (with six defined states as shown below). Discrete input RMP-3H provides installed side information and indicates the power bus type for possible use in power reduction modes.

RMP-3H State Definition

|  |  |  |
| --- | --- | --- |
| **State** | **SDI Side** | **Power Bus Type** |
| 5 | Third | Essential |
| 1 | Non-essential |
| 2 | Right | Essential |
| 3 | Non-essential |
| 4 | Left or Single | Essential |
| 0 | Non-essential |

The other discrete inputs (Inputs 2 through Input 11) should not be defined (as a strobed input) without consultation with ARINC Industry Activities (IA). The Errata or APIM forms included in the rear of this document may be used to propose a new pin definition to the AEEC staff at ARINC IA. Industry consensus is desired to achieve standardization of these strobed program pin inputs and allow box interchangeability. It is expected that the state definitions for Inputs 2 through 11 will take a form similar to the above RMP-3H.

To achieve strap integrity, an odd number of connections (filled-in circles above) should be made. Connections of multiple inputs to a particular output should not be daisy chained because a single faulty connection may cause two inputs to change states simultaneously. This fault will not be detected by the traffic computer. The traffic computer should also check to ensure that each discrete input has no more than one connection.

If other aircraft system functions can handle strobe outputs changing states at power on, the strobe outputs can be used for standard discrete outputs to other systems after power on.

The state of the Program Pin Strobe is provided in Labels 340 and 341, as described in Attachment 6, PART 6W-9 and PART 6W-10, respectively.

### ADS-B Only TA Only (AOTO) Program Pin

The ADS-B Only TA Only (AOTO) program pin may be used by the traffic computer to enable an optional mode allowed by DO-385 to allow for TAs for ADS-B Only traffic (traffic not tracked through direct interrogation). This option is always enabled for ACAS Xu traffic computers (per DO-386, “An ADS-B only target is marked as qualifying for RWC only alerting and guidance provided it meets the high quality ADS-B definition”).

As this traffic can never become an RA, per DO-385 it is necessary to display this traffic differently. How this is shown differently is not specified. The traffic computer indicates to the display that a piece of traffic is not tracked through a direct interrogation response either through the DTIF (Label 366: DTIF Packet Header; Source Data Type is not 001 or 111) or through the TIF (Label 132: Intruder Bearing, Display Matrix is 101).

## Test Pins

Twenty pins are reserved for use by the equipment manufacturers to assist in testing the computer unit at the factory and during service at the user’s maintenance shop. The assignment of these pins and the description of the signal characteristics is the responsibility of the equipment manufacturer.

# Functional Test, Monitoring, and Built-In Test EquipmEnt (BITE)

## ACAS X Functional Test

The ACAS X traffic computer should provide an internal “functional test” feature as described in RTCA DO-385 (ACAS Xa) or DO-386 (ACAS Xu) (latest version applies).

The ACAS X traffic computer should be capable of initiating a short and optionally a long (extended) functional test sequence. The computer should initiate the short functional test sequence within 1 second after receiving Label 016 from the Mode S transponder with the SSM field set to functional test. See Attachment 6 PART 6D.

At the manufacturer’s option, the computer may also initiate the short functional test sequence based on a test switch provided on the front panel of the computer unit, or when requested to do so from the Centralized Fault Display System (CFDS) input bus, per the ARINC 604 interface definition. The ACAS X traffic computer should cause the following indicator/interface functional test sequence to occur as part of its short functional test sequence:

1. The ACAS X traffic computer should monitor the RA (#1 and #2) display status discrete inputs from the RA indicators. When the TCAS computer initiates the system functional test, it should verify that both inputs are initially set to ground. If both inputs are initially at the open state, the TCAS computer should cause an aural annunciation of “TCAS SYSTEM TEST FAIL” at the completion of the functional test sequence.
2. The ACAS X traffic computer should begin to transmit the data defined in ATTACHMENT 13 to the indicators on the ARINC 429 high speed output buses when the functional test sequence is initiated. This transmission should be maintained for a period of 8 ±0.5 seconds from initiation, even if the SSM of Label 016 returns to normal.
3. The ACAS X traffic computer should verify that the RA display status discrete inputs transition from ground to open and back to ground as outlined in Section 4.2, Indicator Response. If both inputs fail to transition properly, the ACAS X traffic computer should cause an aural annunciation of “TCAS SYSTEM TEST FAIL” at the completion of the functional test sequence unless the RA Valid discrete disable program pin (RBP 4G) is connected to program common as defined in ATTACHMENT 3A.
4. The ACAS X traffic computer should cause one cycle of the appropriate test results aural to be activated at the end of the functional test sequence.
5. The ACAS X traffic computer should be capable of testing installed ADS-B functions and annunciating the test results.

The ACAS X traffic computer should only cause the “TCAS SYSTEM TEST OK” aural to annunciate if it has completed its functional tests and has not detected a failure. “TCAS SYSTEM TEST FAIL” should be annunciated if any of the test criteria are not satisfied.

If the TCAS computer terminates the system functional test for any reason before completion of all of its tests, it should inhibit the aural annunciation of “TCAS SYSTEM TEST OK” and “TCAS SYSTEM TEST FAIL.”

COMMENTARY

The intended purpose of the short functional test sequence is to provide an in-flight or on-ground method of quickly verifying the functionality of the ACAS X traffic computer system. The above defined sequence verifies that the RA systems status discrete from the RA displays are functional, causes representative ACAS X data to be displayed and causes an aural message to be annunciated at the end of the test sequence to verify the functionality of the ACAS X aural warning system. The aural messages used for the system test include the word ‘TCAS’ instead of ‘ACAS X’ in order to retain pilot familiarity and consistency with the TCAS II system.

The ACAS X traffic computer may cause an optional extended functional test sequence to occur. If implemented, the ACAS X traffic computer should initiate the extended functional test sequence if it continues to receive Label 016 from the Mode S transponder with the SSM set to functional test for longer than 9 seconds. Once initiated the extended functional test is performed as defined by the equipment manufacturer.

## System Response

The system should respond in the following manner when it receives Label 270/271 from the ACAS X traffic computer with an SSM Field set to functional test (bit 30 is a zero, bit 31 is a one). Note that an ACAS Xa traffic computer will only provide Label 270; an ACAS Xu traffic computer provides both Label 270 and 271. An indication from either label is enough to drive the following response:

1. Within 0 to 3 seconds after receiving Label 270/271 with the SSM set to functional test, the RA display status discrete output should be set to open. This discrete is driven by the RA Display Status Driver (see section 3.4.5). Assumming the system has not detected a failure, the RA display status discrete output should be set to ground no sooner than 4 seconds and no later than 5 seconds after receiving the first Label 270/271 word with SSM set to functional test.
2. All RA indicators and traffic displays should process and display all ACAS data with SSM set to functional test status as if it were valid data.

Note: The ACAS X traffic computer will indicate that it has gone to Standby mode (Label 274, SL = 1, RI = 0) during the functional test sequence. However, the test data received from the traffic computer should be displayed.

1. RA indicators or traffic displays capable of displaying traffic information may also display the failed ACAS X system component upon detecting an ACAS X system failure, based on the data received in the Label 350 fault summary word, during the functional test sequence.
2. If the RA indicator or traffic display receives Label 270/271 with the SSM set to functional test for greater than 9 seconds, it may initiate an optional extended functional test sequence. If implemented, the indicator should continue the extended functional test sequence for as long as Label 270/271 remains set to functional test, or for as long as the internal extended functional test sequence is programmed to last, whichever is longer. However, if the extended functional test remains active after the SSM of Label 270/271 returns to “Normal,” the RA Display Status Driver should set the RA display status discrete output to open as soon as the SSM of Label 270/271 has changed to “Normal.” The discrete should be kept open until the extended functional test is completed.

During the first 9 seconds of the functional test sequence, the system should operate in same manner as described in a, b, and c above. If implemented, the extended test information should be displayed after the 9-second period.

If the extended functional test feature is not provided by the RA indicator or the traffic display, the system should continue to operate as defined in b above for as long as the SSM of Label 270/271 remains set to functional test.

Any non-ACAS X information should continue to be accurately displayed by the system during the functional test sequence.

### Extended Test Text Display

When the Extended Test function is activated (by a prolonged activation of the control panel Self-Test), transfer of text data for display may be provided using the word formats specified in Attachment 6, PART 6X-1, PART 6X-2, PART 6X-3 and PART 6X-4. The content of this data is defined by the TCAS manufacturer.

The text message transfer begins with a Start Of Transmission (STX) word from the TCAS control unit (see PART 6X-1). This STX word should contain the block count word in bits 9-16 to designate the number of words between the STX and End Of Transmission (EOT) words inclusive. Each line of text should end with an ISO-5 carriage return.

The STX word should be followed by one or more data words and, optionally, one or more control words (see PART 6X-3 and PART 6X-2, respectively). Control words are differentiated from data words by the presence of the CNTRL character in the Test Character #3 position.

The control words indicate the color, font, position, and display attributes of the following text character words for optional use by the TCAS CU; displays able to vary the attributes specified by the control words should make appropriate assumptions as to color, font, position, and display attributes in the absence of a preceding control. The use of the control words by displays is also optional; designs not capable of utilizing the control word information should be tolerant of their possible presence as an input.

At the end of the final record an EOT word (see PART 6X-4) will be sent to indicate the end of transmission.

## Built-In Test Equipment (BITE)

The TCAS computer should contain Built-In Test Equipment (BITE) capable of detecting and annunciating a minimum of 95% of the faults or failures which can occur within the system, and as many faults as possible associated with the antenna, control panel, and their interfaces with the system.

BITE should operate continuously during flight. Monitoring of the results should be automatic and the BITE should automatically test, detect, isolate, and record intermittent and steady state failures. The BITE should display system condition and indicate any faults upon activation of the self-test routine described in Section 4.7. In addition, BITE should display faults which have been detected during in-flight monitoring.

No failure occurring within the BITE subsystem should interfere with the normal operation of ACAS X.

System status is provided in the TCAS Fault Summary Words in Labels 350 and 352 as described in Attachment 6, PART 6W-1 and PART 6W-2, respectively. These output words can be used by maintenance personnel via an interface to an onboard maintenance system (e.g., Central Fault Display System (CFDS)/Central Maintenance Computer (CMC)).

COMMENTARY

Sufficient margins should be used in choosing BITE parameters to preclude nuisance warnings. Discrepancies in ACAS X operation caused by power bus transients, Electromagnetic Interference (EMI), ground-handling, servicing interference, abnormal accelerations, or turbulence should not be recorded as faults.

## BITE Display

The ACAS X traffic computer should have a System/Line Replaceable Unit (LRU) status display on the front panel.

Most users desire an alpha-numeric display to present fault information to line maintenance personnel. The desire includes presentation of the information in the form of easily understandable text. The airlines do not want the maintenance personnel to be burdened with carrying a library of code translations. The airlines would like to have the fault analysis capability of BITE using the alpha-numeric display equal to or surpassing the capability currently realized with shop automatic test equipment.

## Fault Monitor

The results of in-flight or ground operations of BITE should be stored in a non-volatile monitor memory. The size of the memory should be sufficient to retain detected faults during the previous ten flight legs. The data in the monitor memory should include flight leg identification, fault description, and faulty LRU.

The contents of the monitor memory should be retrievable by BITE operation or by shop maintenance equipment.

BITE should be used to detect and isolate faults to the LRU level and it should also provide fault isolation information at the Shop Replaceable Unit (SRU) level.

## BITE Monitor Memory Output

The BITE monitor memory output should consist of the following:

1. An output to a display, LEDs or other indicator located on the computer unit, indicating system and LRU status.
2. Additional interface(s) to Automatic Test Equipment (ATE) and/or Central Maintenance Equipment that provides access to current status and recorded fault history records.

## Provisions for Automatic Test Equipment

### General

To enable ATE to be used in the bench maintenance of the TCAS computer, those internal circuit functions not available at the unit service connector and considered by the equipment manufacturer to be needed for automatic test purposes should be brought to pins on an auxiliary connector of a type selected by the equipment manufacturer for this purpose. This connector may be fitted with only that number of contacts as there are functions to be brought to it, and should be provided with a protective cover suitable to protect these contacts from damage, contamination, etc., while the unit is installed in the aircraft. The manufacturer should observe ARINC Specification 600 standards for unit projections, etc., when choosing the location for this auxiliary connector.

## Event Download

ACAS Xu equipment is required to implement event data recording of DAA encounters to non-volatile memory. These events include DAA guidance, DAA corrective alerts and ACAS X resolution advisories. ACAS Xa systems may also record traffic and resolution advisory events.

The ACAS X traffic computer with event recording capability should include an appropriate interface to download the recorded data from the unit for subsequent analysis. It is left to the equipment manufacturer to define the interface and download mechanism.

# Antennas

## Omnidirectional Antenna

The antenna should be designed to receive and transmit vertically polarized signals in the frequency range 960 to 1215 MHz so that it may be used interchangeably for the ATCRBS/Mode S, ADS-B, TCAS/ACAS X, and Distance Measuring Equipment (DME) systems. The following paragraphs and ATTACHMENT 9A set forth details of an L-Band antenna having both this capability and the omnidirectional coverage desired for the ATCRBS/Mode S/TCAS/ACAS X systems.

### Impedance and VSWR

The Voltage Standing Wave Ratio (VSWR) produced by the antenna terminating a 50 ohm transmission line should not exceed 1.42:1 (1.0-1.1 GHz) or 1.8:1 (0.96-1.22 GHz) when installed on a 4-foot diameter (or larger) ground plane (see Figure 1, ATTACHMENT 9A). The antenna should provide a direct path to airframe ground.

### Gain and Polarization

The antenna polarization should be predominately vertical. The gain should not be more than 3.0 dB below a matched vertically polarized quarter-wave stub when installed.

### Power Rating

The antenna should be capable of continuous operation at a peak pulse power input of 3-Kwatts power input of 250 watts.

### Radiation Pattern

The radiation pattern should be omnidirectional when measured on the center of the ground plane (see Figure 1, ATTACHMENT 9A) at conic angles from 5 to 30 degrees above the ground plane.

COMMENTARY

For combined DME, ATCRBS/Mode S, and ACAS X (lower antenna) applications, the ideal azimuth radiation pattern of the antenna when installed on the aircraft is omnidirectional. If the pattern is not omnidirectional, forward coverage should be slightly favored over aft or lateral coverage.

### Connector

The connector used with the omnidirectional antenna should be a Type C female.

### Continuity Check

The omnidirectional antenna should present a Vdc resistance of 50 ohms or less at its input. The ACAS X traffic computer may use this to perform a continuity check to verify that the antenna is installed and connected.

## Directional Antenna

The form factor for sector interrogation/bearing estimation antennas mounted on the top of the aircraft structure is given in ATTACHMENT 9B and ATTACHMENT 9C of this document. For installations in which the bottom antenna is a directional antenna, the same criteria will apply.

COMMENTARY

The ACAS X is delivered as a system. As such, the interface between the ACAS X traffic computer and the directional antenna is unique to each manufacturer. Thus, the characteristics of gain, power, impedance, and VSWR are not specified herein, but will be defined by the equipment manufacturer.

Four TNC female connectors should be used on the directional antenna.

## Environmental Considerations

The antennas will be mounted in the forward part of the fuselage, collocated top, and bottom, on or very near the centerline of the airframe. Refer to RTCA DO-160, Section 22 for standards of lightning strike protection which apply to this installation.

The bottom mounted antenna will be subjected to a highly corrosive environment such as highly corrosive spray and liquids that accumulate in the bottom interior of the airplane. The antenna should be designed to withstand such conditions.

The antenna will be mounted in pressurized areas and should withstand a pressure differential of 25 PSIA.

COMMENTARY

The airlines are very concerned about drag induced by a non-flush antenna. Drag can be equated with aircraft operating equivalent weight, which in turn can be correlated with increased fuel burn and operating costs. The designer should note that the airline customers will look with favor upon antennas which protrude very little.

## L-Band Systems Physical Isolation

The installation designer should also be aware of the need for physical isolation between L-Band antennas. This is necessary to protect receiver input circuitry from high energy RF pulses and to minimize the mutual radiation effects on each antenna. It has been suggested that separation resulting in 20 dB of isolation will provide sufficient protection. This corresponds to 2.5 wave lengths or 30 inches.

## Antenna Installation

Achieving optimum antenna pattern coverage should be a factor in the choice of mounting locations for the ACAS X antennas on the aircraft. The installation designer is encouraged to choose antenna locations such that both antennas appear to an interrogator to be located at the same range and bearing from the interrogator.

Generally, the physical placement of the top and bottom antennas should not vary by more than 25 feet longitudinally. The transmission line delay exhibited by the cabling to the top antenna should be equal to the transmission line delay exhibited by the cabling to the bottom antenna within ± 50 nanoseconds. Cable delay program compensation is provided. See Attachment 3B, Note 24. Cable delay differential should be minimized.

## Antenna and Cable Characteristics

Variations in the length or characteristics of the coaxial cables connecting the ACAS X traffic computer to the top, and bottom if utilized, directional antenna will impact system performance.

COMMENTARY

Either phase or signal amplitude comparisons may be utilized by the computer unit to obtain the relative bearing of other aircraft. For these reasons, limits have been placed on the performance of connecting RF circuitry.

### Total Interconnection Losses

Losses in the coaxial cable connecting the ACAS X traffic computer to either antenna will impact the receiver sensitivity as well as the transmitter power output. For this reason, antenna cable losses for each coaxial cable, including cable connectors, should be 2.5 ± 0.5 dB at 1030 MHz.

### Differential Cable Losses

Differences in signal level at any one input with respect to the other inputs of the directional antenna should not vary more than 0.5 dB at the computer unit. This value, which includes connectors, is expected to hold true with cable aging.

### Differential Phase Delay

The differential phase delay among the coaxial cable and connectors which connect the ACAS X traffic computer to the directional antenna should be limited to one wavelength (approximately 8 inches) at 1090 MHz.

## Anti-Icing

The maximum height of the installed directional antenna is expected to be approximately 1 inch. Therefore, it is not considered susceptible to icing effects in the general area of the proposed installation. Other factors affecting the installation may merit the consideration of anti-icing provisions.

# VSI/TCAS Display

The ACAS X traffic computer retains backward compatibility to a VSI/TCAS display via the ARINC 429 TA/RA bus definitions defined in Attachment 6 PART 6B Table 6-B-1, however, since this display was primarily for retrofit TCAS II implementation and the ACAS X traffic computer is primarily intended for forward fit applications, the VSI/TCAS display interface requirements are not included in this document. The requirements can be referenced in ARINC 735B section 6 and Attachments 14-17.

# Simulator Installation

## Use in Simulators

Operation of the ACAS X traffic computer in a simulator is envisaged. **ARINC Report 610C:** *Guidance for Use of Avionics Equipment and Software in Simulators,* provides the definition of capabilities unique to the simulator environment which should be accommodated by the ACAS X traffic computer.

COMMENTARY

Simulators have the capability to stop the aircraft in midair, back it up, and then re-run a segment of a flight. These functions can add additional complexity to the equipment design. It is advisable that simulator operators be consulted as early in the design phase as possible to identify functions that are desired.



ATTACHMENT 1A TCAS/DUAL MODE S ARCHITECTURE



ATTACHMENT 1B TCAS/DUAL MODE S INTRA SYSTEM DATA LINK DIAGRAM



ATTACHMENT 1C-1 TCAS DISPLAY AND ANNUNCIATION INTERFACE DIAGRAM



Figure 1C-1 – High-Speed TA and RA Data Bus

ATTACHMENT 1C-2 TCAS DISPLAY AND ANNUNCIATION INTERFACE DIAGRAM



ATTACHMENT 1D TCAS/DUAL MODE S POWER INPUT CONFIGURATION DIAGRAM



1. Some installations may utilize +28 Vdc power. See ATTACHMENT 3A for interwiring connections.
2. If an Instantaneous Vertical Speed Indicator (IVSI) is used for Resolution Advisory Display (RAD), the power inputs for the IVSI and RAD functions may not be the same.

ATTACHMENT 1E-1 DIGITAL INPUT SIGNAL DIAGRAM



ATTACHMENT 1E-2 TCAS WITH ADS-B DIGITAL INPUT SIGNAL DIAGRAM



ATTACHMENT 1F TCAS WITH ADS-B DIGITAL OUTPUT SIGNAL DIAGRAM



ATTACHMENT 1G TCAS WITH ADS-B PROGRAM PIN SIGNAL DIAGRAM



1. TRAFFIC COMPUTER CONNECTOR AND POSITIONING



Index Code 40 (4, 3, 1)

D - RTP – Right Top Plug

E - RMP – Right Middle Plug

F - RBP – Right Bottom Plug

A -LTP – Left Top Plug

B - LMP – Left Middle Plug

C - LBP – Left Bottom Plug

ATTACHMENT 3A STANDARD INTERWIRING

| **FUNCTION** | **COMPUTER UNIT** | **XPDR #1** | **XPDR #2** | **OTHER SOURCES/SINKS** | **NOTES** |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| **LEFT TOP INSERT (LTP):** |  |  |  | **TOP ANTENNA** |  |
| Top Antenna, J1 | LTP 1 Coax |  |  | Coax  J1 ANTENNA | [9] [21] |
| Top Antenna, J2 | LTP 2 Coax |  |  | Coax  J2 BLACK | [9] [21] |
| Top Antenna, J3 | LTP 3 Coax |  |  | Coax  J3, BLUE | [9] [21] |
| Top Antenna, J4 | LTP 4 Coax |  |  | Coax  J4, RED | [9] [21] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **LEFT MIDDLE INSERT (LMP):** |  |  |  | **BOTTOM ANTENNA** |  |
| Bottom Omni Antenna or J1 | LMP 1 Coax |  |  | Coax Omni or  J1 YELLOW | [9] [21] |
| Bottom Antenna, J2 | LMP 2 Coax |  |  | Coax Directional  J2 BLACK | [9] [21] |
| Bottom Antenna, J3 | LMP 3 Coax |  |  | Coax Antenna  J3 BLUE | [9] [21] |
| Bottom Antenna, J4 | LMP 4 Coax |  |  | Coax Only  J4 RED | [9] [21] |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **LEFT BOTTOM INSERT(LBP):** |  |  |  |  |  |
| 115 VAC Primary Hot | LBP 1 |  |  | 115 VAC | [10] |
| Future Spare (contact) | LBP 2 |  |  | 5 Amp CB Aircraft | [1] |
| Reserved (28 VDC Return) | LBP 3 |  |  |  |  |
| Future Spare (contact) | LBP 4 |  |  |  |  |
| 115 VAC (H) Output to Fan | LBP 5 |  |  | To Fan | [20] |
| Future Spare (contact) | LBP 6 |  |  |  |  |
| 115 VAC Primary Cold | LBP 7 |  |  | AC Ground | [10] |
| Signal Ground | LBP 8 |  |  | DC Ground to Fan |  |
| 115 VAC (C) Output to Fan | LBP 9 |  |  |  | [20] |
| Reserved (28 VDC Primary Power) | LBP 10 |  |  |  |  |
| Chassis Ground | LBP 11 |  |  | DC Ground |  |
| Suppression Pulse Input | LBP 12 Coax |  |  | Coax Other RF Systems | [26] [9] |
| Suppression Pulse Output | LBP 13 Coax |  |  | Coax Other RF Systems | [26] [9] |

| **FUNCTION** | | **COMPUTER UNIT** | **XPDR #1** | **XPDR #2** | **OTHER SOURCES/SINKS** | **NOTES** | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **RIGHT TOP INSERT (RTP):** | |  |  |  |  |  | |
| (This insert not used) | |  |  |  |  |  | |
|  | |  |  |  |  |  | |
| **RIGHT MIDDLE INSERT (RMP):** | |  |  |  |  |  | |
| Reserved For Discrete Output | | RMP 1A |  |  |  | [1] | |
| Reserved For Discrete Output | | RMP 1B |  |  |  | [1] | |
| Reserved For Discrete Output | | RMP 1C |  |  |  | [1] | |
| Reserved For Discrete Output | | RMP 1D |  |  |  | [1] | |
| Reserved For Discrete Output | | RMP 1E |  |  |  | [1] | |
| Aural Advisory Discrete Output (Resolution Advisory) | | RMP 1F |  |  |  | [35] | |
| Program Strobe (Discrete Out) | | RMP 1G |  |  |  |  | |
| Program Strobe (Discrete Out) | | RMP 1H |  |  |  |  | |
| Spare (Previously Defined) Climb Inihibit Discrete Input #1 | | RMP 1J |  |  |  | [2] | |
| Spare (Previously Defined) Aural Advisory Discrete Output (Preventative) | | RMP 1K |  |  |  | [2] | |
|  | |  |  |  |  |  | |
| Aural Advisory Discrete Output (Traffic/RWC Alert) | | RMP 2A |  |  |  | [35] | |
|  | |  |  |  |  |  | |
| Reserved (previously defined) | A | RMP 2B |  |  |  |  | |
| (RS 422) | B | RMP 2C |  |  |  |  | |
| Common/Ground | | RMP 2D |  |  |  |  | |
| Program Strobe (Discrete Out) | | RMP 2E |  |  |  |  | |
| Synthesized Voice Output | H | RMP 2F |  |  | 8 Ohm Speaker | [13] | |
| (8 ohms) | L | RMP 2G |  |  |  |  | |
|  | |  |  |  |  |  | |
| Radio Altimeter #1 | + | RMP 2H |  |  |  | [5] | |
| ARINC 552/552A Analog Input | - | RMP 2J |  |  | To Radio Altimeter | [5] | |
| Radio Altimeter # 1 - Valid | | RMP 2K |  |  |  |  | |
|  | |  |  |  |  |  | |
| Visual Annunciator Output (Resolution Advisory) | | RMP 3A |  |  | To Visual | [3] | |
| Spare(Previously Defined)Discrete Output | | RMP 3B |  |  | Annunciator | [2] | |
| Visual Annunciator Output  (Traffic/RWC Alert) | | RMP 3C |  |  | Panels | [3] | |
| Spare (Previously Defined) Discrete In | | RMP 3D |  |  |  | [2] | |
| Program Strobe (Discrete Out) | | RMP 3E |  |  |  |  | |
|  | |  |  |  |  |  | |
| Synthesized Voice | H | RMP 3F |  |  | To Audio Distribution | [13] | |
| Output (600 ohms) | L | RMP 3G |  |  | Panel or Headphones | [13] | |
| Program Pin (Discrete In) | | RMP 3H |  |  |  |  | |
| Program Pin (Discrete In) | | RMP 3J |  |  |  |  | |
| Traffic Input 1A (Discrete In) | | RMP 3K |  |  |  | [37] | |
|  | |  |  |  |  |  | |
| Reserved |  | RMP 4A |  |  |  |  | |
| Reserved |  | RMP 4B |  |  |  |  | |
| Reserved |  | RMP 4C |  |  |  |  | |
| TCAS Installed Discrete | | RMP 4D |  |  |  |  | |
| Reserved |  | RMP 4E |  |  |  |  | |
| Reserved |  | RMP 4F |  |  |  |  | |
| Reserved |  | RMP 4G |  |  |  |  | |
| Reserved |  | RMP 4H |  |  |  |  | |
| Reserved |  | RMP 4J |  |  |  |  | |
| Reserved | | RMP 4K |  |  |  |  | |
|  | |  |  |  |  |  | |
| Reserved |  | RMP 5A |  |  |  |  | |
| Reserved |  | RMP 5B |  |  |  | |
| Reserved |  | RMP 5C |  |  |  | |
| Traffic Input 1B (Discrete In) | | RMP 5D |  |  |  | [37] | |
| ADS-B Program Pins - DTIF Enable | | RMP 5E |  |  |  | [36] | |
| ADS-B Program Pin – Reserved | | RMP 5F |  |  |  |  | |
| ADS-B Program Pins - Reserved | | RMP 5G |  |  |  |  | |
| Reserved |  | RMP 5H |  |  |  |  | |
| Reserved) |  | RMP 5J |  |  |  |  | |
| Air/Ground Discrete Input | | RMP 5K |  |  | To Air/Ground Relay | [6] | |
|  | |  |  |  |  |  | |
| FMC #1 Primary | A | RMP 6A |  |  |  | [34] | |
| (ARINC 429) | B | RMP 6B |  |  |  | [34] | |
| Spare (Previously Defined) Mag Heading Valid Discrete Input | | RMP 6C |  |  |  | [2] | |
| Spare(Previously Defined) Performance Limit Discrete Input | | RMP 6D |  |  |  | [2] | |
| Spare(Previously Defined) Altitude Limit Program Pin | | RMP 6E |  |  |  | [2] |
| Spare(Previously Defined) Altitude Limit Program Pin | | RMP 6F |  |  |  | [2] |
| Spare(Previously Defined) Altitude Limit Program Pin | | RMP 6G |  |  |  | [2] |
| Spare(Previously Defined) Altitude Limit Program Pin | | RMP 6H |  |  |  | [2] |
| Spare(Previously Defined) Altitude Limit Program Pin | | RMP 6J |  |  |  | [2] |
| Program Pin Common | | RMP 6K |  |  |  |  |
|  | |  |  |  |  |  | |
| IRS #1 Input | A | RMP 7A |  |  | Heading Source | [19] | |
| (ARINC 429) | B | RMP 7B |  |  |  | [19] | |
| TA/RA Display #1 | A | RMP 7C |  |  | To Traffic  Advisory Display | [6] | |
| ARINC 429 High-Speed | B | RMP 7D |  |  |  | |
| Spare(Previously Defined) TA Display #1 Status Discrete Input | | RMP 7E |  |  | [2] | |
| Reserved (Discrete Input) | | RMP 7F |  |  |  |  | |
| TA/RA Display #2 | A | RMP 7G |  |  | To Traffic  Advisory Display |  | |
| ARINC 429 High-Speed | B | RMP 7H |  |  |  | |
| Spare(Previously Defined) TA Display #2 Status Discrete Input | | RMP 7J |  |  | [2] | |
| Reserved (Discrete Input) | | RMP 7K |  |  |  |  | |
|  | |  |  |  |  |  | |
| Dual Usage A429 Input  Data Loader High-Speed Input or ADS-B A429 Input | A | RMP 8A |  |  |  | [40] | |
| Data Loader High-Speed Input or ADS-B A429 Input | B | RMP 8B |  |  |  | [40] | |
| TA/RA Display Control | A | RMP 8C |  |  | From CDTI /  Displays |  | |
| Bus Input #1 | B | RMP 8D |  |  |  | |
|  |  |  |  |  |  |  | |
| MCDU Input #1 | A | RMP 8E |  |  |  | [38] | |
| MCDU Input #1 | B | RMP 8F |  |  |  | [38] | |
|  |  |  |  |  |  |  | |
| TA/RA Display Control | A | RMP 8G |  |  | From CDTI /  Displays |  | |
| Bus Input #2 | B | RMP 8H |  |  |  | |
| MCDU Input #2 | A | RMP 8J |  |  |  | [38] | |
| MCDU Input #2 | B | RMP 8K |  |  |  | [38] | |
|  |  |  |  |  |  |  | |
| Data Loader HS | A | RMP 9A |  |  |  | [28] | |
| Data Bus Output | B | RMP 9B |  |  |  | [28] | |
| Reserved For Data Bus | A | RMP 9C |  |  |  |  | |
| Outputs | B | RMP 9D |  |  |  |  | |
| Reserved For Data Bus | A | RMP 9E |  |  |  |  | |
| Outputs | B | RMP 9F |  |  |  |  | |
| MCDU Output | A | RMP 9G |  |  |  |  | |
| Output #1 | B | RMP 9H |  |  |  |  | |
|  | | RMP 9J |  |  |  |  | |
|  | | RMP 9K |  |  |  |  | |
|  | |  |  |  |  |  | |
| User Defined | | RMP 10A |  |  |  | [15] | |
| User Defined | | RMP 10B |  |  |  | [15] | |
| User Defined | | RMP 10C |  |  |  | [15] | |
| User Defined | | RMP 10D |  |  |  | [15] | |
| User Defined | | RMP 10E |  |  |  | [15] | |
| User Defined | | RMP 10F |  |  |  | [15] | |
| User Defined | | RMP 10G |  |  |  | [15] | |
|  | |  |  |  |  |  | |
| Traffic Input #2A (Discrete In) | | RMP 10H |  |  |  | [37] | |
| Traffic Input #2B (Discrete In) | | RMP 10J |  |  |  | [37] | |
| Traffic Input #1 PUSH (Discrete In) | | RMP 10K |  |  |  | [37] | |
|  | |  |  |  |  |  | |
| User Defined | | RMP 11A |  |  |  | [15] | |
| User Defined | | RMP 11B |  |  |  | [15] | |
| User Defined | | RMP 11C |  |  |  | [15] | |
| User Defined | | RMP 11D |  |  |  | [15] | |
| GPS #1 Input Bus (A429) | A | RMP 11E |  |  |  |  | |
| GPS #1 Input Bus (A429) | B | RMP 11F |  |  |  |  | |
| FMC #1 Input Bus (A429) | A | RMP 11G |  |  |  |  | |
| FMC #1 Input Bus (A429) | B | RMP 11H |  |  |  |  | |
| Air Data #1 Input Bus (A429) | A | RMP 11J |  |  |  |  | |
| Air Data #1 Input Bus (A429) | B | RMP 11K |  |  |  |  | |
|  | |  |  |  |  |  | |
| User Defined | | RMP 12A |  |  |  | [15] | |
| User Defined | | RMP 12B |  |  |  | [15] | |
| User Defined | | RMP 12C |  |  |  | [15] | |
| User Defined | | RMP 12D |  |  |  | [15] | |
| User Defined | | RMP 12E |  |  |  | [15] | |
| User Defined | | RMP 12F |  |  |  | [15] | |
| Ethernet RX A | | RMP 12G |  |  | From ATAR | [8] | |
| Ethernet RX B | | RMP 12H |  |  |  |  | |
| Ethernet TX A | | RMP 12J |  |  | To ATAR | [8] | |
| Ethernet TX B | | RMP 12K |  |  |  |  | |
|  | |  |  |  |  |  | |
| Spare (Previously Defined) RA Display #1 | A | RMP 13A |  |  |  | [2] | |
| ARINC 429 Output | B | RMP 13B |  |  |  | |
| Spare (Previously Defined) RA Display #2 | A | RMP 13C |  |  |  | [2] | |
| ARINC 429 Output | B | RMP 13D |  |  |  | |
| RA Display #2 Status Input | | RMP 13E |  |  | From RA Display #2 | [12] | |
|  | |  |  |  |  |  | |
| Landing Gear Discrete Input | | RMP 13F |  |  | To Landing Gear Relay | [4] | |
| Spare (Previously Defined) Climb Inihibit Discrete Input #2 | | RMP 13G |  |  |  | [2] | |
| Radio Altimeter #1 | A | RMP 13H |  |  | To ARINC 707 |  | |
| Input ARINC 429 | B | RMP 13J |  |  | Altimeter |  | |
| System Status Valid Discrete Output | | RMP 13K |  |  |  | [18] | |
|  | |  |  |  |  |  | |
| TX Coordination #2 Out | A | RMP 14A |  | TP 5E |  | [11] | |
| ARINC 429 High-Speed | B | RMP 14B |  | TP 5F |  | [11] | |
| RA Display #1 Status In | | RMP 14C |  |  | From RA Display | [12] | |
|  | |  |  |  |  |  | |
| Spare (Previously Defined) Selected Altitude | A | RMP 14D |  |  |  | [2] | |
| ARINC 429 Input | B | RMP 14E |  |  |  | |
| XT Coordination #1 In | A | RMP 14F | TP 5G |  |  | [11] | |
| ARINC 429 High-Speed | B | RMP 14G | TP 5H |  |  | [11] | |
| XT Coordination #2 In | A | RMP 14H |  | TP 5G |  | [11] | |
| ARINC 429 High-Speed | B | RMP 14J |  | TP 5H |  | [11] | |
| Traffic Input 1 PULL (Discrete In) | | RMP 14K |  |  |  | [37] | |
|  | |  |  |  |  |  | |
| Air Data #2 Input Bus (A429) | A | RMP 15A |  |  |  |  | |
| Air Data #2 Input Bus (A429) | B | RMP 15B |  |  |  |  | |
| GPS #2 Input Bus (A429) | A | RMP 15C |  |  |  |  | |
| GPS #2 Input Bus (A429) | B | RMP 15D |  |  |  |  | |
| Manufacturer Defined #3 | A | RMP 15E |  |  |  |  | |
| Output Bus (A429) | B | RMP 15F |  |  |  | |
|  | |  |  |  |  |  | |
| Manufacturer Defined #4 | A | RMP 15G |  |  |  |  | |
| Output Bus(A429) | B | RMP 15H |  |  |  |  | |
| TX Coordination #1 Output | A | RMP 15J | TP 5E |  |  | [11] | |
| ARINC 429 High-Speed | B | RMP 15K | TP 5F |  |  | [11] | |

| **FUNCTION** | | **COMPUTER UNIT** | **XPDR #1** | **XPDR #2** | **OTHER SOURCES/SINKS** | **NOTES** |
| --- | --- | --- | --- | --- | --- | --- |
| **RIGHT BOTTOM INSERT (RBP):** | |  |  |  |  |  |
| Reserved |  | RBP 1A |  |  |  |  |
| Reserved |  | RBP 1B |  |  |  |  |
| Reserved |  | RBP 1C |  |  |  |  |
| Reserved |  | RBP 1D |  |  |  |  |
| Reserved |  | RBP 1E |  |  |  |  |
| Reserved (Previously Defined) GPS Time Mark | A | RBP 1F |  |  |  | [2] |
| #2 (RS 422) | B | RBP 1G |  |  |  |  |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 1H |  |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 1J |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 1K |  |  | [2] |
|  | |  |  |  |  |  |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Power {Red} | | RBP 2A |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Power Ret/Com. {Black} | | RBP 2B |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Clock {Green} | | RBP 2C |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Serial Data Input {Blue} | | RBP 2D |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Serial Data Output {Gray} | | RBP 2E |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Enable {Yellow} | | RBP 2F |  |  |  | [39] |
| Reserved for Program Pin Discrete Input or (Reserved Output)  APM Write Enable {White} | | RBP 2G |  |  |  | [39] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 2H |  |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 2J |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 2K |  |  | [2] |
|  | |  |  |  |  |  |
| Radio Altitude #2 | + | RBP 3A |  |  | To ARINC 552/552A  Radio Altimeter | [5] |
| ARINC 552/552A | - | RBP 3B |  |  |  |
| Analog Input #2 Valid | | RBP 3C |  |  |  |  |
| Radio Altitude #2 | A | RBP 3D |  |  | To ARINC 707  Radio Altimeter |  |
| ARINC 429 Input | B | RBP 3E |  |  | [5] |
| Program Pin (Discrete In) | | RBP 3F |  |  |  |  |
| Program Pin (Discrete In) | | RBP 3G |  |  |  |  |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 3H |  |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 3J |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 3K |  |  | [2] |
|  | |  |  |  |  |  |
| Spare (Previously Defined) Mag/True Heading Discrete Input | | RBP 4A |  |  |  | [2] |
| TA Only (with aurals) Discrete Input | | RBP 4B |  |  |  | [16] |
| AOTO Enable Program Pin | | RBP 4C |  |  |  | [41] |
| Reserved For Discrete Input | | RBP 4D |  |  |  | [1] |
| Traffic input #2 PUSH (Discrete Input) | | RBP 4E |  |  |  | [37] |
| Traffic input #2 PULL (Discrete Input) | | RBP 4F |  |  |  | [37] |
| RA Valid Discrete Disable | | RBP 4G |  |  | To RBP 7K which  Disables RA Display Discrete Monitoring | [34] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 4H |  |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 4J |  |  | [2] |
| Spare(Previously Defined) RA Word 270 Discrete Output |  | RBP 4K |  |  | [2] |
|  | |  |  |  |  |  |
| Advisory Inhibit Disc Input | 1 | RBP 5A |  |  |  | [16] |
| Advisory Inhibit Disc Input | 2 | RBP 5B |  |  |  | [16] |
| Advisory Inhibit Disc Input | 3 | RBP 5C |  |  |  | [16] |
| Advisory Inhibit Disc Input | 4 | RBP 5D |  |  |  | [16] |
| Spare (Previously Defined) Increase Climb Inihibit Discrete Input #1 | | RBP 5E |  |  |  | [2] |
| Spare (Previously Defined) Increase Climb Inihibit Discrete Input #2 | | RBP 5F |  |  |  | [2] |
| Spare (Previously Defined) Increase Climb Inihibit Discrete Input #3 | | RBP 5G |  |  |  | [2] |
| Spare (Previously Defined) Increase Climb Inihibit Discrete Input #4 | | RBP 5H |  |  |  | [2] |
| Spare (Previously Defined) Climb Inihibit Discrete Input #3 | | RBP 5J |  |  |  | [2] |
| Spare (Previously Defined) Climb Inihibit Discrete Input #4 | | RBP 5K |  |  |  | [2] |
|  | |  |  |  |  |  |
| Data Loader Enable Discrete Input | | RBP 6A |  |  | To ARINC 615 Data Loader Link A | [27] [40] |
| Data Loader Function Discrete #2 | | RBP 6B |  |  | To ARINC 615 Data Loader | [32] |
| Data Loader Function Discrete #3 | | RBP 6C |  |  | To ARINC 615 Data Loader | [32] |
| Software P/N Enable Discrete Input | | RBP 6D |  |  |  | [31] |
| CFDS Data Bus Output | A | RBP 6E |  |  |  |  |
| ARINC 429 | B | RBP 6F |  |  |  |  |
| CFDS Data Bus Input | A | RBP 6G |  |  |  |  |
| ARINC 429 | B | RBP 6H |  |  |  |  |
| XPDR Program Pin | | RBP 6J |  |  | To RBP 7K indicates only XPDR #1 is installed |  |
| Radio Altimeter Program Pin | | RBP 6K |  |  | To RBP 7K indicates only a single Radio Altimeter is installed |  |
|  | |  |  |  |  |  |
| Audio | #1 | RBP 7A |  |  |  | [29] |
| Level | #2 | RBP 7B |  |  |  | [29] |
| Program (airborne) | #3 | RBP 7C |  |  |  | [29] |
| Aural Advisory Discrete Program | | RBP 7D |  |  |  | [14] |
| Ground Display Mode Program | | RBP 7E |  |  |  | [22] |
| Display All Traffic/Threat Traffic Program | | RBP 7F |  |  |  | [23] |
| Cable | Sign | RBP 7G |  |  |  | [24] |
| Delay | MSB | RBP 7H |  |  |  | [24] |
| Program | LSB | RBP 7J |  |  |  | [24] |
| Program Pin Common | | RBP 7K |  |  |  |  |
|  | |  |  |  |  |  |
| Audio Level | #1 | RBP 8A |  |  |  | [30] |
| Program (on | #2 | RBP 8B |  |  |  | [30] |
| ground) | #3 | RBP 8C |  |  |  | [30] |
| Spare (previously defined) Alternate Antenna Select Program Pin | | RBP 8D |  |  |  | [2] |
| Self Test Inhibit Program | | RBP 8E |  |  |  | [33] |
| TA/RA | 16 | RBP 8F |  |  |  | [25] |
| Display | 8 | RBP 8G |  |  |  | [25] |
| Intruder | 4 | RBP 8H |  |  |  | [25] |
| Limit | 2 | RBP 8J |  |  |  | [25] |
| Program | 1 | RBP 8K |  |  |  | [25] |
|  | |  |  |  |  |  |
| Reserved | | RBP 9A  thru  RBP 10K |  |  |  | [17] |
| for | |  |  |  |  |
| Test | |  |  |  |  |

ATTACHMENT 3B NOTES APPLICABLE TO THE STANDARD INTERWIRING

1. **Future Spare (Contact)**

Contact positions in equipment-mounted service connectors labeled Future Spare (contact) should be furnished with contact hardware (pin or socket as appropriate) and provisions made within the equipment for their easy use. Contact positions labeled Future Spare may or may not be furnished with contact hardware at the equipment manufacturer’s discretion. Contact hardware need not be provided in either type of contact position in aircraft-mounted rack connectors. The Future Spare (contact) positions will be the first to be used if and when additional contact assignments are needed.

1. **Spare (Previously Defined)**

Contact positions in equipment-mounted service connectors labeled Spare (Previously Defined) refer to connections that were specifically assigned previously (ARINC 735B) but are no longer used. Care should be taken when reassigning these contacts when backward compatibility is desired.

1. **Visual Annunciator Discrete Output**

Each Visual Annunciator Discrete output should, at the appropriate time described in Section 3.5.2.4 of this document, be set to a ground to indicate the presence of a resolution or traffic/RWC advisory. Once activated, the Discrete output should remain set in the ground state for the duration of the. Only one Visual Annunciator Discrete output should be active at a time, with the higher priority resolution advisory discrete displacing the traffic advisory discrete.

The ground state is defined as a resistance of less than 10 ohms or a voltage between 0 and + 3.5 Vdc at the pin. Under normal conditions, the Discrete outputs should be open (100,000 ohms or more resistance or 18.5 to 36 Vdc). The maximum current flow through the Visual Annunciation Discrete wire should not exceed 200 milliamperes.

1. **Landing Gear Input**

This pin is assigned to provide landing gear position input to TCAS. This information may be used to compensate for changes to the bottom antenna beam pattern when a directional antenna is installed. The Landing Gear Discrete input should be wired to the appropriate logic source in the aircraft that presents a standard open circuit (100,000 ohms or more resistance from pin to airframe dc ground, or a voltage between 18.5 and 36 Vdc) when retracted and a standard ground (less than 10 ohms resistance from the pin to airframe dc ground or a voltage between 0 and 3.5 Vdc) when extended. Airframe and equipment manufacturers are cautioned to provide sneak circuit protection for this input, so malfunctions of other equipment connected to the same logic source do not affect TCAS operation. The system should be designed such that the normal failure mode should be to the retracted condition.

1. **Radio Altitude Inputs**

Section 3.2.1 describes the computer unit use of altimeter inputs. The ARINC 707 radio altimeter digital interfaces are shown wired as this is representative of new‑generation aircraft practice. In retrofit situations, the ARINC 552/522A analog radio altimeter inputs may be employed instead, leaving the ARINC 429 inputs unused.

1. **Air/Ground Logic Input**

This pin is assigned to an Air/Ground Discrete input. It should be wired to a logic source in the aircraft that presents a standard open circuit (100,000 ohms or more resistance from this pin to airframe dc ground or a voltage between + 18.5 and + 36 Vdc) while the aircraft is airborne and a standard ground (less than 10 ohms resistance from the pin to aircraft dc ground or a voltage between 0 and + 3.5 Vdc) when the aircraft is on the ground. Airframe and equipment manufacturers are cautioned to provide sneak circuit protection for this input so that malfunctions of other equipment connected to the same logic source does not affect the TCAS operation. The system should be designed such that the normal failure mode should be to the airborne condition.

1. **ACAS Xu C2 Link and Maneuver Performance Data**

The ACAS Xu C2 Link and Maneuver Performance data are assumed to use the existing TA/RA Display Control interfaces. The labels for these data are undefined.

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1. **Air--to-Air Radar (ATAR) Interface**

The ATAR interface for ACAS Xu is assumed to use Ethernet. This document does not define the protocol between the ACAS Xu and the ATAR. ACAS X equipment designers should be aware of EMI challenges related to Ethernet speed and encoding.

1. **Coaxial Cables**

Connector inserts LTP and LMP use size 1 RF contacts. Coaxial cable contacts located in LBP‑12, LBP‑13 are size 5.

1. **Primary Power Wiring**

ATTACHMENT 1D to this document shows how primary power should be wired to the computer. The primary power cold function has been assigned to a long pin in the LBP insert of the computer to ensure that it breaks after the primary power hot connection when the computer is removed from the rack. This is intended to prevent the infamous hot pull problems which can occur when the ground breaks first during removal of the equipment with the power applied.

1. **Transponder/TCAS Interfaces**

The Transponder to TCAS interface consists of two ARINC 429 high-speed data bus outputs and two ARINC 429 high-speed data bus inputs (Also, see Section 3.3).

1. **Display Status Discrete Inputs**



There are two Display Status Discrete inputs used to indicate to the ACAS X that the display device is capable of displaying resolution advisories. These discrete are set by the RA Display or display interface as defined in Section 3.4.5. The ACAS X traffic computer should use the Display Status Discrete inputs to determine whether it has at least one working RA display when it is manually selected to TA/RA mode (Label 016, SL = 0, or 3 to 7). If both Display Status Discrete inputs are open when ACAS X is selected to TA/RA mode, the ACAS X traffic computer should indicate an ACAS X system failure. If ACAS X has been manually selected to Standby or TA Only/RWC mode (Label 016, SL = 1 or 2), The ACAS X traffic computer should not indicate an ACAS X system failure has occurred based on these discrete inputs.

For ACAS Xu, the ability to report RA guidance is dependent on the C2 link status. A C2 link failure should result in the RA Display Status Discrete Inputs indicating failed.

1. **Voice Output**

There are two outputs which provide synthesized audio. One is a low power output to be applied to aircrew headsets via the aircraft audio distribution panel. The other is capable of driving a speaker (Also, see Section 3.1.2).

1. **Aural Advisory Discrete Program**

This program pin is provided to inform the TCAS computer unit, when connected to Program Pin Common (RBP-7K) that a 1 + .02 second duration ground state should be applied to the appropriate Aural Advisory Discrete Output (Corrective, Preventive or Traffic Advisory) when an advisory is issued.

1. **User Defined Pins**

These pins have been set aside to accommodate the unique needs of some retrofit installations. The user should define both ends of the connection and the signals.

1. **Advisory Inhibit Discrete Inputs**

Five pins, Advisory Inhibit Discretes #1 - #4 and the TA/Surveillance Only Discrete, are assigned to provide the ACAS X traffic computer with a command to inhibit normal operation during hazardous or other desired conditions. A ground at Advisory Inhibit Discrete input #1 should cause the ACAS X function to go into the STBY mode. A ground at Advisory Inhibit Discrete input #2, #3, or #4 should cause the ACAS X function to go into the TA Only/Surveillance Only mode (STBY mode is also allowed) and inhibit aurals. A ground of the TA/Surveillance Only Discrete input should cause the ACAS X function to be limited to the TA Only/Surveillance Only mode (STBY mode is also allowed) with aural outputs enabled.

An input at #1 should have precedence over an input at #2, #3, or #4. An input at Advisory Discrete #1, #2, #3 or #4 should have precedence over an input at the TA/Surveillance Only Discrete Input. An open at all these pins indicates normal advisory/alert operation. See Section 3.5.1.3.

1. **Reserved Test Pins**

These pins have been reserved for use by equipment manufacturers for bench test pur­poses.

1. **System Status Valid Discrete Output**

This output is available to accommodate retrofit installations where instrumentation may need to monitor System status. A ground at this pin indicates normal system operation. An open indicates a system fault.

1. **Attitude, Heading Inputs**

ACAS X does not require heading, pitch, or roll inputs. Aircraft manufacturers should pro­vide appropriate magnetic heading and attitude inputs and related data valid discrete wiring for display stabilization purposes in all new aircraft.

1. **Power to Fan**

This pin is assigned to supply power from the TCAS computer unit to rack‑mounted fan for cooling in retrofit installations where forced air cooling is not available. These wires need not be installed unless the external fan is used.

1. **Antenna RF Connectors**

The directional antenna should be legibly and permanently marked to clearly identify each of the four TNC female connectors, J1 through J4, as applicable. The physical location of any particular antenna connector with respect to the forward (FWD) direction of the antenna may vary depending on manufacturer. In all cases, the standard interwiring of ATTACHMENT 3A should be followed; i.e., TCAS computer unit LTP‑1 Coax should always be connected to Top Antenna J1 Coax. This procedure should also be followed in installations in which the bottom antenna is a directional antenna.

1. **Ground Display Mode Program**

An open at this pin indicates that the ACAS X computer should operate in TA Only mode for ACAS Xa or Surveillance Only mode for ACAS Xu (with aural and voice inhibited due to altitude, as defined by CAS logic) when the aircraft is on the ground as indicated by the Air/Ground Discrete (RMP‑5K). See Note 5. Connection to Program Pin Common (RBP-7K) indicates that the ACAS X computer unit should place itself in the Standby mode when the aircraft is on the ground.

1. **Display All Traffic/Threat Traffic Program**

An open at this input sets bit 19 of the RTS Word (Label 357) in the intruder file indicating to the TA Display that “all traffic” should be displayed. Connection to Program Pin Common (RBP‑7K) at this pin clears bit 19 to zero, indicating to the TA Display that traffic should only be displayed if a TA or RA. See also Note 4 of Attachment 6 PART 6C and Note 2, Table 6B-1 of Attachment 6.

1. **Cable Delay Program**

These pins are used to convey to the ACAS X computer unit the amount of differential delay between top and bottom antenna cables. When programming, a 1 is designated by connecting the desired pin to Program Pin Common (RBP‑7K).

It may be necessary to use different cable types to match cable losses when the upper and lower antenna cable lengths vary dramatically.

The round trip cable delay is twice the length (in feet) multiplied by the delay (in nanoseconds/foot). A typical one way delay is 1.54 nsec/foot.

|  |  |  |  |
| --- | --- | --- | --- |
| **Pin** | | **Coding** | |
| RBP-7G | | 0 = Add time delay to top  1 = Add time delay to bottom | |
| RBP- | RBP- | Differential Delay (nsec) | Add (nsec) in ACAS X |
| 7H | 7J |
| 0 | 0 | 0-50 | 0 |
| 0 | 1 | 51-150 | 100 |
| 1 | 0 | 151-250 | 200 |
| 1 | 1 | 251-350 | 300 |
| RBP-7K | | Program Pin Common | |

Example Calculation:

Given:

Top cable length = 75 ft.

Bottom cable length = 25 ft.

Procedure:

1. Select Top/Bottom code 1 to add time compensation to the bottom antenna
2. Install coding in the interwiring: Connect RBP‑7G to RBP‑7K
3. Calculate time compensation:
4. Calculate the difference in cable lengths: 75 ‑ 25 = 50 ft.
5. Determine the cable delay: 50 ft. X 2 X 1.54 = 154 nsec.
6. Select coding: (151‑250 nsec delay)  
   RBP‑7H = 1, RBP‑7J = 0
7. Install coding in the interwiring: Connect RBP‑7H to RBP‑7K
8. Leave RBP‑7J open.

1. **TA Display Intruder Limit Program**

These pins are used to encode the maximum number of intruder symbols to be presented on certain TA displays. The encoded value will be placed within the RTS data word (Label 357) sent to the display. The logic of programming is that an open represents selected and a connection to Program Pin Common (RBP‑7K) represents Not Selected.

1. **Suppression Pulse**

The Suppression Pulse input and Suppression Pulse output signals are identical and may be utilized as needed within the aircraft installation.

1. **Data Loader Enable Discrete Input**

Pin RBP 6A is assigned as the Data Loader Enable Discrete Input and should be connected to the Link A output of the ARINC 615 data loader. The ACAS X computer should use a ground at the Data Loader Enable discrete as a condition for initiating the software data load process. When this input is open, RMP 8A/8B should be considered Reserved ADS-B ARINC 429 Input.

1. **Data Loader Data Bus Output/Input**

Two pins are provided for the TCAS computer unit to accept an input from an on-board data loader via a twisted shielded cable. Similarly, two pins are provided for the data loader to send commands to the data loader via an ARINC 429 data bus on twisted shielded cable.

1. **Audio Level Program – Airborne**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **RBP Pin 1** | | | **Low Level 2**  **Output**  **dBm mW** | | **High Level 2**  **Output**  **dB W** | |
| **7A** | **7B** | **7C** |
| 1 | 1 | 1 | 16 | 40 | 6 | 4 |
| 1 | 1 | 0 | 13 | 20 | 3 | 2 |
| 1 | 0 | 1 | 10 | 10 | 0 | 1 |
| 1 | 0 | 0 | 7 | 5 | -3 | 0.5 |
| 0 | 1 | 1 | 4 | 2.5 | -6 | 0.25 |
| 0 | 1 | 0 | 1 | 1.25 | -9 | 0.125 |
| 0 | 0 | 1 | -2 | 0.625 | -12 | 0.0625 |
| 0 | 0 | 0 | 19 | 80 | 9 | 8 |

Notes:

1 = open

0 = connected to Program Pin Common (RBP 7K)

These power output values should be uniform for all installations. An ACAS X computer unit that is not capable of meeting the higher level outputs should produce the maximum undistorted output for which it was designed.

1. **Audio Level Program – Ground**

When RBP 8A, 8B, and 8C are all open (111), the ground audio level is the same as that selected by RBP 7A, 7B, and 7C. This default value allows aircraft not requiring different audio levels in air versus ground to use only the original RBP 7A, 7B, and 7C.

1. **Software P/N Enable Discrete Input**

Pin RBP 6D is assigned to be used to indicate to the ACAS X computer that it should transmit its software part number. Normal operation is an open at the input. A ground at the input should cause the ACAS X computer unit to report its software part number in the manner described in Section 3.5.2.6.

1. **Data Loader Function Discrete Inputs**

Pins RBP 6B and 6C are assigned as Data Loader Function Discrete #2 and #3, respectively, and should be connected to the Function Discrete #2 and Function Discrete #3 outputs of the ARINC 615 data loader. The operational definition of these discrete is defined by the manufacturer of the ACAS X computer.

1. **Self-Test Inhibit Program**

Connecting RBP 8E to program pin common inhibits the selection of manual Functional Test while the aircraft is airborne.

1. **RA Valid Discrete Disable**

This program pin disables the monitoring of valid discrete from resolution advisory indicators when connected to RBP 7K. It is to be used in aircraft with resolution advisory indicators that have adequate self-monitoring to indicate to the flight deck crew the inability to display a resolution advisory.

1. **Aural Advisory Discrete Output**

Each Aural Advisory Discrete Output should at the appropriate time (during a Resolution or Traffic/RWC Advisory) be set to ground state. Once activated, each discrete output should remain set in the ground state for the duration of the aural alert plus a tolerance between 0 and 0.2 seconds. Only one Aural Advisory Discrete Output should be active at a time, with the Resolution Advisory aural discrete being of higher priority. When utilizing the Aural Advisory Discrete outputs in an installation, Aural Advisory Discrete Program, pin RBP 7D, may be connected to Program Pin Common (RBP 7K) to provide a 1 ± 0.02 second delay in the synthesized Voice Output.

1. **DTIF (Display Traffic Information File) Enable**

The DTIF Enable Pin (RMP 5E) and DTIF field (Label 013, bit 15) should be used together in order to prohibit transmission of the DTIF file from the ACAS X processor to the displays.

Ground = DTIF On (Transmit both TCAS Intruder file and DTIF to displays).

Open = DTIF Off (Transmit only TCAS intruder file to displays if RMP 5E is Open AND Label 013, bit 15 is set to 0, indicating the DTIF is OFF).

1. **Traffic Selector Discrete Inputs**

The ground state on this pin indicates either a change in the position (for inputs 1A, 1B, 2A, 2B), or a selection through PUSH/PULL state (input 2 push, 2 pull, 1 push, 1 pull). Reference ATTACHMENT 1E-2.

1. **MCDU Inputs**

These two inputs are used to connect up to two MCDUs for crew control means and Cockpit Display of Traffic Information (CDTI).

1. **Airplane Personality Module Inputs**

These pins are reserved for the potential interface to an Airplane Personality Module (APM) as defined in ARINC Report 607. When connected to the APM, relevant configuration data will be provided to the TCAS computer. In some installations, the same pins can be used for program pin discrete inputs for the strobed program pins described in Section 3.6.9.

1. **Dual Usage ARINC 429 Input**

If the Data Loader Enable Discrete (RMP-6A) is ground, then pins RMP-8A/B should be considered Data Loader High-Speed (HS) Input. If the Data Loader Enable Discrete (RMP-6A) is open, then pins RMP-8A/B should be considered Reserved ADS-B ARINC 429 Input.

1. **AOTO Enabled Program Pin**

If RBP 4C is ground, then the traffic computer (if capable) should enable its “ADS-B Only TA Only” (AOTO) function. In this mode, TAs may be issued for traffic that is tracked via ADS-B, but not through direct interrogation. See Section 3.6.9.

ATTACHMENT 4 ACAS X COMPUTER UNIT CONNECTOR INSERT LAYOUT



Right Middle Plug (RMP)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | | | E | | F | G | | | H | J | | K |
| 1 | Reserved for Discrete Output  ο o o o | | | | | | Reserved  o  DiscOut | | Aural  Adv Disc  o  Out RA | Program  Strobe  o | | | Program  Strobe  o | Reserved  o  Disc In | | Reserved  ο  Disc Out |
| 2 | Aural  Adv Disc  ο  Out TA/RWC | Reserved  RS-422 Input  o o  A B | | | | o  Common | Program  o  Strobe | | Synth Voice  8 ohms  o o  H L | | | | Radio Altitude #1 Input  ARINC 552/522A  o o o  + - Valid | | | |
| 3 | Visual  Ann RA  ο  Disc Out | Reserved  ο  Disc Out | Visual  Ann TA/RWC  ο  Disc Out | | | Reserved  ο  Disc In | Program  o  Strobe | | Synth Voice  600 ohms  o o  H L | | | | Program  Strobe  o  Input | Program  Strobe  o  Input | | Traffic input 1A  o  Disc In |
| 4 | Reserved  ο o o | | | | | Reserved  o  Disc In | Reserved  ο o o | | | | | | Reserved  o o | | | Reserved    o  Disc In |
| 5 | Reserved  ο o o | | | | | Traffic input 1B  o  Disc In | ADS-B Program Pins  DTIF  ο o o  Enable Reserved Reserved | | | | | | Reserved  o o | | | Air/Gnd  o  Disc In |
| 6 | FMC #1 Primary  o o  A In B | | Reserved  o  Disc In | | | Resered  o  Disc In | Reserved Program Pins  o o o o o o  Common | | | | | | | | | |
| 7 | IRS #1  o o  A B | | TA/RA Display #1 Previously  High-Speed Out Defined  o o o  A B Disc In | | | | | | Reserved  o  Disc In | TA/RA Display #2 Previously  High-Speed Out Defined  o o o  A B Disc In | | | | | | Reserved  o  Disc In |
| 8 | Dual Usage  ARINC 429 Input o  A B | | TA/RA Display  Control Input #1  o o  A B | | | | MCDU Input #1  A429 Input  o o  A B | | | TA/RA Display  Control Input #2  o o  A B | | | | MCDU Input #2  A429 Input  o o  A B | | |
| 9 | Data Loader  High-Speed Output  o o  A B | | Reserved  Data Bus Output  o o  A B | | | | Reserved  Data Bus Output  o o  A B | | | MCDU Output  A429 Output  o o  A B | | | | o o  A B | | |
| 10 | User Defined  o o o o o o o | | | | | | | | | | | Traffic Input 2A  o  Disc In | | Traffic Input 2B  o  Disc In | | Traffic Input 1 PUSH  o  Disc In |
| 11 | User Defined  o o o o | | | | | | GPS #1  A429 Input  o o  A B | | | FMC #1 EFIS  A429 Input  o o  A B | | | | Air Data #1  A429 Input  o o  A B | | |
| 12 | User Defined  o o o o o o | | | | | | | | | Ethernet1  RX-A  o | | Ethernet1  RX-B  o | | Ethernet1  TX-A  o | | Ethernet1  TX-B  o |
| 13 | Previously Defined  A429 Output  o o  A B | | Previously Defined  A429 Output  o o  A B | | | | RA #2  Status  o  Disc In | Landing  Gear  o  Disc In | | Reserved  o  Disc In | | Radio Alt #1  A429 Input  o o  A B | | | | Sys  Status Valid  o  Disc Out |
| 14 | TX Coordination #2  A429 Output  o o  A B | | RA #1  Status  o  Disc In | | Reserved  A429 Input  o o  A B | | | XT Coordination #1  A429 HS Input  o o  A B | | | | XT Coordination #2  A429 HS Input  o o  A B | | | | Traffic Input 1 PULL  o  Disc In |
| 15 | Air Data #2  A429 Input  o o  A B | | GPS #2  A429 Input  o o  A B | | | | Mfr Def #3  A429 Output  o o  A B | | | | Reserved  A429 Output #2  o o  A B | | | | TX Coordination #1  A429 Output  o o  A B | |

Right Bottom Plug (RBP)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | | B | C | | D | | E | | | F | G | H | J | K |
| 1 | Reserved  o o o o o | | | | | | | | | | Reserved  RS-422 Input  o o  A B | | Reserved  o  Disc Out | Reserved  o  Disc Out | Reserved  o  Disc Out |
| 2 | Program Strobe Inputs (reserved for Program Pins or APM)  #3 #4 #5 #6 #7 #8 #9  o o o o o o o  APM Pwr APM Rtn APM Clk APM Data In APM Data Out APM Enab APMWritEnab | | | | | | | | | | | | Reserved o  Disc Out | Reserved o  Disc Out | Reserved o  Disc Out |
| 3 | Radio Altitude #2 Input  ARINC 552/552A  o o o  + - Valid | | | | | Radio Altitude #2  (Digital)  o o  A B | | | | Program  Strobe#10  o  Input | | Program  Strobe#11  o  Input | Reserved o  Disc Out | Reserved o  Disc Out | Reserved o  Disc Out |
| 4 | Reserved  o  Disc In | TA Only (with Aurals)  o  Disc In | | | AOTO  Enable  o  Disc In | | Reserved  o  Disc In | | Traffic Input #2 PUSH  o  Disc In | Traffic  Input #2  PULL  o  Disc In | | RA Valid  Discrete  Disable  o | Reserved  o  Disc Out | Reserved  o  Disc Out | Reserved  o  Disc Out |
| 5 | Advisory Inhibit Discrete Input  o o o o  #1 #2 #3 #4 | | | | | | | Reserved Discrete Inputs  o o o o  #1 #2 #3 #4 | | | | | | Reserved  Discrete Inputs  o o  #3 #4 | |
| 6 | Data Loader  Enable  Disc Input  o  Link A | | Data Ldr  Funct  Disc Inp  o  #2 | Data Ldr  Funct  Disc Inp  o  #3 | | S/W P/N  Enable  Disc Inp  o | | CFDS Data Bus  Output  o o  A B | | | | CFDS Data Bus  Input  o o  A B | | Single  Mode S  Prog Pin  o | Single  Rad Alt  Prog Pin  o |
| 7 | Airborne Audio Program Pins  o o o | | | | | Aural  Adv Disc  o  Program | | Gnd Disp  Mode  o  Program | | | Disp All  Traffic  o  Program | Cable Delay Program Pins  o o o  Sign MSB LSB | | | Program  o  Common |
| 8 | Ground Audio Program Pins  o o o | | | | | Reserved  o  Discrete Input | | Self-Test  Inhibit  o  Prog | | | TA Display Intruder Limit Program  o o o o o  16 8 4 2 1 | | | | |
| 9 | Reserved for Test  o o o o o o o o o o | | | | | | | | | | | | | | |
| 10 | Reserved for Test  o o o o o o o o o o | | | | | | | | | | | | | | |



ATTACHMENT 5 MODE A REPLY CODE COMBINATIONS

|  |  |
| --- | --- |
| **Code No.** | **Contains Information**  **Pulse Present** |
| 0000 | NONE |
| 0001 | D1 |
| 0002 | D2 |
| 0003 | D1 D2 |
| 0004 | D4 |
| 0005 | D1 D4 |
| 0006 | D2 D4 |
| 0007 | D1 D2 D4 |
|  |  |
| 0010 | C1 |
| 0020 | C2 |
| 0030 | C1 C2 |
| 0040 | C4 |
| 0050 | C1 C4 |
| 0060 | C2 C4 |
| 0070 | C1 C2 C4 |
|  |  |
| 0100 | B1 |
| 0200 | B2 |
| 0300 | B1 B2 |
|  |  |
| 0400 | B4 |
| 0500 | B1 B4 |
| 0600 | B2 B4 |
| 0700 | B1 B2 B4 |
|  |  |
| 1000 | A1 |
| 2000 | A2 |
| 3000 | A1 A2 |
| 4000 | A4 |
| 5000 | A1 A4 |
| 6000 | A2 A4 |
| 7000 | A1 A2 A4 |

Examples:

|  |  |
| --- | --- |
| **Code No.** | **Contains Information**  **Pulses** |
| 1100 | A1 B1 |
| 0011 | C1 D1 |
| 3600 | A1 A2 B2 B4 |
| 7700 | A1 A2 A4 B1 B2 B4 |
| 0314 | A1 B1 C1 D4 |
| 0536 | B1 B4 C1 C2 D2 D4 |
| 0475 | B4 C1 C2 C4 D1 D4 |
| 2004 | A2 D2 |
| 3461 | A1 A2 B4 C2 C4 D1 |
| 6060 | A2 A4 C2 C4 |
| 7777 | A1 A2 A4 B1 B2 B4  C1 C2 C4 D1 D2 D4 |

In every case, the Framing Pulses, F1 and F2, bracket the information pulse content of a transmitted reply.

ATTACHMENT 6 DATA WORDS APPLICABLE TO ACAS X TRAFFIC COMPUTER (ACAS X WITH ADS-B)

AEEC staff note: The data words specified in this attachment (Part 6A through Part 6BV) are applicable to ACAS X traffic computer equipment defined by RTCA DO-385, DO-386 and DO-317.

PART 6A ACAS X Traffic Computer ARINC 429 Inputs

**Table 6A-1 LOW-SPEED ARINC 429 DATA BUS INPUTS**

**FROM RADIO ALTIMETER**

**RMP-13H, 13J**

**RBP-3D, 3E**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Label | Parameter | Rate Min-Max | Format | Cross Reference | Use |
| 164 | Radio Altitude | Max = 50 msec | BNR | ARINC 429 | TCAS |

**Table 6A-2 HIGH-SPEED ARINC 429 DATA BUS INPUTS**

**FROM INS/IRS**

**RMP-7A, 7B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Label | Parameter | Rate Min-Max | Format | Cross Reference | Use |
| 320 | Magnetic Heading | Max = 50 msec | BNR | ARINC 429 | TCAS |
| 324 | Pitch Angle | Max = 50 msec | BNR | ARINC 429 | TCAS |
| 325 | Roll Angle | Max = 50 msec | BNR | ARINC 429 | TCAS |
| 310 | IRS Latitude |  | BNR | ARINC 429 | TCAS/ADS-B |
| 311 | IRS Longitude |  | BNR | ARINC 429 | TCAS/ADS-B |
| 312 | IRS Ground Speed | Dependent on Manufacturer | BNR | ARINC 429 | TCAS/ADS-B |
| 313 | IRS True Track | Max = 50 msec | BNR | ARINC 429 | TCAS/ADS-B |
| 314 | IRS True Heading | Max = 50 msec | BNR | ARINC 429 | TCAS/ADS-B |
| 366 | IRS North-South Velocity | Max = 200 msec | BNR | ARINC 429 | ADS-B |
| 367 | IRS East-West Velocity | Max = 200 msec | BNR | ARINC 429 | ADS-B |

**Table 6A-3 HIGH-SPEED ARINC 429 DATA BUS INPUTS**

**FROM GPS**

**RMP-11E, 11F**

**RMP-15C, 15D**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Label | Parameter | Rate Min-Max | Format | Cross Reference | Use |
| 103 | GNSS Track Angle | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 110 | GNSS Latitude Coarse | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 111 | GNSS Longitude Coarse | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 112 | GNSS Ground Speed | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 120 | GNSS Latitude Fine | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 121 | GNSS Longitude Fine | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 130 | Horizontal Protection Limit | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 133 | GNSS Vertical Integrity Limit | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 136 | Vertical Figure of Merit | 200-1200 msec | BNR | ARINC 429 | ACAS Xu/ADS-B |
| 145 | Horizontal Velocity Figure of Merit | 200-1200 msec | BNR | ARINC 429 | ACAS Xu/ADS-B |
| 165 | Vertical Velocity | 200-1200 msec | BNR | ARINC 429 | ACAS Xu/ADS-B |
| 166 | GNSS North-South Velocity | Min = 200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 174 | GNSS East-West Velocity | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 247 | Horizontal Figure of Merit | 200-1200 msec | BNR | ARINC 429 | ACAS X/ADS-B |
| 273 | GNSS Sensor Status | 200-1200 msec | DIS | ARINC 429 | ACAS X/ADS-B |
| 370 | GNSS Height WGS-84 | 200-1200 msec | BNR | ARINC 429 | ACAS Xu/ADS-B |

**Table 6A-5 LOW-SPEED ARINC 429 DATA BUS INPUTS**

**FROM ADC**

**RMP-11J, 11K**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Label | Parameter | Rate Min-Max | Format | Cross Reference | Use |
| 203 | Barometric Altitude (Uncorrected) | 31.25-62.5 msec | BNR | ARINC 429 | TCAS/ADS-B |
| 204 | Barometric Altitude (Corrected) | 31.25-62.5 msec | BNR | ARINC 429 | TCAS/ADS-B |
| 205 | Mach | 62.50-125 msec | BNR | ARINC 429 | ADS-B |
| 206 | Computed Airspeed | 62.50-125 msec | BNR | ARINC 429 | ADS-B |
| 210 | True Airspeed | 62.50-125 msec | BNR | ARINC 429 | ADS-B |
| 212 | Barometric Altitude Rate | 62.50-125 msec | BNR | ARINC 429 | TCAS/ADS-B |
| 213 | Static Air Temperature | 250-500 msec | BNR | ARINC 429 | ADS-B |

**Table 6A-6 LOW-SPEED ARINC 429 DATA BUS INPUTS**

**FROM FMS PRIMARY**

**RMP-6A, 6B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** |
| 103 | VNAV Airspeed Target | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |
| 272 | Performance Limit-Vertical Rate | Dependent on Manufacturer | DISC | PART 6BT | ACAS Xu |
| 273 | Performance Limit-Turn Rate | Dependent on Manufacturer | DISC | PART 6BU | ACAS Xu |
| 106 | VNAV Mach Target | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |
| 315 | Wind Speed | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |
| 316 | Wind Direction | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |

**Table 6A-7 HIGH-SPEED ARINC 429 DATA BUS INPUTS**

**FROM FMS EFIS**

**RMP-11G, 11H**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** |
| 225 | Min Maneuver Speed | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |
| 001 | Distance to Go (next waypoint) | Dependent on Manufacturer | BCD | ARINC 429 | ADS-B |
| 056 | Time to Go (next waypoint) | Dependent on Manufacturer | BCD | ARINC 429 | ADS-B |
| 070 | Flight Plan Active Waypoint | Dependent on Manufacturer | BNR | ARINC 702A | ADS-B |
| 301 | Flight Plan STX | Dependent on Manufacturer | Application  Dependent | ARINC 702A | ADS-B |
| 302 | Flight Plan EXT | Dependent on Manufacturer | Application  Dependent | ARINC 702A | ADS-B |
| 330 | Flight Plan Waypoint | Dependent on Manufacturer | Dependent on Manufacturer | ARINC 702A | ADS-B |

**Table 6A-8 HIGH-SPEED ARINC 429 DATA BUS INPUTS**

**FROM FMS GENERAL PURPOSE**

**USER DEFINED PINS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** |
| 265 | Min Buffet Speed | Dependent on Manufacturer | BNR | ARINC 429 | ADS-B |
| 100 | Flight Plan Vector | Max = 62.5 msec | BNR | ARINC 429 | ADS-B |

**Table 6A-9 LOW-SPEED ARINC 429 DATA BUS INPUTS**

**FROM MCDU**

**RMP-8E, 8F**

**RMP-8J, 8K**

**RMP-15A, 15B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** |
| 300 | MCDU Words | Dependent on Manufacturer | Various | ARINC 739A-1 | ADS-B |
| 377 | MCDU Identifier | Dependent on Manufacturer | Various | ARINC 739A-1 | ADS-B |

Table 6A-10 – TRANSPONDER TO TCAS (XT) LABELS

XT Coordination #1 In Bus **(RMP – 14F, 14G)**  
XT Coordination #2 In Bus **(RMP – 14H, 14J)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Signal**  **Format** | **Cross Reference** | **Use** | **Notes** |
| 270 | XTWORD10 (GICB Register Data) |  | DISC | ATTACHMENT 14G |  | 5 |
| 271 | XTWORD1 (MTB,CVC,VRC,CHC,HRC,HSB,VSB) |  | DISC | PART 6S | ACAS X | 1, 3 |
| 272 | XTWORD2 (Broadcast, MID (Part 1)) |  | DISC | PART 6L | ACAS X | 1, 3 |
| 273 | XTWORD3 (SLC, IIS) |  | DISC | PART 6N |  | 8 |
| 203 | XTWORD4 (Altitude Resolution, Altitude) | 32.3 – 62.5 msec | BNR | PART 6O | ACAS X/ADS-B | 7 |
| 204 | XTWORD9 (Altitude Resolution, Corrected Altitude) | 32.3 – 62.5 msec | BNR | PART 6Y | ACAS X/ADS-B | 3 |
| 275 | XTWORD5 (Own ID (Part 1)) | 0.1 – 0.2 sec | DISC | PART 6P | ACAS X | 2 |
| 276 | XTWORD6 (Own ID (Part 2), Max A/S, RI Echo, VI) | 0.1 – 0.2 sec | DISC | PART 6Q | ACAS X | 2 |
| 277 | XTWORD7 (ACK/NAK) |  | DISC | PART 6R | ACAS X | 4 |
| 274 | XTWORD8(MID (Part 2) |  | DISC | PART 6M | ACAS X | 1, 3 |
| 013 | TCAS Display Control |  | DISC | PART 6C | ACAS X | 6 |
| 015 | Altitude Select Limits |  | DISC | PART 6V | ACAS X | 6 |
| 016 | Mode S Control Panel Data |  | DISC | PART 6D | ACAS X | 6 |
| 350 | Maintenance |  | DISC | ARINC 718A-4 |  |  |
| 354 | Program Pin Status |  | DISC | PART 6BQ |  | 9 |

Notes:

1. These words are sent as a triplet. Each word isacknowledged separately. The subsequent word is not sent until the previous word is acknowledged.
2. These words are sent as a pair. No acknowledgment by the receiver is required. Integrity checking is by update rate for each word.
3. Sent on a demand basis following any transmission already in progress.
4. Acknowledgment word is sent for each non-periodic type word.
5. This data is transferred using the XGD protocol   
   (ATTACHMENT 14G).
6. These labels are received from the TCAS control unit by the transponder and should be passed to the TCAS computer exactly as received.
7. This label is not used by the transponder and if received, should be passed to the TCAS computer exactly as received.
8. This label contains the sensitivity level command which is not used by ACAS X systems. It is included for backward compatibility and will be ignored by ACAS X.
9. See Attachment 6, PART 6BQ, for full definition of Label 354.

**Table 6A-11 LOW-SPEED ARINC 429 DATA BUS INPUTS**

**FROM MAINTENANCE COMPUTERS (CFDS)**

**CFDS INPUT DATA BUS (RBP-6G, 6H)**

The contents of this bus are described in ARINC Report 604 and in specific Maintenance Computer Specifications.

**Table 6A-12 HIGH-SPEED ARINC 429 DATA BUS**

**INPUTS FROM SOFTWARE DATA LOADER (ARINC 615)**

**SOFTWARE DATA LOADER INPUT BUS (RMP-8A, 8B)**

The contents of this bus are described in ARINC Report 615 and in specific Data Loader Specifications.

**Table 6A-13 HIGH-SPEED ARINC 429 DATA BUS INPUT**

**FROM TA/RA DISPLAY (CDTI DISPLAY CONTROL)**

**TA/RA DISPLAY CONTROL BUS INPUT #1 (RMP 8C, 8D)**

**TA/RA DISPLAY CONTROL BUS INPUT #2 (RMP 8G, 8H)**

| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross**  **Reference** | **Use** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| 272 | Target Designation Command Word | 50 – 150 msec | DISC | PART 6AG | ADS-B | 1 |
| 273 | ADS-B Current Application Word | 50 – 150 msec | DISC | PART 6AK | ADS-B |  |
| 276 | Display Selection Word 1 | 50 – 100 msec | DISC | PART 6AH | ADS-B |  |
| 277 | Display Selection Word 2 | 50 – 100 msec | DISC | PART 6AI | ADS-B |  |
| 024 | Traffic Designation Command Word | 50 – 150 msec | DISC | PART 6BN | ADS-B | 1 |
| 144 | Display information for traffic (0 to 63) | 50 – 150 msec | DISC | PART 6BO | ADS-B | 2 |
| 157 | Display information for traffic (64 to 127) | 50 – 150 msec | DISC | PART 6BP | ADS-B | 2 |
| 163 | Display Application Status | 50 – 150 msec | BNR | Manufacturer Specified | ADS-B | 3 |
| 174 | ADS-B Application Information File (AIF) Transaction Header | Aperiodic | BNR | PART 6AP | ADS-B | 16, 17 of Table 6B-1 |
| 174 | AIF Packet Header | Aperiodic | BNR | PART 6AQ | ADS-B | 16, 17 of Table 6B-1 |
| 174 | Merging and Spacing (M&S) Flight ID Chars 1, 2, 3  Trans 2 Word 1 | Aperiodic | BNR | PART 6AR | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Flight ID Chars 4, 5, 6  Trans 2 Word 2 | Aperiodic | BNR | PART 6AS | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Flight ID Chars 7, 8  Trans 2 Word 3 | Aperiodic | BNR | PART 6AT | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Merge Point Latitude  Trans 2 Word 4 | Aperiodic | BNR | PART 6AU | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Merge Point Latitude/Longitude  Trans 2 Word 5 | Aperiodic | BNR | PART 6AV | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Merge Point Longitude/Final Approach Speed  Trans 2 Word 6 | Aperiodic | BNR | PART 6AW | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Merge Point ID Chars 1, 2, 3  Trans 2 Word 7 | Aperiodic | BNR | PART 6AX | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Merge Point ID Chars 4, 5, 6  Trans 2 Word 8 | Aperiodic | BNR | PART 6AY | ADS-B | 16, 17 of Table 6B-1 |
| 174 | M&S Minimum Distance and Spacing Interval  Trans 2 Word 9 | Aperiodic | BNR | PART 6AZ | ADS-B | 16, 17 of Table 6B-1 |
| 175 | ADS-B Application Information File (STX) | 1 sec | BNR | PART 6BH | ADS-B | 16, 17 of Table 6B-1 |
| 175 | ADS-B Application Information File (ETX) | 1 sec | BNR | PART 6BI | ADS-B | 16, 17 of Table 6B-1 |

Notes:

1. In some systems, the highlighting and selecting of traffic may be carried out by the display unit itself using for example a cursor control device or electronic flight bag. On these systems, this label is a command sent by the display designating what has been highlighted and selected. In this sense, it is a traffic COMMAND. See note 17 of Table 6B-1 for corresponding status label. For display systems already producing a Label 272, Label 024 has been created as an alternate to perform the same functioning. TCAS units are expected to be equipped to handle either label, but not typically both.
2. These two labels are transmitted with SDI indication (00, 01, 11, 10), so that only two label numbers need to be used for the total number of intruders (0 to 127). These labels indicate, at a given time, the intruder numbers that are displayed on the selected range.
3. This label is used to indicate what ADS-B application is running on a specific display. The formatting for this label would be difficult to specify due to the number of different display configurations on different aircraft. Therefore, this label is manufacturer-specified.

PART 6B ACAS X Traffic Computer ARINC 429 Outputs

**Table 6B-1 HIGH-SPEED ARINC 429 DATA BUS OUTPUTS**

**TO TA OR TA/RA DISPLAYS**

**TA/RA DATA BUS #1 (RMP-7C, 7D)**

**TA/RA DATA BUS #2 (RMP-7G, 7H)**

| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| 274 | Selected Sensitivity Level (same as TXWORD 2) | 300-500 msec | DISC | PART 6T | TCAS |  |
| 377 | Equipment ID | ---- | DISC | ARINC 429 | TCAS | 8 |
| 270 | Vert. Res. Adv. | 300-500 msec | DISC | PART 6E | TCAS |  |
| 271 | Horiz. Res. Adv. | 300-500 msec | DISC | PART 6F | TCAS | 5, 19 |
| 170 | Horiz. RWC Guidance Data | 300-500 msec | DISC | PART 6K-1 | ACAS Xu |  |
| 171 | Vert. RWC Guidance Data 1 | 300-500 msec | DISC | PART 6K-2 | ACAS Xu |  |
| 172 | Vert. RWC Guidance Data 2 | 300-500 msec | DISC | PART 6K-3 | ACAS Xu |  |
| 130 | Intruder Range | Max 500 msec | BNR | PART 6G | TCAS | 1 |
| 131 | Intruder Altitude | Max 500 msec | BNR | PART 6H | TCAS | 1 |
| 132 | Intruder Bearing | Max 500 msec | BNR | PART 6J | TCAS | 1 |
| 134 | Relative Altitude of the Most Threatening Traffic | 800-1200 msec | BNR | PART 6BS | TCAS | 20 |
| 203 | Own Aircraft Altitude (Uncorrected) | Max 500 msec | BNR | PART 6O | TCAS |  |
| 204 | Own Aircraft Altitude (Corrected) | Max 500 msec | BNR | PART 6Y | TCAS | 9 |
| 320 | Own Aircraft Mag Hdg | Max 500 msec | BNR | ARINC 429 | TCAS | 4 |
| 350 | Maintenance | 1200 msec Maximum | DISC | PART 6W-1 | TCAS/ADS-B |  |
| 352 | Maintenance | 1200 msec Maximum | DISC | PART 6W-2 | TCAS/ADS-B |  |
| 360 | TCAS Program Pin Status Word #1 | 1200 msec Maximum | DISC | PART 6W-3 | TCAS/ADS-B |  |
| 361 | TCAS Program Pin Status Word #2 | 1200 msec Maximum | DISC | PART 6W-4 | TCAS/ADS-B |  |
| 362 | TCAS Input Discrete Status Word #1 | 1200 msec Maximum | DISC | PART 6W-5 | TCAS/ADS-B |  |
| 363 | TCAS Input Discrete Status Word #2 | 1200 msec Maximum | DISC | PART 6W-6 | TCAS/ADS-B |  |
| 364 | TCAS Input Discrete Status Word #3 | 1200 msec Maximum | DISC | PART 6W-7 | TCAS/ADS-B |  |
| 365 | TCAS Program Pin Status Word #3 | 1200 msec Maximum | DISC | PART 6W-8 | TCAS/ADS-B |  |
| 340 | TCAS Program Pin Strobe Word #1 | 1200 msec Maximum | DISC | PART 6W-9 | TCAS/ADS-B |  |
| 341 | TCAS Program Pin Strobe Word #2 | 1200 msec Maximum | DISC | PART 6W-10 | TCAS/ADS-B |  |
| 013 | Control Panel Set | 100-200 msec | DISC | PART 6C | TCAS/ADS-B |  |
| 015 | Altitude Select Limits | 100-500 msec | DISC | PART 6V | TCAS | 6,8 |
| 016 | TCAS Mode/Sens | 100-200 msec | DISC | PART 6D | TCAS |  |
| 272 | Traffic Selection/Status Word | 50-150 msec | DISC | PART 6AJ | ADS-B | 14,15 |
| 357 | RTS/ETX | ---- | DISC | ARINC 429 | TCAS | 1,2,3 |
| 356 | STX/EOT/TEXT | 100-1000 msec | DISC | PART 6X-1  PART 6X-2  PART 6X-3  PART 6X-4 | TCAS | 11,12 |
| 110 | Own Aircraft Latitude – Coarse | 200-500 msec | BNR | PART 6Z | TCAS/ADS-B |  |
| 111 | Own Aircraft Longitude – Coarse | 200-500 msec | BNR | PART 6AA | TCAS/ADS-B |  |
| 120 | Own Aircraft Latitude – Fine | 200-500 msec | BNR | PART 6AB | TCAS/ADS-B | 13 |
| 121 | Own Aircraft Longitude – Fine | 200-500 msec | BNR | PART 6AC | TCAS/ADS-B | 13 |
| 312 | Own Aircraft Ground Speed | 50-500 msec | BNR | PART 6AD | TCAS/ADS-B | 13 |
| 313 | Own Aircraft True Track Angle | 50-500 msec | BNR | PART 6AE | TCAS/ADS-B | 13 |
| 314 | Own Aircraft True Heading | 25-500 msec | BNR | PART 6AF | TCAS/ADS-B | 13 |
| 367 | DTIF Start of File Protocol (STX) | 1 sec | Various | ATTACHMENT 15D | TCAS/ADS-B |  |
| 367 | DTIF End of File protocol (ETX) | 1 sec | Various | ATTACHMENT 15E | TCAS/ADS-B |  |
| 366 | DTIF HEADER | Aperiodic | Various | ATTACHMENT 15F | TCAS/ADS-B |  |
| 366 | DTIF PACKET HEADER | Aperiodic | Various | ATTACHMENT 15G | ADS-B |  |
| 366 | Type 0: Traffic Flight ID | Aperiodic | Various | ATTACHMENT 15H-1  ATTACHMENT 15H-2  ATTACHMENT 15H-3 | ADS-B |  |
| 366 | Type 1: Traffic Range, Altitude and Bearing) | Aperiodic | Various | ATTACHMENT 15I | TCAS/ADS-B |  |
| 366 | Type 2: Traffic Position  (Latitude and Longitude) and Relative Altitude | Aperiodic | Various | ATTACHMENT 15J | TCAS/ADS-B |  |
| 366 | Type 2: Traffic Position  (Latitude and Longitude) and Vertical Speed | Aperiodic | Various | ATTACHMENT 15K | TCAS/ADS-B |  |
| 366 | Type 3: Traffic Ground Speed, Track  Angle and Closure Rate) | Aperiodic | Various | ATTACHMENT 15L | TCAS/ADS-B |  |
| 366 | Type 4: Traffic Quality Information by Grouping) | Aperiodic | Various | ATTACHMENT 15M | ADS-B |  |
| 366 | Type 5: Intruder Information Length/Width Word) | Aperiodic | Various | ATTACHMENT 15N | ADS-B |  |
| 366 | Type 6: User Defined | User Defined | User Defined | N/A | ADS-B |  |
| 366 | Type 7: Traffic Time of Applicability (UTC) | Aperiodic | Various | ATTACHMENT 15P | ADS-B |  |
| 160 | Alerting Status | 200-1000 msec | DISC | PART 6AL | ADS-B |  |
| 162 | Generic DISC Word #1 | 200-1000 msec | DISC | PART 6AM | ADS-B |  |
| 163 | Application Availability Word | 200-1000 msec | DISC | PART 6AN | ADS-B |  |
| 164 | Application Availability Word Continued | 200-1000 msec | DISC | PART 6AO | ADS-B |  |
| 174 | ADS-B Application Information File (AIF) Transaction Header | Aperiodic | BNR | PART 6AP | ADS-B | 16, 17 |
| 174 | AIF Packet Header | Aperiodic | BNR | PART 6AQ | ADS-B | 16, 17 |
| 174 | M&S Computed Airspeed Target | Aperiodic | BNR | PART 6BA | ADS-B | 16, 17 |
| 174 | M&S Mach Target | Aperiodic | BNR | PART 6BB | ADS-B | 16, 17 |
| 174 | M&S Current Computed Airspeed | Aperiodic | BNR | PART 6BC | ADS-B | 16, 17 |
| 174 | M&S Current Mach | Aperiodic | BNR | PART 6BD | ADS-B | 16, 17 |
| 174 | M&S Spacing Distance Error | Aperiodic | BNR | PART 6BE | ADS-B | 16, 17 |
| 174 | M&S Status Message | Aperiodic | DISC | PART 6BF | ADS-B | 16, 17 |
| 174 | Differential Ground Speed | Aperiodic | BNR | PART 6BG | ADS-B | 16, 17 |
| 175 | ADS-B Application Information File (STX) | 1 sec | BNR | PART 6BH | ADS-B | 16, 17 |
| 175 | ADS-B Application Information File (ETX) | 1 sec | BNR | PART 6BI | ADS-B | 16, 17 |
| 370 | M&S Command Speed – CAS | 200 -1000 msec | BNR | PART 6BJ | ADS-B | 18 |
| 372 | M&S Command Speed – Mach | 200 -1000 msec | BNR | PART 6BK | ADS-B | 18 |
| 373 | M&S Differential GS | 200 -1000 msec | BNR | PART 6BL | ADS-B | 18 |
| 374 | M&S Distance | 200 -1000 msec | BNR | PART 6BM | ADS-B | 18 |
| 165 | Designated Intruder Mode and Status | 200 – 1000 msec | DISC | PART 6BV | ACAS Xo | 21 |

Notes:

\*Rate defined in ARINC Specification 429.

1. These words are combined together in a file and placed on one high-speed data bus.
2. The intruder data (range, altitude, and bearing) should be sent to the TA display as a file transfer. Although the traffic computer may only update the intruder files once per second, the entire file containing the list of all qualifying intruders should be sent two times per second on the average. If no data is available, RTS/ETX should be sent.
3. If the traffic computer detects a ACAS X system failure, it should stop transmitting all intruder information (words 130, 131, and 132) and only send the Label 357 RTS/ETX words (with word count = 2).

The intruder file should be constructed as follows:

|  |  |  |
| --- | --- | --- |
| **Label** | **Function** | **Sequence** |
|  |  |  |
| 357 | Request to Send (RTS) |  |
| 130 | Intruder #i Range | Highest |
| 131 | Intruder #i Altitude | ‑ TA |
| 132 | Intruder #i Bearing | Score |
|  | (relative to aircraft nose) |  |
|  | “ | “ |
|  | “ | “ |
|  | “ | “ |
| 130 | Intruder #n Range | Lowest |
| 131 | Intruder #n Altitude | ‑ TA |
| 132 | Intruder #n Bearing | Score |
| 357 | End of Transmission (ETX) |  |

1. The intruder numbers i and n represent the assigned intruder numbers as variables, and the values can range from 0 to 31, inclusive. The intruder file can contain up to 30 intruders. The same number may not be used twice in the same intruder file. Normally, the number assigned to a particular intruder will not be reassigned to a different intruder until that number has been removed from the intruder file for a period of at least one second (two transmissions of the intruder file). This allows the display to follow the position of the intruders from one intruder file to the next, and also detect when a “new” intruder has appeared, for display smoothing purposes. An exception to this rule is made only when the number of new intruders that appear in the next intruder file is greater than the number of available unused intruder numbers. The following example illustrates this situation:
2. Intruder file #1 ‑ The intruder file contains 30 intruders, numbered 2 through 31. The intruder numbers 0 and 1 are not being used.
3. Intruder file #2 ‑ Intruders 2, 3, and 4 are dropped from the Intruder Track File, but it immediately becomes necessary to track three new intruders. The new intruders would have to be assigned the numbers 0, 1, and 4. In this case, the intruder number 4 would have to be reassigned without removing it from the intruder files for the one second period.
4. The intruder file contains all data taken in the current computational cycle, in order of highest to lowest TA score. Thus, displays which are unable to display all intruders may choose which to display based on CAS logic scoring.
5. Additional information, such as trend vector data, could be added to each intruder file as needed in the future. If used, these new words would be of the same format as the labels already defined.
6. The data file should be sent in its entirety with no other labels interleaved. It should not be interrupted by other transmissions.
7. Request to Send (RTS) Word Format
8. For convenience, the format of the Request to Send (RTS) words are shown below. In all cases, ARINC Specification 429 will have precedence over this characteristic unless specifically stated.

|  |  |  |
| --- | --- | --- |
| **Bits** | **Function** | **Notes** |
| 1 to 8 | Label 357 octal |  |
| 9 to 16 | Number of words in the transfer including RTS and ETX. The range is from 1 to 255. |  |
| 17 to 18 | Pad bits set to zero |  |
| 19 | 0 = Display All Traffic Only if a TA or RA is active.  1 = Display All Traffic | a |
| 20 to 24 | Display Limit - Number of intruders to display. Range is from 1 to 30, where 31 (all open) is no limit. (Bit 20 is LSB, corresponding to RBP-8K, and bit 24 is MSB, corresponding to RBP-8F). | b |
| 25 to 31 | ISO #5 Character DC2 (1/2) |  |
| 32 | Odd Parity |  |

This bit reflects the state of the Display All Traffic/Threat Traffic Program pin described in Section 3.6.6.

Note 25 of Attachment 3B defines the logic of the input discrete which determine the state of bits 20 through 24.

1. END OF TRANSMISSION (ETX) WORD FORMAT
2. For convenience, the format of the End of Text (ETX) words are shown below. In all cases, ARINC Specification 429 will have precedence over this characteristic unless specifically stated.

|  |  |  |
| --- | --- | --- |
| **Bits** | **Function** | **Notes** |
| 1 to 8 | Label 357 octal |  |
| 9 to 16 | Number of words in the transfer including RTS and ETX. The range is from 1 to 255. |  |
| 17 to 18 | Pad bits set to zero |  |
| 19 | Reserved for Interference Limiting Status | a |
| 20 to 24 | Pad bits set to zero |  |
| 25 to 31 | ISO #5 Character ETX (0/3) |  |
| 32 | Odd Parity |  |
|  |  |  |

This bit is reserved for an Interference Limiting status bit. A user defined program pin may be used to activate this feature, otherwise the bit is set to zero.

1. The output of magnetic heading is intended for display stabilization. Its use is optional (since a heading input is not always available to the ACAS X traffic computer). If used, the output should not be considered as a source for heading.
2. The data word should be generated from an ARINC 429 or syncro input source. The word should be transmitted with its SSM field set to NCD if the input source is absent, or if the status of the input data is NCD or FAIL. The SSM field should be set to FAIL if the TCAS unit itself has failed. Units not designed to implement Mag Heading need not output this label at all.
3. This data word defines the Horizontal RA Data for ACAS Xu.
4. The traffic computer should continually broadcast this word.
5. All traffic computer output words that originate in the traffic computer should have SDI bits (bits 9 and 10) set to 00. The SDI of words that are passed to the ACAS X display through the traffic computer should not be altered.
6. The SSM field of this word should always be set to Normal operation unless the traffic computer itself has failed; it should then be set to Failure Warning.
7. The transmission of this label is optional.
8. The average rate of transmission is defined as two times per second. There may be variations of the rate to accommodate the output of two back-to-back reports. The actual rate is influenced by the size of the Intruder file, etc.
9. General Text should be sent to the display when bit 17 of Label 356 data words is set to 0. The structure of the General Text file transmission is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Label | Field | Content | Part |
| 356 | STX | Word Count | PART 6X-1 |
| 356 | CNTL | Optional | PART 6X-2 |
| 356 | DATA | Text | PART 6X-3 |
| 356 | DATA | Text | PART 6X-3 |
| 356 | CNTL | Optional | PART 6X-2 |
| 356 | DATA | Text | PART 6X-3 |
|  | “ | “ | PART 6X-3 |
|  | “ | “ | PART 6X-3 |
| 356 | DATA | Text | PART 6X-3 |
| 356 | CNTL | Optional | PART 6X-2 |
| 356 | DATA | ISO-5 Carriage Rtn | PART 6X-3 |
| 356 | EOT | End of Transmission | PART 6X-4 |

1. These words are combined together in a file and placed on the high-speed data bus for general text display data. This data should be transmitted only in the Extended Test mode (see Section 4.1) and while the aircraft is on the ground. The general text file should be sent in its entirety with no other labels interleaved.
2. Bit 17 of the STX word is used to determine whether the information contained in this transmission is General Text or the Software Part Number.
3. Carriage Returns can be inserted anywhere after the STX word. Once the display receives this command, the display will advance to the beginning of the next line, where additional text can be written. The last Data word should contain an ISO-5 Carriage Return.
4. Software Part Number file is sent to the display and the software data loader (RMP-9A, 9B) by setting bit 17 of a Label 356 data word is set to 1 and bits 18 through 24 are set to 0. The structure of the Software Part Number file transmission is as follows:

|  |  |  |
| --- | --- | --- |
| **Label** | **Function** | **Reference** |
| 356 | Start of Transmission (STX) | PART 6X-1 |
| 356 | Data Word #1 | PART 6X-3 |
| 356 | Data Word #2 | PART 6X-3 |
| 356 | Data Word #3 | PART 6X-3 |
| 356 | Data Word #4 | PART 6X-3 |
| 356 | Data Word #5 | PART 6X-3 |
| 356 | End of Transmission (EOT) | PART 6X-1 |

1. The software text data should be sent to the RA/TA or TA display as a file transfer. The entire file containing the list of all text data should be sent at a rate of 0.1 to 1.0 seconds. The construction of the file will provide for as many as 15 characters in the software part number. The software part number file should only be transmitted when the Software P/N Discrete input is enabled. The word count should always be equal to seven and no control word should be included in the software part number file. The software part number may also be transmitted during an extended test sequence.
2. If the input data to the TCAS processor is absent, the data word should not be transmitted from the TCAS processor to the Display. If the input data to the TCAS processor is NCD OR FAIL, the data word should be transmitted (from the TCAS processor to the Display) with its SSM field set to No Computed Data (NCD).
3. The transmission of Own Aircraft Latitude, Own Aircraft Longitude, and Own Aircraft True Heading are intended for traffic orientation when absolute data is used by the display. The transmission of Own Aircraft Ground Speed is used by the display to calculate traffic closure rate.
4. Label 272 is sent at 100ms with SDI set to (0,1) and SDI set to (1,0) sent from the traffic computer on each TA/RA output bus.
5. In some systems, the highlighting and selecting of traffic is carried out by a means outside of the display unit, using for example selector knob or MCDU selection. For these systems, this output to the display unit is the traffic computer command over what traffic should be highlighted or selected. In this sense, it is a traffic SELECTION. In alternate systems, the highlighting and selecting of traffic may be carried out by the display unit itself using for example a cursor control device or electronic flight bag. On these systems, this label is merely a confirmation sent by the traffic computer over what has already been highlighted and selected through the display control of this feature. In this sense, it is a traffic STATUS.
6. With the introduction of many possible ADS-B applications in use by a single TCAS system, a variable length file structure is introduced. This file structure is analogous to the DTIF file structure. However, where the DTIF file structure is built based on one data set per Traffic Member, the ADS-B Application Information File (AIF) is built based on one data set per transaction type. A given application may have several different transactions possible. Of the several different transactions, the data rate may be slower than 1 Hz and therefore a given AIF may contain data that is updated aperiodically. Transaction types are listed in note 19.
7. STX, ETX, and AIF Transaction Header are transmitted at a 1 Hz rate regardless of which, if any, applications are currently active. When a given application becomes active, the TCAS will nominally begin transmitting and receiving the corresponding application information.
8. The number of words in a data type is communicated.
9. The AIF is designed to allow data transfer in two separate directions: the TCAS writing to the Display and also the Display writing to the TCAS.

ADS-B Application Information File (AIF)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Label 175 (AIF STX)** | | | | | | |
|  | Label 174 (AIF Transaction Header) | | | | |  |
|  |  | Label 174 (AIF Transaction Packet Header X) | | |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. X Word 1) |  |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. X Word 2) |  |  |  |
|  |  |  | :  : |  |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. X Word N) |  |  |  |
|  |  | :  : | | |  |  |
|  |  | Label 174 (AIF Transaction Packet Header Y) | | |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. Y Word 1) |  |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. Y Word 2) |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  | Label 174 (AIF Data Word – Trans. Y Word N) |  |  |  |
|  |  |  | | |  |  |
|  |  | | | | |  |
| Label 175 (AIF ETX) | | | | | | |

1. The table below identifies the currently defined transaction types for the AIF (Application Information File). The number of labels per transaction type are identified. The definition of ARINC 429 Label 174 for each of these transaction types is in the referenced attachments as identified in Table 6A-13 and Table 6B-1.

|  |  |  |
| --- | --- | --- |
| **Description** | **Transaction ID** | **Number of Labels (20)** |
| Reserved | 1 |  |
| Entered M&S Data, Display to TCAS | 2 | 10 |
| Reserved | 3 |  |
| M&S Command Data, TCAS to Display | 4 | 7 |
| Differential Groundspeed, TCAS to Display | 5 | 2 |
| Reserved | 6 |  |
| Reserved | 7 |  |
| Reserved | 8 |  |
| Reserved | 9 |  |
| Reserved | 10 |  |
| Reserved | 11 |  |

1. This set of labels were created to allow independent display of speed and distance data for the Merging and Spacing application on a custom device known as an AGD or ADS-B Guidance Display. This data can also be used for other display types.
2. The output of this data word is only required for ACAS Xu.
3. The purpose of this label is to allow easier access to most threatening relative altitude by systems not fitted with TIF/DTIF format decoding capabilities. Possible uses of this label are:

DFDR recording

Identification of another aircraft at, or approaching an adjacent altitude or flight level while climbing or descending to an assigned altitude or flight level. This will allow vertical speed reduction when approaching an assigned altitude or flight level in compliance with Section 3.3 recommendation of ICAO Procedures for Air Navigation Services – Aircraft Operations (PANS OPS) 8168-OPS/611.

1. This label indicates the mode and status for the ACAS Xo designated intruder. Since only one intruder is allowed to be designated at a time only one label is needed.

**Table 6B-2 HIGH-SPEED ARINC 429 DATA BUS OUTPUTS** **TO MODE S TRANSPONDERS**

**TX COORD BUS #1 (RMP-15J, 15K)**

**TX COORD BUS #2 (RMP-14A, 14B)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** | **Notes** |
| 270 | TXWORD1 (MB/MV FIELD DATA) |  |  | ATTACHMENT 14A-F | ACAS X | 1, 3 |
| 274 | TXWORD2 (VI, SL, RI, CCCB, DAA, RWC Active]) | 100-200 msec | DISC | PART 6T | ACAS X |  |
| 275 | TXWORD3 (ACK/NAK) |  | DISC | PART 6U | ACAS X | 2 |
| 305 | Block Transfer Configuration Data |  | DISC | PART 6BR | ADS-B |  |

Notes:

1. Sent on a demand basis following any transmission already in progress.
2. Acknowledgement word is sent for each non-periodic type word.
3. This data is transferred using the TGD protocol   
   (ATTACHMENT 14A).

**Table 6B-3 LOW-SPEED ARINC 429 DATA BUS OUTPUT**

**TO MAINTENANCE COMPUTERS (CFDS)**

**CFDS OUTPUT DATA BUS (RBP 6E, 6F)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Label | Parameter | Rate  Min-Max | Format | Cross Reference | Use | Notes |
| 350 | Maintenance | 1200 msec Maximum | DISC | PART 6W-1 | TCAS/ADS-B |  |
| 352 | Maintenance | 1200 msec Maximum | DISC | PART 6W-2 | TCAS/ADS-B |  |
| 360 | TCAS Program Pin Status Word # 1 | 1200 msec Maximum | DISC | PART 6W-3 | TCAS/ADS-B |  |
| 361 | TCAS Program Pin Status Word # 2 | 1200 msec Maximum | DISC | PART 6W-4 | TCAS/ADS-B |  |
| 362 | TCAS Input Discrete Status Word # 1 | 1200 msec Maximum | DISC | PART 6W-5 | TCAS/ADS-B |  |
| 363 | TCAS Input Discrete Status Word # 2 | 1200 msec Maximum | DISC | PART 6W-6 | TCAS/ADS-B |  |
| 364 | TCAS Input Discrete Status Word # 3 | 1200 msec Maximum | DISC | PART 6W-7 | TCAS/ADS-B |  |
| 365 | TCAS Program Pin Status Word # 3 | 1200 msec Maximum | DISC | PART 6W-8 | TCAS/ADS-B |  |
| 340 | TCAS program Pin Strobe Word # 1 | 1200 msec Maximum | DISC | PART 6W-9 | TCAS/ADS-B |  |
| 341 | TCAS program Pin Strobe Word # 2 | 1200 msec Maximum | DISC | PART 6W-10 | TCAS/ADS-B |  |

**Table 6B-4 LOW-SPEED ARINC 429 DATA BUS OUTPUTS**

**TO MCDU**

**RMP-9G, 9H**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Label** | **Parameter** | **Rate Min-Max** | **Format** | **Cross Reference** | **Use** |
| 172 | Subsystem Identifier | Max 1000 msec | per ARINC 739A-1 | ARINC 429 | ADS-B |
| 220 | MCDU 1 Words | Aperiodic | per ARINC 739A-1 | ARINC 429 | ADS-B |
| 221 | MCDU 2 Words | Aperiodic | per ARINC 739A-1 | ARINC 429 | ADS-B |

**Table 6B-5 HIGH-SPEED ARINC 429 DATA BUS OUTPUT**

**TO SOFTWARE DATA LOADER**

**SOFTWARE DATA LOADER OUTPUT BUS (RMP-9A, 9B)**

The content of these buses is described in ARINC Report 615 and in note 12 of Table 6A-2 of Attachment A.

PART 6C

**ARINC 429 CONTROL WORD – TRANSPONDER TO TCAS, TCAS TO DISPLAY**

**TCAS Display Control**

**LABEL 013**

Note that the below label may be constructed by either a control panel algorithm or may require the TCAS unit to modify particular labels. If a modification is needed for a given installation, the modification technique is described in the notes following this label definition. Regardless of which system constructs the label, the end result should be per the definition shown here.

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 0 0

2 Label 1st Digit 0

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 3 0

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI [1]

10 SDI [1]

11 Intruder Altitude 0 = Relative [5]

12 Altitude Select [2]

13 Altitude Select

14 All Traffic/Threat Traffic 0 = Display All Traffic [4]

1 = Display All Traffic only if TA or RA is active

15 DTIF Transmit 0 = Not Transmitted

1 = Transmitted [6]

16 ADS-B Control Select LSB [7]

17ADS-B Control Select MSB [6] [7]

18 Reserved for Military Use

19 Reserved for Military Use

20 Reserved for Military Use

21 128 [8]

22 0.5

23 1.0

24 Selected 2.0

25 TCAS 4.0

26 Range 8.0

27 nautical miles (nmi) 16.0

28 32.0

29 64.0

30 SSM [3]

31 SSM

32 Parity (Odd)

1. Notes:
2. SDI

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **10** | **9** |
| 0 | 0 | Both (TA/RA Bus #1 and #2) |
| 0 | 1 | Left (TA/RA Bus #1) |
| 1 | 0 | Right (TA/RA Bus #2) |
| 1 | 1 | Not Used |

SDI bits are set by the Mode S transponder control panel and indicate the intended destination. When both Label 013 having SDI = 01 and Label 013 having SDI = 10 are provided by the transponder control panel, the Mode S transponder should be capable of sending each of the two words to the traffic computer. Each word should be transmitted to the traffic computer at the designated rate and each word should be mutually exclusive of the other. Otherwise, as a minimum, the Mode S transponder should transmit the Label 013 to the traffic computer exactly as the word was received from the control panel.

The traffic computer should transmit only the appropriate Label 013 (as defined by the SDI) on the appropriate TC output bus. The SDI could be changed by the traffic computer based on the ADS-B settings from each pilot using the control panel (independent selection on bus #1 and #2).

1. Altitude Select

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **13** | **12** |
| 0 | 0 | Normal –A to +A |
| 0 | 1 | Above –A to +B |
| 1 | 0 | Below –B to +A |
| 1 | 1 | Unrestricted |

The magnitudes of A and B are defined in Label 015 (Attachment 6 PART 6V).

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal |
| 0 | 1 | No Computed Data |
| 0 | 1 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM field of this word should always be set to Normal Operation unless the traffic computer itself has failed; it should then be set to Failure Warning.

1. See Section 3.6.6 for a description of the All Traffic/Threat Traffic function. Bit 14 reflects the state of an optional control panel switch. This bit can be used by the TCAS display in conjunction with Bit 19 of RTS word 357 (refer to Note 2, Table 6B-1) to provide an All/Threat Traffic function. The following truth table demonstrates the relationship of the two data words.

|  |  |  |
| --- | --- | --- |
| **LABEL**  **357**  **BIT 19** | **LABEL**  **013**  **BIT 14** | **MEANING** |
| 0 | 0 | All Traffic only if TA or RA is present. |
| 0 | 1 | All Traffic only if TA or RA is present. |
| 1 | 0 | All Traffic |
| 1 | 1 | All Traffic only if TA or RA is present. |

1. The Displays should compute and display absolute intruder altitude based on own aircraft altitude (Label 203) and intruder relative altitude (Label 131) when this bit is set to 1. The Displays should display relative intruder altitude (Label 131) when this bit is set to 0.

Note: Label 204 contains own aircraft corrected barometric altitude. It is reserved for optional transmission by traffic computer. If this label is received by the displays, Label 204 can be used in lieu of Label 203 when computing absolute intruder altitude.

1. The TCAS output of bit 15 is set based on the RMP-5E setting and the Transponder input bit 15 from Label 013, using the following logic.

0 = OFF indicating not to transmit the Display Traffic Information File

1 = ON, if the transponder input bit 15 is set to 1 OR RMP 5E is Strapped (indicating the DTIF is enabled). This setting indicates that the system will transmit the Display Traffic Information File.

The complete system effect of both bit 15 and bit 17 is seen in Table 20B-1 in ATTACHMENT 15B.

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **17** | **16** |
| 0 | 0 | Flt ID OFF – ADS-B ON |
| 0 | 1 | Flt ID ON – ADS-B ON |
| 1 | 0 | Flt ID OFF – ADS-B OFF |
| 1 | 1 | Not Used |

The setting of bit 17 is per above table shown in Table 20B-1 in ATTACHMENT 15B.

1. The 128 nautical miles (nmi) bit was added in ARINC Characteristic 735A to provide growth for system enhancement. System integrators and installers are cautioned that if a Mode S transponder control panel capable of setting the 128 nmi bit for Selected TCAS Range is used, the traffic displays used in the installation must be capable of correctly decoding combinations of selected range that includes the 128 nmi bit. For example, if 150 nmi range is selected on the control panel, a display not capable of decoding the 128 nmi bit would decode a selected range of 22 nmi which most likely would not be a valid setting.

PART 6D

**ARINC 429 CONTROL WORD – TRANSPONDER TO TCAS, TCAS TO DISPLAY**

**Mode S Control Panel Data**

**LABEL 016**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 0 0

2 Label 1st Digit 0

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI [1]

10 SDI

11 Alt Reporting 0 = ON

1 = OFF

12 SPI 0 = Ident OFF

1 = Ident ON

13 Display

14 Control [5]

15 Sensitivity

16 Level [2]

17 Control

18 D1

19 D2

20 D4

21 C1

22 C2 4096

23 C4 Ident [4]

24 B1 Code

25 B2

26 B4

27 A1

28 A2

29 A4

30 SSM [3]

31 SSM

32 Parity (Odd)

Notes:

1. SDI

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **10** | **9** |
| 0 | 0 | Both (TA/RA Bus #1 and #2) |
| 0 | 1 | Left (TA/RA Bus #1) |
| 1 | 0 | Right (TA/RA Bus #2) |
| 1 | 1 | Not Used |

SDI bits are set by the Mode S transponder control panel and indicate the intended destination. When both an 016 word having SDI = 01 and an 016 word having SDI = 10 are provided by the transponder control panel, the Mode S transponder should be capable of sending each of the two words to the TCAS computer. Each word should be transmitted to the TCAS computer at the designated rate and each word should be mutually exclusive of the other. Otherwise, as a minimum, the Mode S transponder should transmit the 016 word to the TCAS computer exactly as the word was received from the control panel.

The TCAS computer should transmit only the appropriate octal Label 016 (as defined by the SDI) on the appropriate TCAS output bus.

1. Manual Sensitivity Level Control

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **17** | **16** | **15** |
| 0 | 0 | 0 | SL = 0 (AUTOMATIC) |
| 0 | 0 | 1 | SL = 1 (STBY) |
| 0 | 1 | 0 | SL = 2 (TA/Surveillance ONLY) |
| 0 | 1 | 1 | SL = 3 |
| 1 | 0 | 0 | SL = 4 |
| 1 | 0 | 1 | SL = 5 |
| 1 | 1 | 0 | SL = 6 |
| 1 | 1 | 1 | SL = 7 |

These bits indicate the sensitivity level that is manually selected on the Mode S Control Panel. The SL and RI fields of octal Label 274 defined in Attachment 6 PART 6T indicate the actual TCAS computer mode of operation.

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal |
| 0 | 1 | No Computer Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM should always be 00 unless the TEST button is pressed. A functional test should be initiated when bit 30 is 0 and bit 31 is 1.

1. See ATTACHMENT 5 for Mode A reply codes.
2. Display Control

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **14** | **13** |
| 0 | 0 | Primary and Traffic Display |
| 0 | 1 | Primary Display Functions Only (no TCAS data) |
| 1 | 0 | TCAS Traffic Display Only |
| 1 | 1 | No Control Function Possible |

Primary display functions are those functions for which a display may have need designed when that display is also being used in a shared manner as Traffic Advisory display.

1. The transfer time should not exceed 200 milliseconds.

COMMENTARY

The delay from the time a command is activated at the control panel to the time of the equipment response should be minimized.

PART 6E

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS Vertical Resolution Advisory RA Data Output Word**

**LABEL 270**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit MSB 2 1

2 Label 1st Digit 0

3 Label 2nd Digit MSB 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit MSB 0 0

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 SDI BIT 0

10 SDI BIT 1

11 Advisory 100 ft/min [9]

12 Rate to 200 ft/min

13 Maintain 400 ft/min

14 Binary 800 ft/min

15 Two’s 1600 ft/min

16 Complement 3200 ft/min

17 Sign

18 Combined Control

19 Combined Control [1]

20 Combined Control

21 Vertical Control

22 Vertical Control [2]

23 Vertical Control

24 Up Advisory

25 Up Advisory [3] [8]

26 Up Advisory

27 Down Advisory

28 Down Advisory [4] [8]

29 Down Advisory

30 SSM

31 SSM [5] [6] [7]

32 Parity (Odd)

Notes:

1. Combined Control

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **20** | **19** | **18** |
| 0 | 0 | 0 | No Advisory (ACAS) |
| 0 | 0 | 1 | Clear of Conflict (ACAS Xa)  Vertical RA Clear (ACAS Xu) |
| 0 | 1 | 0 | Spare |
| 0 | 1 | 1 | Spare |
| 1 | 0 | 0 | Up Sense Advisory Green Arc |
| 1 | 0 | 1 | Down Sense Advisory Green Arc |
| 1 | 1 | 0 | Monitor Vertical Speed Advisory (ACAS Xa) Preventative Alert (ACAS Xu) |
| 1 | 1 | 1 | Not Used |

1. Vertical Control

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **23** | **22** | **21** |
| 0 | 0 | 0 | Advisory is not one of the following types: |
| 0 | 0 | 1 | Altitude Crossing RA |
| 0 | 1 | 0 | RA Reversal |
| 0 | 1 | 1 | Increase Rate RA |
| 1 | 0 | 0 | Maintain Rate RA |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. Up Advisory

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **26** | **25** | **24** |
| 0 | 0 | 0 | No Up Sense RA |
| 0 | 0 | 1 | Climb RA |
| 0 | 1 | 0 | Do Not Descend RA |
| 0 | 1 | 1 | Not Used |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. Down Advisory

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **29** | **28** | **27** |
| 0 | 0 | 0 | No Down Sense RA |
| 0 | 0 | 1 | Descend RA |
| 0 | 1 | 0 | Do Not Climb RA |
| 0 | 1 | 1 | Not Used |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. Sign Status Matrix (SSM)(DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. The presence of a No Computed Data report in the SSM field indicates that the information in bits 11 through 29 is unreliable. Therefore, no RA should be issued by the Display.
2. The TCAS computer should also set the SSM of this word to NCD when it is in STBY or TA Only mode (as reflected in the SL and RI fields of TX Word 2, Label 274). Failure Warning should be reported in the SSM field only if the TCAS computer itself has failed. The presence of a Functional Test report in the SSM field of this word indicates that a TCAS Functional Test sequence should be performed by the displays. Refer to Section 4.2.
3. Whenever Climb (Bits 24-26 = 1,0,0) or Descend (Bits 27-29 = 1,0,0) are set in Word 270, the TCAS computer sets the Advisory Rate Field (Bits 11-17) to the desired Climb/Descend value.
4. If no RA is present, bits 11-17 should be set to zero.

PART 6F

**ARINC 429 CONTROL WORD – ACAS Xu TO DISPLAY**

**TCAS Horizontal RA Data Output Word**

**LABEL 271**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit MSB 2 1

2 Label 1st Digit 0

3 Label 2nd Digit MSB 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit MSB 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 SDI BIT 0

10 SDI BIT 1

11 Target Track Angle bit 1 [1]

12 Target Track Angle bit 2

13 Target Track Angle bit 3

14 Target Track Angle bit 4

15 Target Track Angle bit 5

16 Target Track Angle bit 6

17

18 Combined Control

19 Combined Control [2]

20 Combined Control

21

22

23

24

25

26

27

28

29

30 SSM

31 SSM [3] [4] [5]

32 Parity (Odd)

Notes:

1. Target Track Angle

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **BITS** | | | | | | **MEANING** |
| **16** | **15** | **14** | **13** | **12** | **11** |
| 0 | 0 | 0 | 0 | 0 | 0 | Value = 0, Track Angle = 360/000 degrees |
| 0 | 0 | 0 | 0 | 0 | 1 | Value = 1, Track Angle = 10 degrees (value X 10) |
| 0 | 0 | 0 | 0 | 1 | 0 | Value = 2, Track Angle = 20 degrees (value X 10) |
| 0 | 0 | 0 | 0 | 1 | 1 | Value = 3, Track Angle = 30 degrees (value X 10) |
| . | . | . | . | . | . | For Values 4-34, Track Angle = Value X 10 |
| 1 | 0 | 0 | 0 | 1 | 1 | Value = 35, Track Angle = 350 degrees (value X 10) |
| . | . | . | . | . | . | Values 36 – 62 are not used |
| 1 | 1 | 1 | 1 | 1 | 1 | Value = 63, No Target Track Angle/Horizontal RA Clear |

1. Combined Control

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **20** | **19** | **18** |
| 0 | 0 | 0 | No Advisory |
| 0 | 0 | 1 | Horizontal RA Clear |
| 0 | 1 | 0 | Turn Right |
| 0 | 1 | 1 | Turn Left |
| 1 | 0 | 0 | Not Assigned |
| 1 | 0 | 1 | Not Assigned |
| 1 | 1 | 0 | Not Assigned |
| 1 | 1 | 1 | Not Assigned |

1. Sign Status Matrix (SSM)(DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. The presence of a No Computed Data report in the SSM field indicates that the information in bits 11 through 29 is unreliable. Therefore, no RA should be issued by the Display.
2. The ACAS X computer should also set the SSM of this word to NCD when it is in STBY or TA/Surveillance Only mode (as reflected in the SL and RI fields of TX Word 2, Label 274). Failure Warning should be reported in the SSM field only if the ACAS X computer itself has failed. The presence of a Functional Test report in the SSM field of this word indicates that a ACAS X Functional Test sequence should be performed by the displays. Refer to Section 4.2.

PART 6G

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS TRAFFIC ADVISORY, INTRUDER RANGE WORD**

**LABEL 130**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 3 0

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 0 0

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 SDI BIT 0

10 SDI BIT 1

11 Intruder Number 1 LSB Maximum number of intruders is 31

12 Intruder Number 2

13 Intruder Number 4

14 Intruder Number 8

15 Intruder Number 16 MSB

16 Intruder Sens. Level LSB

17 Intruder Sens. Level [1]

18 Intruder Sens. Level MSB

19 Intruder Range 1/16 NM LSB

20 Intruder Range 1/8

21 Intruder Range 1/4 [3]

22 Intruder Range 1/2

23 Intruder Range 1 Maximum

24 Intruder Range 2 Range

25 Intruder Range 4 is

26 Intruder Range 8 127‑15/16

27 Intruder Range 16 Nautical

28 Intruder Range 32 Miles

29 Intruder Range 64 MSB

30 SSM [2] [4]

31 SSM

32 Parity (Odd)

Notes:

1. Intruder Sensitivity Level Status

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **18** | **17** | **16** |
| 0 | 0 | 0 | Not Reported |
| 0 | 0 | 1 | SL = 1 |
| 0 | 1 | 0 | SL = 2 |
| 0 | 1 | 1 | SL = 3 |
| 1 | 0 | 0 | SL = 4 |
| 1 | 0 | 1 | SL = 5 |
| 1 | 1 | 0 | SL = 6 |
| 1 | 1 | 1 | SL = 7 |

1. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. The TCAS computer should compute and transmit horizontal range to the displays when intruder altitude information is available   
   (Label 131 = Valid), and should transmit slant range when intruder altitude information is not available (Label 131 = NCD).
2. The TCAS computer should never set the SSM field of this word to NCD. Failure Warning should be reported in the SSM field only if the TCAS computer itself has failed. Refer also to Note 1 of Table 6A – 2.

PART 6H

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS TRAFFIC ADVISORY, INTRUDER ALTITUDE WORD**

**LABEL 131**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 3 0

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 SDI BIT 0

10 SDI BIT 1

11 Intruder Number LSB 1 Maximum

12 Intruder Number 2 Number of

13 Intruder Number 4 Intruders

14 Intruder Number 8 is 31

15 Intruder Number MSB 16

16 Future Spare

17 Future Spare

18 Future Spare

19 Future Spare

20 Intruder Vert. Sense [1]

21 Intruder Vert. Sense

22 Relative Altitude 100

23 Relative Altitude 200 Binary,

24 Relative Altitude 400 Two’s

25 Relative Altitude 800 Complement

26 Relative Altitude 1600 Range =

27 Relative Altitude 3200 ± 12,700 ft.

28 Relative Altitude 6400

29 Relative Altitude Sign

30 SSM [2] [3] [4]

31 SSM

32 Parity (Odd)

Notes:

1. Sense of Intruders Vertical Rate

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **21** | **20** |
| 0 | 0 | No Vertical Rate (Level Flight) |
| 0 | 1 | Climbing |
| 1 | 0 | Descending |
| 1 | 1 | No Data |

1. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. Failure Warning should be reported in the SSM field only if the TCAS computer itself has failed. Refer also to Note 1 of Table 6A-2.
2. The No Computed Data report of the SSM field applies to relative altitude (bits 22-29) only.

PART 6J

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS TRAFFIC ADVISORY, INTRUDER BEARING ESTIMATE WORD**

**LABEL 132**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 3 0

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI BIT 0

10 SDI BIT 1

11 Intruder Number LSB 1 Maximum

12 Intruder Number 2 Number of

13 Intruder Number 4 Intruders

14 Intruder Number 8 is 31.

15 Intruder Number MSB 16

16 Display Matrix

17 Display Matrix [1]

18 Display Matrix

19 Bearing 0.17578125 LSB

20 Bearing 0.3515625

21 Bearing 0.703125 Signed Two’s

22 Bearing 1.40625 Complement

23 Bearing 2.8125 (Degrees)

24 Bearing 5.625

25 Bearing 11.25

26 Bearing 22.5

27 Bearing 45

28 Bearing 90 MSB

29 Bearing Sign [5]

30 SSM [2] [3] [4]

31 SSM

32 Parity (Odd)

Notes:

1. Display Matrix

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **18** | **17** | **16** |
| 0 | 0 | 0 | No Threat |
| 0 | 0 | 1 | Traffic Advisory |
| 0 | 1 | 0 | Resolution Advisory |
| 0 | 1 | 1 | Proximate Advisory |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | ADS-B Only Traffic Advisory\* |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. \* The "ADS-B Only Traffic Advisory" setting is only used if the "ADS-B Only TA Only" function is enabled (RBP 4C is grounded) and there is a possibility that the display is not using the DTIF output.  DO-385 specifies that the pilot must be informed if an TA cannot progress to an RA.  How the pilot is informed is not specified.
2. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. Failure Warning should be reported in the SSM field only if the TCAS computer itself has failed. Refer also to Note 1 of Table 6A‑2.
2. The No Computed Data report in the SSM field applies to bearing information (bits 19-29) only.
3. Intruder Bearing Sign

|  |  |
| --- | --- |
| **BIT 29** | **MEANING** |
| 0 | Positive |
| 1 | Negative |

Per ARINC 429, the angular range 0 through 359.XXX degrees is encoded as 0 through ±179.XXX degrees, with the value of the most significant bit being one half of a semicircle (90°). Angles between 180° to 360° will be determined by taking the two’s complement of the fractional binary series for the result of subtracting each value from 360. Thus, the code for 181° is the two’s complement of the code for 179°. Throughout the negative semicircle, which includes 180°, the sign bit contains the negative sign.

The following examples illustrate the encoding of angles. As the examples show, angles can be considered to be signed two’s complement values over the range of (-180,180) or they can be considered to be unsigned values over the range (0, 360). Both paradigms result in the same encoding. For instance, Example 2 shows that the encoding for -84.375 degrees using the two’s complement paradigm is identical to the encoding of 275.625 degrees using the full circle paradigm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BIT | | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| **Weighting – two’s complement paradigm** | | **Sign** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
| **Weighting – 0-360 full circle paradigm** | | **180** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Example 1 | 95.625 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 2 | -84.375 (275.625) | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 3 | -95.625 (264.375) | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

PART 6K-1

**ARINC 429 CONTROL WORD – ACAS Xu TO DISPLAY**

**ACAS Xu Horizontal RWC Guidance Data Output Word**

**LABEL 170**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit MSB 1 0

2 Label 1st Digit 1

3 Label 2nd Digit MSB 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit MSB 0 0

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 SDI BIT 0

10 SDI BIT 1

11 Horizontal RWC Guidance bit 1 [1]

12 bit 2

13 bit 3

14 bit 4

15 bit 5

16 bit 6

17 bit 7

18 bit 8

19 bit 9

20 bit 10

21 bit 11

22 bit 12

23 Horizontal RWC Guidance bit 13

24

25

26

27

28

29

30 SSM

31 SSM [2] [3] [4]

32 Parity (Odd)

Notes:

1. Horizontal RWC Guidance Data

|  |  |  |
| --- | --- | --- |
| **Label 170Bit** | **Horizontal RWC Bit** | **Band Min/Max** |
| 11 | 1 | -97.5-82.5 |
| 12 | 2 | -82.5/-67.5 |
| 13 | 3 | -67.5/-52.5 |
| 14 | 4 | -52.5/-37.5 |
| 15 | 5 | -37.5/-22.5 |
| 16 | 6 | -22.5/-7.5 |
| 17 | 7 | -7.5/7.5 |
| 18 | 8 | 7.5/22.5 |
| 19 | 9 | 22.5/37.5 |
| 20 | 10 | 37.5/52.5 |
| 21 | 11 | 52.5/67.5 |
| 22 | 12 | 67.5/82.5 |
| 23 | 13 | 82.5/97.5 |

1. Sign Status Matrix (SSM)(DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. The presence of a No Computed Data report in the SSM field indicates that the information in bits 11 through 29 is unreliable. Therefore, no RWC guidance should be displayed by the Display.
2. The ACAS X computer should also set the SSM of this word to NCD when it is in STBY or TA/Surveillance Only mode (as reflected in the SL and RI fields of TX Word 2, Label 274). Failure Warning should be reported in the SSM field only if the ACAS X computer itself has failed. The presence of a Functional Test report in the SSM field of this word indicates that a ACAS X Functional Test sequence should be performed by the displays. Refer to Section 4.2.

PART 6K-2

**ARINC 429 CONTROL WORD – ACAS Xu TO DISPLAY**

**ACAS Xu Vertical RWC Guidance Data Output Word 1**

**LABEL 171**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit MSB 1 0

2 Label 1st Digit 1

3 Label 2nd Digit MSB 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit MSB 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 SDI BIT 0

10 SDI BIT 1

11 Vertical RWC Guidance bit 1 [1]

12 bit 2

13 bit 3

14 bit 4

15 bit 5

16 bit 6

17 bit 7

18 bit 8

19 bit 9

20 bit 10

21 bit 11

22 bit 12

23 bit 13

24 bit 14

25 bit 15

26 bit 16

27 bit 17

28 bit 18

29 Vertical RWC Guidance bit 19

30 SSM

31 SSM [2] [3] [4]

32 Parity (Odd)

Notes:

* 1. Vertical RWC Band Region Limits

|  |  |  |
| --- | --- | --- |
| **Label 171 Bit** | **Vertical RWC Bit** | **Band Max/Min** |
| 11 | 1 | 2900/3100 |
| 12 | 2 | 2700/2900 |
| 13 | 3 | 2500/2700 |
| 14 | 4 | 2300/2500 |
| 15 | 5 | 2100/2300 |
| 16 | 6 | 1900/2100 |
| 17 | 7 | 1700/1900 |
| 18 | 8 | 1500/1700 |
| 19 | 9 | 1300/1500 |
| 20 | 10 | 1100/1300 |
| 21 | 11 | 900/1100 |
| 22 | 12 | 700/900 |
| 23 | 13 | 500/700 |
| 24 | 14 | 300/500 |
| 25 | 15 | 100/300 |
| 26 | 16 | -100/100 |
| 27 | 17 | -300/-100 |
| 28 | 18 | -500/-300 |
| 29 | 19 | -700/-500 |

* 1. Sign Status Matrix (SSM)(DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. 1. The presence of a No Computed Data report in the SSM field indicates that the information in bits 11 through 29 is unreliable. Therefore, no RWC guidance should be displayed by the Display.
   2. The ACAS X computer should also set the SSM of this word to NCD when it is in STBY or TA/Surveillance Only mode (as reflected in the SL and RI fields of TX Word 2, Label 274). Failure Warning should be reported in the SSM field only if the ACAS X computer itself has failed. The presence of a Functional Test report in the SSM field of this word indicates that a ACAS X Functional Test sequence should be performed by the displays. Refer to Section 4.2.

PART 6K-3

**ARINC 429 CONTROL WORD – ACAS Xu TO DISPLAY**

**ACAS Xu Vertical RWC Guidance Data Output Word 2**

**LABEL 172**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit MSB 1 0

2 Label 1st Digit 1

3 Label 2nd Digit MSB 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit MSB 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI BIT 0

10 SDI BIT 1

11 Vertical RWC Guidance bit 20 [1]

12 bit 21

13 bit 22

14 bit 23

15 bit 24

16 bit 25

17 bit 26

18 bit 27

19 bit 28

20 bit 29

21 bit 30

22 Vertical RWC Guidance bit 31

23

24

25

26

27

28

29

30 SSM

31 SSM [2] [3] [4]

32 Parity (Odd)

Notes:

1. Vertical RWC Band Region Limits

|  |  |  |
| --- | --- | --- |
| **Label 172Bit** | **Vertical RWC Bit** | **Band Max/Min** |
| 11 | 20 | -900/-700 |
| 12 | 21 | -1100/-900 |
| 13 | 22 | -1300/-1100 |
| 14 | 23 | -1500/-1300 |
| 15 | 24 | -1700/-1500 |
| 16 | 25 | -1900/-1700 |
| 17 | 26 | -2100/-1900 |
| 18 | 27 | -2300/-2100 |
| 19 | 28 | -2500/-2300 |
| 20 | 29 | -2700/-2500 |
| 21 | 30 | -2900/-2700 |
| 22 | 31 | -3100/-2900 |

1. Sign Status Matrix (SSM)(DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. Sign The presence of a No Computed Data report in the SSM field indicates that the information in bits 11 through 29 is unreliable. Therefore, no RWC guidanceshould be displayed by the Display.
2. The ACAS X computer should also set the SSM of this word to NCD when it is in STBY or TA/Surveillance Only mode (as reflected in the SL and RI fields of TX Word 2, Label 274). Failure Warning should be reported in the SSM field only if the ACAS X computer itself has failed. The presence of a Functional Test report in the SSM field of this word indicates that a ACAS X Functional Test sequence should be performed by the displays. Refer to Section 4.2.

PART 6L

**ARINC 429 FORMAT FOR BUS 1 WORD 2 – TRANSPONDER TO TCAS**

**TCAS COORDINATION DATA (MID PART 1)**

**LABEL 272**

RF

**BIT FUNCTION CODING MSG BIT NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 TCAS Broadcast Bit 0 = Coordination Msg.

1 = Rcvd TCAS Broadcast

10 MID BIT A 1 MSB MID (PART 1) 65

11 MID BIT A 2 66

12 MID BIT A 3 67

13 MID BIT A 4 68

14 MID BIT A 5 69

15 MID BIT A 6 70

16 MID BIT A 7 71

17 MID BIT A 8 72

18 MID BIT A 9 73

19 MID BIT A 10 74

20 MID BIT A 11 75

21 MID BIT A 12 76

22 MID BIT A 13 77

23 MID BIT A 14 78

24 MID BIT A 15 79

25 MID BIT A 16 80

26 Pad

27 Pad

28 Pad

29 Pad

30 SSM MSB [1]

31 SSM LSB

32 Parity (Odd)

Note: ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first.

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6M

**ARINC 429 FORMAT FOR BUS 1 WORD 8 – TRANSPONDER TO TCAS**

**TCAS COORDINATION DATA (MID PART 2)**

**LABEL 274**

**RF**

**BIT FUNCTION CODING MSG BIT NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 4 1

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 MID BIT A17 MID (PART 2) 81

10 MID BIT A18 82

11 MID BIT A19 83

12 MID BIT A20 84

13 MID BIT A21 85

14 MID BIT A22 86

15 MID BIT A23 87

16 MID BIT A24 LSB 88

17 Pad

18 Pad

19 Pad

20 Pad

21 Pad

22 Pad

23 Pad

24 Pad

25 Pad

26 Pad

27 Pad

28 Pad

29 Pad

30 SSM MSB [1]

31 SSM LSB

32 Parity (Odd)

Note: ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first.

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6N

**ARINC 429 FORMAT FOR BUS 1 WORD 3 – TRANSPONDER TO TCAS**

**MODE S GROUND UPLINK (SLC, IIS)**

**LABEL 273**

**RF**

**BIT FUNCTION CODING MSG BIT NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 3 0

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Pad

17 Pad

18 Pad

19 Pad

20 Pad

21 Pad

22 SLC MSB 41

23 SLC 42 [1] [3] [4]

24 SLC 43

25 SLC LSB 44

26 IIS MSB 17

27 IIS 18 [3] [4]

28 IIS 19

29 IIS LSB 20

30 SSM MSB [2]

31 SSM LSB

32 Parity (Odd)

Notes: ACAS X systems do not allow Sensitivity Level change via the Label 273 SLC and will ignore this label if received. Transponders compatible with RTCA DO-181F will discontinue transmission of this label.

1. Sensitivity Level Control [SLC]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BITS** | | | | **MEANING** |
| **22** | **23** | **24** | **25** |
| 0 | 0 | 0 | 0 | SLC 0 |
| 0 | 0 | 0 | 1 | SLC 1 |
| 0 | 0 | 1 | 0 | SLC 2 |
| 0 | 0 | 1 | 1 | SLC 3 |
| 0 | 1 | 0 | 0 | SLC 4 |
| 0 | 1 | 0 | 1 | SLC 5 |
| 0 | 1 | 1 | 0 | SLC 6 |
| 0 | 1 | 1 | 1 | SLC 7 |
| 1 | 0 | 0 | 0 |  |
| to | to | to | to | Not Assigned |
| 1 | 1 | 1 | 0 |  |
| 1 | 1 | 1 | 1 | Cancel previous level command |

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. This data is received from the ground station in data words UF=20 and UF = 21.
2. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first.

PART 6O

**ARINC 429 FORMAT FOR BUS 1 WORD 4 TRANSPONDER TO TCAS**

**Altitude Resolution**

**LABEL 203**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 0 0

4 Label 2nd Digit 0

5 Label 2nd Digit 0

6 Label 3rd Digit 3 0

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI [2]

10 SDI [2]

11 Altitude Resolution 0 = 1 ft, 1 = 100 ft

12 Altitude 1 ft

13 Altitude 2 ft

14 Altitude 4 ft

15 Altitude 8 ft

16 Altitude 16 ft

17 Altitude 32 ft

18 Altitude 64 ft

19 Altitude 128 ft

20 Altitude 256 ft

21 Altitude 512 ft

22 Altitude 1024 ft

23 Altitude 2048 ft

24 Altitude 4096 ft

25 Altitude 8192 ft

26 Altitude 16384 ft

27 Altitude 32768 ft

28 Altitude 65536 ft

29 Sign

30 SSM MSB [1]

31 SSM LSB

32 Parity (Odd)

1. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. SDI

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **10** | **9** |
| 0 | 0 | Not Used |
| 0 | 1 | Data from XPDR’s Air Data #1 Input Bus |
| 1 | 0 | Data from XPDR’s Air Data #2 Input bus |
| 1 | 1 | Not Used |

SDI bits are set by the Mode S transponder to indicate which Air Data input it is using for pressure altitude. The transponder sets the SDI to 01 if pressure altitude is taken from its Air Data #1 input port. The transponder sets the SDI to 10 if pressure altitude is taken from its Air Data #2 input port. An SDI setting of 00 probably means that the transponder is compliant to a previous version of ARINC 735() as these bits were previously defined as “Pad”.

Note that it is not necessarily given that a transponder and the traffic computer will have the same air data computer wired into the port of the same name. For example, in a single sided installation, the left transponder will likely have the left air data computer (ADC #1) connected to its Air Data #1 Input and the the right transponder will likely have the right air data computer (ADC #2) wired into its Air Data #1 Input. A method for the traffic computer to determine which of its air data inputs to use based on the SDI of this label is outside the scope of this specification.

PART 6P

**ARINC 429 FORMAT FOR BUS 1 WORD 5 – TRANSPONDER TO TCAS**

**TCAS CONTROL DATA (24-BIT AIRCRAFT ADDRESS PART 1)**

**LABEL 275**

**BIT FUNCTION CODING RF MSG BIT NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 5 1

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 User Defined

10 User Defined

11 User Defined

12 User Defined

13 User Defined

14 BIT A 1 MSB 24-BIT AIRCRAFT ADDRESS (PART 1) 65

15 BIT A 2 66

16 BIT A 3 67

17 BIT A 4 68

18 BIT A 5 69

19 BIT A 6 70 [2]

20 BIT A 7 71

21 BIT A 8 72

22 BIT A 9 73 [3]

23 BIT A10 74

24 BIT A11 75

25 BIT A12 76

26 BIT A13 77

27 BIT A14 78

28 BIT A15 79

29 BIT A16 80

30 SSM MSB [1]

31 SSM LSB

32 Parity (Odd)

Note:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. Sent by own TCAS in data word UF = 16.
2. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first.

PART 6Q

**ARINC 429 FORMAT FOR BUS 1 WORD 6 – TRANSPONDER TO TCAS**

**TCAS CONTROL DATA (OCM Transmit Status, RI Echo, Version Indicator, 24-BIT AIRCRAFT ADDRESS PART 2, MAX A/S, ADS-B Position Source)**

**LABEL 276**

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 6 1 |
| 7 Label 3rd Digit 1 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 OCM Transmit Status 42 [7], [4] |
| 10 RI Echo [1] |
| 11 Version Indicator (VI) (LSB) [2] |
| 12 Version Indicator (VI) (MSB) [2] |
| 13 Bit A17 (MSB) 81 [3], [4] |
| 14 Bit A18 82 [3] ,[4] |
| 15 Bit A19 83 [3], [4] |
| 16 24-Bit Aircraft Address Bit A20 84 [3], [4] |
| 17 Part 2 Bit A21 85 [3], [4] |
| 18 Bit A22 86 [3], [4] |
| 19 Bit A23 87 [3], [4] |
| 20 Bit A24 (LSB) 88 [3], [4] |
| 21 Max Airspeed (MSB) 14 [4] |
| 22 Max Airspeed 15 [4] |
| 23 Max Airspeed 16 [4] |
| 24 Max Airspeed (LSB) 17 [4] |
| 25 ADS-B Position Source (MSB) [6] |
| 26 ADS-B Position Source (LSB) [6] |
| 27 Pad |
| 28 Pad |
| 29 Pad |
| 30 SSM [5] |
| 31 SSM [5] |
| 32 Parity (Odd) |
|  |

Notes:

1. See ATTACHMENT 11 for logic encoding of the RI field.
2. The Version Indicator field provides the method for the Transponder to advise the TCAS whether or not it is compatible with RTCA   
   DO-185A/B and is encoded as follows:

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **12** | **13** |
| 0 | 0 | FAA TSO-C119A Compatible |
| 0 | 1 | RTCA DO-185A/B Compatible |
| 1 | 0 | Not Defined |
| 1 | 1 | Not Defined |

VI = 0, Indicates that the transponder is compatible with the communication protocol defined by FAA TSO-C119A as provided in Attachments 6A through 6D, Attachments 6K through 6V, and Attachment 12 of ARINC 735B. The ACAS X traffic computer is not compatible with this protocol and will indicate a non-operative state when connected to a transponder reporting VI = 0.

VI = 1, Indicates RTCA DO-185A and DO-185B compatibility and that the ACAS X traffic computer should communicate with the Transponder using communication protocols defined in ATTACHMENT 6 and ATTACHMENT 11.

1. These bits are sent by Own Transponder in DF = 0,16.
2. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used for RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
3. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **SSM BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. The ADS-B Position Source field provides indication of the currently selected ADS-B Out position source to the Traffic Computer, to ensure that both the ADS-B Out and ADS-B In functions are using the same qualified ADS-B position source. The ADS-B Position Source is defined per the table below:

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **25** | **26** |
| 0 | 0 | Unknown |
| 0 | 1 | ADS-B Position Source 1 |
| 1 | 0 | ADS-B Position Source 2 |
| 1 | 1 | Reserved |

1. The transponder should set this field to ADS-B Position Source 1 when the transponder is using the position input on the FMC/GNSS #1 In #1 port defined in ARINC 718A-4 (pins TP 2A and 2B), regardless of which navigation sensor is physically attached to that port on a given installation. Similarly, the transponder should set this field to ADS-B Position Source 2 when the transponder is using the position input on the FMC/GNSS #2 In #1 port defined in ARINC 718A-4 (pins MP 4C and 4D), regardless of which navigation sensor is physically attached to that port on a given installation.
2. The transponder should set this field to one when it has the capability to transmit Operational Coordination Messages. This bit will also be transmitted in bit 42 of the Data Link Capability Report.

PART 6R

**ARINC 429 FORMAT FOR BUS 1 WORD 7 – TRANSPONDER TO TCAS**

**ACKNOWLEDGEMENT (ACK/NACK)**

**LABEL 277**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 7 1

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Pad

17 Pad

18 Pad

19 Pad

20 Pad

21 Pad

22 Pad

23 Pad

24 Pad

25 Pad

26 Pad

27 Pad

28 Pad

29 ACK/NAK 0 = NAK

1 = ACK

30 SSM MSB

31 SSM LSB [1]

32 Parity (Odd)

Note:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6S

**ARINC 429 FORMAT FOR BUS 1 WORD 1 – TRANSPONDER TO TCAS**

**TCAS COORDINATION DATA (MTB, CVC, VRC, CHC, HRC, HSB, VSB)**

**LABEL 271**

**BIT FUNCTION CODING RF MSG BIT NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 MTB 42

10 CVC MSB 43

11 CVC LSB 44

12 VRC MSB 45

13 VRC LSB 46

14 CHC MSB 47

15 CHC 48

16 CHC LSB 49

17 HRC MSB 50

18 HRC 51

19 HRC LSB 52

20 HSB MSB 56

21 HSB 57

22 HSB 58

23 HSB 59

24 HSB LSB 60

25 VSB MSB 61

26 VSB 62

27 VSB 63

28 VSB LSB 64

29 Pad

30 SSM MSB [1]

31 SSM LSB

32 Parity (Odd)

Note:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6T

**ARINC 429 FORMAT FOR BUS 2 WORD 2 – TCAS TO TRANSPONDER**

**AND DISPLAYS**

**TCAS OUTPUT (VI, SL, RI, CCCB, DAA, RWC Active)**

**LABEL 274**

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 [1] |
| 2 Label 1st Digit (LSB) 0 [1] |
| 3 Label 2nd Digit (MSB) 7 1 [1] |
| 4 Label 2nd Digit 1 [1] |
| 5 Label 2nd Digit (LSB) 1 [1] |
| 6 Label 3rd Digit (MSB) 4 1 [1] |
| 7 Label 3rd Digit 0 [1] |
| 8 Label 3rd Digit (LSB) 0 [1] |
| 9 PAD |
| 10 PAD |
| 11 Version Indicator (VI) (LSB) [2] |
| 12 Version Indicator (VI) (MSB) [2] |
| 13 CCCB Sense Bit\_1 (MSB) 65 [8],[9] |
| 14 CCCB Sense Bit\_0(LSB) 66 [8],[9] |
| 15 CCCB CAS Type Bit\_2 (MSB) 67 [8],[9] |
| 16 CCCB CAS Type Bit\_1 68 [8],[9] |
| 17 CCCB CAS Type Bit\_0 (LSB) 69 [8],[9] |
| 18 CCCB (Reserved) 0 70 |
| 19 CCCB (Reserved) 0 71 |
| 20 DAA Bit\_1 (MSB) 55 [8],[10] |
| 21 DAA Bit\_0 (LSB) 56 [8],[10] |
| 22 RWC Active 72 [8],[11] |
| 23 SL (MSB) 9 [3], [4], [5] |
| 24 SL 10 [3], [4], [5] |
| 25 SL (LSB) 11 [3], [4], [5] |
| 26 RI (MSB) 14 [3], [4], [6] |
| 27 RI 15 [3], [5], [6] |
| 28 RI 16 [3], [4], [6] |
| 29 RI (LSB) 17 [3], [4], [6] |
| 30 SSM [7] |
| 31 SSM [7] |
| 32 Parity (Odd) |

Notes:

1. The FAA TSO-C119A compatible interface defined the 274 TXWORD2 for output to both the Transponder and Displays. This definition includes additional bits useful only to the Transponder. Existing Displays may or may not be capable of properly processing these additional bits, therefore, unless it can be guaranteed that the additional bits will not impact operation of the Displays, the TXWORD2 sent to the Displays by the ACAS X unit should remain the same as previously defined in Attachment 6U of ARINC 735B.
2. The Version Indicator field provides the method for the ACAS X to advise the Transponder whether or not it is compatible with RTCA DO-185A/B/385/386, and is encoded as follows:

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **12** | **11** |
| 0 | 0 | FAA TSO-C119A Compatible |
| 0 | 1 | RTCA DO-185A/B, DO-385, DO-386 Compatible |
| 1 | 0 | Not Defined |
| 1 | 1 | Not Defined |

VI = 0, Indicates compatibility with TCAS/Transponder communicattion protocols defined in Attachments 6A through 6D, Attachments 6K through 6V, and Attachment 12 of ARINC 735B which detail the FAA TSO-C119A compatible bus operation. The ACAS X traffic computer does not support this setting.

VI = 1, indicates compatibility with TCAS/Transponder communication protocols defined in ATTACHMENT 6 and ATTACHMENT 11 which are consistent with the requirements of RTCA DO-185A/B, DO-385 and DO-386.

The ACAS X traffic computer will only support the VI=1 communication protocol and will always set VI=1. The receiving transponder will also need to support this protocol for the system to be operative.

1. These bits are sent by Own Transponder in DF = 0, 16.
2. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used for RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
3. The SL bits should be used by the TA and TA/RA displays to determine the TCAS computer mode. The SL should be used by the displays to determine if the TCAS computer is in STBY mode. When the TCAS computer is not in STBY mode, the RI field should be used to determine the TCAS computer mode. The following bit definitions apply:

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **25** | **24** | **23** |
| 1 | 0 | 0 | STBY |

1. RI Field

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BITS** | | | | **MEANING** |
| **29** | **28** | **27** | **26** |
| 0 | 0 | 0 | 0 | No operating CAS |
| 1 | 0 | 0 | 0 | Active CAS of Junior Status with Resolution Capability or Passive CAS with Resolution Capability\* |
| 0 | 1 | 0 | 0 | CAS with resolution capability inhibited (TA/Surveillance Only) |
| 1 | 1 | 0 | 0 | CAS with resolution capabilty (TA/RA or RWC/CA) |
| 0 | 0 | 1 | 0 | Must not be assigned |
| 1 | 0 | 1 | 0 | Must not be assigned |
| 0 | 1 | 1 | 0 | Must not be assigned |
| 1 | 1 | 1 | 0 | Must not be assigned |
| 0 | 0 | 0 | 1 | Not provided by ACAS X |
| 1 | 0 | 0 | 1 | Not provided by ACAS X |
| 0 | 1 | 0 | 1 | Not provided by ACAS X |
| 1 | 1 | 0 | 1 | Not provided by ACAS X |
| 0 | 0 | 1 | 1 | Not provided by ACAS X |
| 1 | 0 | 1 | 1 | Not provided by ACAS X |
| 0 | 1 | 1 | 1 | Not provided by ACAS X |
| 1 | 1 | 1 | 1 | Not Assigned |

1. \*ACAS Xa/Xu will never set RI=1
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. These bit are set by Own Transponder in the DF=17 Aircraft Operational Status Message
2. Collision Avoidance Coordination Capability Bits (CCCB) consist of 7 bits according to the following definitions. (Bits 18-19 are reserved)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **13** | **14** |
| 0 | 0 | Vertical Only |
| 0 | 1 | Horizontal Only |
| 1 | 0 | Blended |
| 1 | 1 | Vertical-only or Horizontal-only per intruder |

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **15** | **16** | **17** |
| 0 | 0 | 0 | TCAS II or no CAS |
| 0 | 0 | 1 | Active CAS (not TCAS II) |
| 0 | 1 | 0 | Active CAS (not TCAS II) with OCM transmit capability |
| 0 | 1 | 1 | Active CAS of junior status |
| 1 | 0 | 0 | Passive CAS with 1030 MHz TCAS Resolution Message receive capability |
| 1 | 0 | 1 | Passive CAS with only OCM receive capability |
| 1 | 1 | 0 | Reserved |
| 1 | 1 | 1 | Reserved |

1. Detect and Avoid (DAA) capability is defined as follows:

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **20** | **21** |
| 0 | 0 | No RWC capability or no capability of RWC function to receive TCAS Resolution Messages or ADS-B OCMs |
| 0 | 1 | Aircraft has an RWC function capable of receiving TCAS Resolution Messages and ADS-B OCMs |
| 1 | 0 | Aircraft has an RWC function capable of receiving only ADS-B OCMs |
| 1 | 1 | Not defined |

1. The ‘RWC Active’ bit is set (1) whenever an RWC corrective alert is active and cleared (0) otherwise.

PART 6U

**ARINC 429 FORMAT FOR BUS 2 WORD 3 – TCAS TO TRANSPONDER**

**AND DISPLAYS**

**ACKNOWLEDGEMENT (ACK/NAK)**

**LABEL 275**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 5 1

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Pad

17 Pad

18 Pad

19 Pad

20 Pad

21 Pad

22 Pad

23 Pad

24 Pad

25 Pad

26 Pad

27 Pad

28 Pad

29 ACK/NAK 0 = NAK

1 = ACK

30 SSM (MSB)

31 SSM (LSB) [1]

32 Parity (Odd)

Note:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6V

**ARINC 429 CONTROL WORD – TRANSPONDER TO TCAS, TCAS TO DISPLAY**

**ALTITUDE SELECT LIMITS WORD**

**LABEL 015**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 0 0

2 Label 1st Digit 0

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 5 1

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 SDI = Pad

10 SDI = Pad

11 Altitude limit A 100

12 Altitude limit A 200

13 Altitude limit A 400

14 Altitude limit A 800 [1]

15 Altitude limit A 1600

16 Altitude limit A 3200

17 Altitude limit A 6400

18 Altitude limit B 100

19 Altitude limit B 200

20 Altitude limit B 400

21 Altitude limit B 800 [2]

22 Altitude limit B 1600

23 Altitude limit B 3200

24 Altitude limit B 6400

25 Spare

26 Spare

27 Spare

28 Spare

29 Spare

30 SSM [3]

31 SSM

32 Parity

Notes:

1. The TCAS computer should transmit A = 2700 ft unless it receives a different value from the Mode S Transponder on Label 015 with SSM = Normal or Functional Test.
2. The TCAS computer should transmit B = 9000 ft unless it receives a different value from the Mode S Transponder on Label 015 with SSM = Normal or Functional Test.
3. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Valid |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM field of this word should always set to Normal Operation unless the TCAS computer itself has failed; it should then be set to Fail Warn.

PART 6W-1

**ARINC 429 FORMAT – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS, TCAS TO RA DISPLAY**

**TCAS FAULT SUMMARY WORD 1**

**LABEL 350**

|  |  |  |
| --- | --- | --- |
| Bit Function Coding Notes | | |
|  | | |
| 1 Label 1st Digit (MSB) 3 1 | | |
| 2 Label 1st Digit (LSB) 1 | | |
| 3 Label 2nd Digit (MSB) 5 1 | | |
| 4 Label 2nd Digit 0 | | |
| 5 Label 2nd Digit (LSB) 1 | | |
| 6 Label 3rd Digit (MSB) 0 0 | | |
| 7 Label 3rd Digit 0 | | |
| 8 Label 3rd Digit (LSB) 0 | | |
| 9 SDI Bit 0 | | |
| 10 SDI Bit 1 | | |
| 11 Traffic Computer Unit | 0 = Normal, 1 = Failure |  |
| 12 Upper Antenna | 0 = Normal, 1 = Failure | [1] |
| 13 Lower Antenna | 0 = Normal, 1 = Failure | [1] |
| 14 Radio Alt Input Bus 1 | 0 = Normal, 1 = Inactive | [2] |
| 15 Radio Alt Input Bus 2 | 0 = Normal, 1 = Inactive | [2] |
| 16 ATC/Mode S Transponder #1 | 0 = Active or Standby  1 = Inactive or Fail | [2], [7] |
| 17 ATC/Mode S Transponder #2 | 0 = Active or Standby  1 = Inactive or Fail | [2], [7] |
| 18 Attitude Input Bus Status | 0 = Normal, 1 = Inactive | [2] |
| 19 Magnetic Heading Input Bus Status | 0 = Normal, 1 = Inactive | [2] |
| 20 TCAS System Status | 0 = Normal, 1 = Failure | [3] |
| 21 Flight Performance Input Bus Status | 0 = Normal, 1 = Inactive | [2] |
| 22 ASAS System Status | 0 = Normal, 1 = Failure | [4] |
| 23 Spare | 0 |  |
| 24 Spare | 0 |  |
| 25 RA 1 Display System Status | 0 = Normal, 1 = Failure | [5] |
| 26 RA 2 Display System Status | 0 = Normal, 1 = Failure | [5] |
| 27 CFDIU Input Bus Status | 0 = Normal, 1 = Inactive | [2] |
| 28 BITE Test Inhibit | 0 = Enable, 1 = Inhibit | [6] |
| 29 Command Word Acknowledge | 0 = NAK, 1 = ACK | [6] |
| 30 SSM |  | [8] |
| 31 SSM |  | [8] |
| 32 Parity | (Odd) |  |

Notes:

1. This bit indicates whether the antenna has either failed, is not connected to the Traffic Computer, or is not connected to the correct port of the Traffic Computer. This bit should be set regardless of the state of fault status bit or the TCAS mode of operation.
2. These bits should always indicate the status of the respective inputs into the Traffic Computer, regardless of the state of fault status bits or the TCAS mode of operation (i.e., TA/RA, TA/Surveillance Only, or Standby mode).
3. Section 3.5.2.5 defines the logic for this discrete bit.
4. Only applicable to units which have ASAS applications enabled. If no ASAS applications are enabled, this bit should always be set to ‘0’ (Normal).
5. Refer to Section 3.4.5 and Note 12 of Attachment 3B. A ‘1’ state (Failure) indicates the display is unable to display an RA (applicable to bits 25 and 26).
6. This information is provided for maintenance purposes only. The definition of this bit of the Label 350 word is contained in Appendix 7 of ARINC 604-1.
7. Refer to Section 6.0 of ATTACHMENT 11.
8. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-2

**ARINC 429 FORMAT – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS FAULT SUMMARY WORD 2**

**LABEL 352**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bit** | **Function** | **Coding** | **Notes** |
|  | | | |
| 1 Label 1st Digit (MSB) 3 1 | | | |
| 2 Label 1st Digit (LSB) 1 | | | |
| 3 Label 2nd Digit (MSB) 5 1 | | | |
| 4 Label 2nd Digit 0 | | | |
| 5 Label 2nd Digit (LSB) 1 | | | |
| 6 Label 3rd Digit (MSB) 2 0 | | | |
| 7 Label 3rd Digit 1 | | | |
| 8 Label 3rd Digit (LSB) 0 | | | |
| 9 SDI Bit 0 | | | |
| 10 SDI Bit 1 | | | |
| 11 TCAS Hybrid Surveillance Status | | 0 = Normal, 1 = Failure | [2] |
| 12 GPS #1 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 13 GPS #2 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 14 IRS #1 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 15 FMC #1 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 16 ADC #1 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 17 FCC Controller Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 18 MCDU #1 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 19 MCDU #2 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 20 ADC #2 Input Bus Status | | 0 = Normal, 1 = Inactive | [1] |
| 21 C2 Link Status | | 0 = Normal, 1 = Inactive | [3] |
| 22 ATAR Interface Status | | 0 = Normal, 1 = Inactive | [3] |
| 23 Spare | |  |  |
| 24 Spare | |  |  |
| 25 Spare | |  |  |
| 26 Spare | |  |  |
| 27 Spare | |  |  |
| 28 Spare | |  |  |
| 29 Spare | |  |  |
| 30 SSM | |  | [4] |
| 31 SSM | |  | [4] |
| 32 Parity | | (Odd) |  |

1. Notes:
2. These bits should always indicate the status of the respective inputs into the Traffic Computer, regardless of the state of fault status bits or the ACAS mode of operation (i.e., TA/RA, TA/Surveillance Only, or Standby mode).
3. The TCAS Hybrid Surveillance Status bit may be used to annunciate to the pilot on the flight deck that TCAS hybrid surveillance functionality has failed. If the TCAS hybrid surveillance function is not enabled within the Traffic Computer, then the status should be set to 0 (Normal).
4. For ACAS Xu, the C2 Link Status and ATAR Interface should always indicate the status of the respective inputs into the ACAS Computer, regardless of the state of fault status bits or the ACAS mode of operation. For ACAS Xa the status should be set to 0 (Normal).
5. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-3

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA, OR TA/RA DISPLAYS**

**TCAS PROGRAM PIN STATUS WORD #1**

**LABEL 360**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 0 0 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 0 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | Audio Level Program (Airborne) #1 | RBP 7A | [1] |
| 12 | Audio Level Program (Airborne) #2 | RBP 7B | [1] |
| 13 | Audio Level Program (Airborne) #3 | RBP 7C | [1] |
| 14 | Display All Traffic/Threat Traffic Program | RBP 7F | [1] |
| 15 | TA/RA Display Intruder Limit Program (1) | RBP 8K | [1] |
| 16 | TA/RA Display Intruder Limit Program (2) | RBP 8J | [1] |
| 17 | TA/RA Display Intruder Limit Program (4) | RBP 8H | [1] |
| 18 | TA/RA Display Intruder Limit Program (8) | RBP 8G | [1] |
| 19 | TA/RA Display Intruder Limit Program (16) | RBP 8F | [1] |
| 20 | Unused | 0 | [1] |
| 21 | Unused | 0 | [1] |
| 22 | Unused | 0 | [1] |
| 23 | Unused | 0 | [1] |
| 24 | Unused | 0 | [1] |
| 25 | Ground Display Mode Program | RBP 7E | [1] |
| 26 | Reserved for Supplier Use |  |  |
| 27 | Reserved for Supplier Use |  |  |
| 28 | Reserved for Supplier Use |  |  |
| 29 | Spare Program Pin | RBP 8D | [1] |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-4

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS PROGRAM PIN STATUS WORD # 2**

**LABEL 361**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 1 0 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 1 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | Unused | 0 | [1] |
| 12 | Unused | 0 | [1] |
| 13 | Unused | 0 | [1] |
| 14 | Unused | 0 | [1] |
| 15 | Unused | 0 | [1] |
| 16 | Unused | 0 | [1] |
| 17 | Unused | 0 | [1] |
| 18 | Unused | 0 | [1] |
| 19 | Cable Delay Program Pins (Sign) | RBP 7G | [1] |
| 20 | Cable Delay Program Pins (MSB) | RBP 7H | [1] |
| 21 | Cable Delay Program Pins (LSB) | RBP 7J | [1] |
| 22 | Unused | 0 | [1] |
| 23 | Self Test Inhibit Program | RBP 8E | [1] |
| 24 | Advisory Inhibit Disc Input 1 (STBY) | RBP 5A | [1] |
| 25 | Advisory Inhibit Disc Input 2 | RBP 5B | [1] |
| 26 | Advisory Inhibit Disc Input 3 | RBP 5C | [1] |
| 27 | Advisory Inhibit Disc Input 4 | RBP 5D | [1] |
| 28 | Software P/N Enable Discrete Input | RBP 6D | [1] |
| 29 | Spare |  |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |
|  |  |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-5

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS INPUT DISCRETE STATUS WORD # 1**

**LABEL 362**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 2 0 |  |
| 7 | Label 3rd Digit | 1 |  |
| 8 | Label 3rd Digit | 0 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | Spare (Discrete In) | RMP 3D | [1] |
| 12 | RA Valid Discrete Disable | RBP 4G | [1] |
| 13 | Air/Ground Discrete Input | RMP 5K | [1] |
| 14 | Landing Gear Discrete Input | RMP 13F | [1] |
| 15 | RA Display Status #1 | RMP 14C | [1] |
| 16 | RA Display Status #2 | RMP 13E | [1] |
| 17 | Spare |  |  |
| 18 | Spare |  |  |
| 19 | Spare |  |  |
| 20 | Spare |  |  |
| 21 | Spare |  |  |
| 22 | Spare |  |  |
| 23 | Spare |  |  |
| 24 | Spare |  |  |
| 25 | Spare |  |  |
| 26 | Spare |  |  |
| 27 | Spare |  |  |
| 28 | Spare |  |  |
| 29 | Spare |  |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-6

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS INPUT DISCRETE STATUS WORD # 2**

**LABEL 363**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 3 0 |  |
| 7 | Label 3rd Digit | 1 |  |
| 8 | Label 3rd Digit | 1 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | Reserved | RMP 4K | [1] |
| 12 | Data Loader Enable Discrete Input | RBP 6A | [1] |
| 13 | Unused | 0 | [1] |
| 14 | Radio Altitude #1 Valid Discrete Input | RMP 2K | [1] |
| 15 | Radio Altitude #2 Valid Discrete Input | RBP 3C | [1] |
| 16 | Data Loader Function Discrete #2 | RBP 6B | [1] |
| 17 | Data Loader Function Discrete #3 | RBP 6C | [1] |
| 18 | TA Only (w/Aurals) Discrete | RBP 4B | [1] |
| 19 | Reserved Discrete Input | RMP 7F | [1] |
| 20 | Reserved Discrete Input | RMP 7K | [1] |
| 21 | Spare |  |  |
| 22 | Spare |  |  |
| 23 | Spare |  |  |
| 24 | Spare |  |  |
| 25 | Spare |  |  |
| 26 | Spare |  |  |
| 27 | Spare |  |  |
| 28 | Spare |  |  |
| 29 | Spare |  |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-7

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS INPUT DISCRETE STATUS WORD # 3**

**LABEL 364**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 4 1 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 0 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | Traffic Input 1A (Discrete In) | RMP 3K | [1] |
| 12 | Traffic Input 1B (Discrete In) | RMP 5D | [1] |
| 13 | User Defined Discrete Input | RMP 10A | [1] |
| 14 | User Defined Discrete Input | RMP 10B | [1] |
| 15 | User Defined Discrete Input | RMP 10C | [1] |
| 16 | User Defined Discrete Input | RMP 10D | [1] |
| 17 | User Defined Discrete Input | RMP 10E | [1] |
| 18 | User Defined Discrete Input | RMP 10F | [1] |
| 19 | User Defined Discrete Input | RMP 10G | [1] |
| 20 | Traffic Input #2A (Discrete In) | RMP 10H | [1] |
| 21 | Traffic Input #2B (Discrete In) | RMP 10J | [1] |
| 22 | Traffic Input #1 PUSH (Discrete In) | RMP 10K | [1] |
| 23 | User Defined Discrete Input | RMP 11A | [1] |
| 24 | Traffic Input 1 PULL (Discrete In) | RMP 14K | [1] |
| 25 | Unused | 0 | [1] |
| 26 | Traffic input #2 PUSH (Discrete Input) | RBP 4E | [1] |
| 27 | Traffic input #2 PULL (Discrete Input) | RBP 4F | [1] |
| 28 | Reserved | 0 |  |
| 29 | Reserved | 0 |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-8

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS PROGRAM PIN STATUS WORD # 3**

**LABEL 365**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 5 1 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 1 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | ADS-B Program Pins - DTIF Enable | RMP 5E | [1] |
| 12 | ADS-B Program Pin - Reserved | RMP 5F | [1] |
| 13 | ADS-B Program Pin - Reserved | RMP 5G | [1] |
| 14 | Reserved | 0 |  |
| 15 | Aural Advisory Discrete Program | RBP 7D | [1] |
| 16 | Audio Level Program (On Ground) #1 | RBP 8A | [1] |
| 17 | Audio Level Program (On Ground) #2 | RBP 8B | [1] |
| 18 | Audio Level Program (On Ground) #3 | RBP 8C | [1] |
| 19 | Radio Altimeter Program Pin | RBP 6K | [1] |
| 20 | User Defined Program Pin | RMP 12A | [1] |
| 21 | User Defined Program Pin | RMP 12B | [1] |
| 22 | User Defined Program Pin | RMP 12C | [1] |
| 23 | Reserved | 0 |  |
| 24 | XPDR Program Pin | RBP 6J | [1] |
| 25 | AOTO Program Pin | RBP 4C | [1] |
| 26 | Reserved for Discrete Input | RBP 4D | [1] |
| 27 | Reserved for Supplier Use | 0 |  |
| 28 | Reserved for Supplier Use | 0 |  |
| 29 | Reserved | 0 |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  | [2] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Unless otherwise noted, the encoding of the bits in this label for any given input pin are a 0 for open and 1 for grounded.
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

PART 6W-9

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS PROGRAM PIN STROBE WORD # 1**

**LABEL 340**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 4 1 |  |
| 4 | Label 2nd Digit | 0 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 0 0 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 0 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | RBP 2A Reserved Program Pin Strobe/APM Pin | RBP 2A | [2] |
| 12 |
| 13 |
| 14 | RBP 2B Reserved Program Pin Strobe/APM Pin | RBP 2B | [2] |
| 15 |
| 16 |
| 17 | RBP 2C Reserved Program Pin Strobe/APM Pin | RBP 2C | [2] |
| 18 |
| 19 |
| 20 | RBP 2D Reserved Program Pin Strobe/APM Pin | RBP 2D | [2] |
| 21 |
| 22 |
| 23 | RBP 2E Reserved Program Pin Strobe/APM Pin | RBP 2E | [2] |
| 24 |
| 25 |
| 26 | RBP 2F Reserved Program Pin Strobe/APM Pin | RBP 2F | [2] |
| 27 |
| 28 |
| 29 | Spare |  |  |
| 30 | SSM |  | [1] |
| 31 | SSM |  | [1] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

1. Program Strobed Pin Definition. For all of the Program Pin Strobe pins, there are 6 possible states indicated by 3 bits each (which includes the bit above and below the the Program Pin Strobe name). The highest numbered bit in each of these fields is the MSB; the lowest numbered bit in each of these fields is the LSB (states 6 and 7 are currently not used). See Section 3.6.8 for a definition of the states.

PART 6W-10

**ARINC 429 CONTROL WORD – TCAS TO MAINTENACE COMPUTERS (CFDS), TCAS TO TA OR TA/RA DISPLAYS**

**TCAS PROGRAM PIN STROBE WORD #2**

**LABEL 341**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1 | Label 1st Digit | 3 1 |  |
| 2 | Label 1st Digit | 1 |  |
| 3 | Label 2nd Digit | 4 1 |  |
| 4 | Label 2nd Digit | 0 |  |
| 5 | Label 2nd Digit | 0 |  |
| 6 | Label 3rd Digit | 1 0 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit | 1 |  |
| 9 | SDI Bit 0 | 0 |  |
| 10 | SDI Bit 1 | 0 |  |
| 11 | RBP 2G Reserved Program Pin Strobe/APM Pin | RBP 2G | [2] |
| 12 |
| 13 |
| 14 | RMP 3H SDI/Power Bus Type Program Pin Strobe | RMP 3H | [2] [3] |
| 15 |
| 16 |
| 17 | RMP 3J Reserved Program Pin Strobe | RMP 3J | [2] |
| 18 |
| 19 |
| 20 | RBP 3F Reserved Program Pin Strobe | RBP 3F | [2] |
| 21 |
| 22 |
| 23 | RBP 3G Reserved Program Pin Strobe | RBP 3G | [2] |
| 24 |
| 25 |
| 26 | Spare |  |  |
| 27 | Spare |  |  |
| 28 | Spare |  |  |
| 29 | Spare |  |  |
| 30 | SSM |  | [1] |
| 31 | SSM |  | [1] |
| 32 | Parity (Odd) |  |  |

Notes:

1. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 31 | 30 |
| 0 | 0 | Normal Operation |
| 0 | 1 | NCD |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

The SSM of this discrete word should ALWAYS be set to Normal Operation.

1. Program Strobed Pin Definition. For all of the Program Pin Strobe pins, there are 6 possible states indicated by 3 bits each (which includes the bit above and below the the Program Pin Strobe name). The highest numbered bit in each of these fields is the MSB; the lowest numbered bit in each of these fields is the LSB (states 6 and 7 are currently not used). See Section 3.6.8 for a definition of the states.
2. RMP 3H Power Bus Type Program Pin Strobe. Discrete input RMP-3H provides installed side information and indicates the power bus type for possible use in power reduction modes.

PART 6X-1

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS DISPLAY START OF TRANSMISSION (STX) RECORD WORD**

**LABEL 356**

**BIT FUNCTION CODING**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 5 1

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Block Word Count

10 Block Word Count

11 Block Word Count

12 Block Word Count

13 Block Word Count

14 Block Work Count

15 Block Word Count

16 Block Word Count

17 Control Bit 0 = Text

1 = Software Part Number

18 Spare

19 Spare

20 Spare

21 Spare

22 Spare

23 Spare

24 Spare

25 STX Character 0

26 STX Character 1

27 STX Character 0

28 STX Character 0

29 STX Character 0

30 STX Character 0

31 STX Character 0

32 Parity (Odd)

PART 6X-2

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS DISPLAY TEXT DISPLAY DATA CONTROL WORD**

**LABEL 356**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 5 1

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Character Position

10 Character Position

11 Character Position [1]

12 Character Position

13 Character Position

14 Reverse Video 0 = No Reverse

1 = Reverse

15 Underscore 0 = No Underscore

1 = Underscore

16 Flashing 0 = Not Flashing

1 = Flashing

17 Line Number

18 Line Number

19 Line Number [2]

20 Line Number

21 Color Select

22 Color Select [3]

23 Color Select

24 Font Select 0 = Font 1 [3]

1 = Font 2

25 CNTL Character 1

26 CNTL Character 0

27 CNTL Character 0

28 CNTL Character 0

29 CNTL Character 0

30 CNTL Character 0

31 CNTL Character 0

32 Parity (Odd)

Notes:

1. This is a binary word in the range of 1 to 24 which defines the column position of the next character.
2. This is a binary word in the range of 1 to 13 which defines the line position for the following text.
3. Colors and fonts selected by states of these controls are defined by the display manufacturer.

PART 6X-3

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS DISPLAY TEXT DISPLAY DATA CHARACTER WORD**

**LABEL 356**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 5 1

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Text Character #1

10 Text Character #1

11 Text Character #1

12 Text Character #1 [1]

13 Text Character #1

14 Text Character #1

15 Text Character #1

16 Spare

17 Text Character #2

18 Text Character #2

19 Text Character #2

20 Text Character #2 [1]

21 Text Character #2

22 Text Character #2

23 Text Character #2

24 Spare

25 Text Character #3

26 Text Character #3

27 Text Character #3

28 Text Character #3 [1]

29 Text Character #3

30 Text Character #3

31 Text Character #3

32 Parity (Odd)

Note:

1. The text characters will be represented in ISO-5 format. Unused characters will be padded with NUL characters.

PART 6X-4

**ARINC 429 CONTROL WORD – TCAS TO DISPLAY**

**TCAS DISPLAY END OF TRANSMISSION (EOT) WORD**

**LABEL 356**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 5 1

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Spare

10 Spare

11 Spare

12 Spare

13 Spare

14 Spare

15 Spare

16 Spare

17 Spare

18 Spare

19 Spare

20 Spare

21 Spare

22 Spare

23 Spare

24 Spare

25 EOT Character 0

26 EOT Character 0

27 EOT Character 1

28 EOT Character 0 [1]

29 EOT Character 0

30 EOT Character 0

31 EOT Character 0

32 Parity (odd)

Note:

1. The text characters will be represented in ISO-5 format. Unused characters will be padded with NUL characters.

PART 6Y

**ARINC 429 FORMAT FOR BUS 1 WORD 9 TRANSPONDER TO TCAS**

**AND TA/RA DISPLAY – TRANSPONDER AND TCAS OUTPUTS**

**OWN AIRCRAFT ALTITUDE (CORRECTED)**

**LABEL 204**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 0 0

4 Label 2nd Digit 0

5 Label 2nd Digit 0

6 Label 3rd Digit 4 1

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 Pad

10 Pad

11 Pad

12 Altitude (feet) 1 LSB

13 | 2

14 | 4

15 | 8

16 | 16

17 | 32

18 | 64

19 | 128

20 | 256

21 | 512

22 | 1024

23 | 2048

24 | 4096

25 | 8192

26 | 16384

27 | 32768

28 Altitude (feet) 65536 MSB

29 Sign

30 SSM [1]

31 SSM [1]

32 Parity (Odd)

Note:

1. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

PART 6Z

**ARINC 429 FORMAT – GNSS TO TCAS , TCAS TO DISPLAY**

**OWN AIRCRAFT LATITUDE**

**LABEL 110**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 0 0

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 Latitude 0.000172 Signed Two’s Complement

10 Latitude 0.000343 (Degrees)

11 Latitude 0.000687

12 Latitude 0.001373

13 Latitude 0.002747

14 Latitude 0.005493

15 Latitude 0.010986

16 Latitude 0.021973

17 Latitude 0.043945

18 Latitude 0.087891

19 Latitude 0.175781

20 Latitude 0.351563

21 Latitude 0.703125

22 Latitude 1.40625

23 Latitude 2.8125

24 Latitude 5.625

25 Latitude 11.25

26 Latitude 22.5

27 Latitude 45.0

28 Latitude 90.0

29 Latitude Sign

30 SSM

31 SSM

32 Parity (Odd)

PART 6AA

**ARINC 429 FORMAT – INS/IRS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT LONGITUDE**

**LABEL 111**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 Longitude 0.000172 Signed Two’s Complement

10 Longitude 0.000343 (Degrees)

11 Longitude 0.000687

12 Longitude 0.001373

13 Longitude 0.002747

14 Longitude 0.005493

15 Longitude 0.010986

16 Longitude 0.021973

17 Longitude 0.043945

18 Longitude 0.087891

19 Longitude 0.175781

20 Longitude 0.351563

21 Longitude 0.703125

22 Longitude 1.40625

23 Longitude 2.8125

24 Longitude 5.625

25 Longitude 11.25

26 Longitude 22.5

27 Longitude 45.0

28 Longitude 90.0

29 Longitude Sign

30 SSM

31 SSM

32 Parity (Odd)

PART 6AB

**ARINC 429 FORMAT – GNSS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT LATITUDE – FINE**

**LABEL 120**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 2 0

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 0 0

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Pad

17 Pad

18 Latitude 8.381903171 x 10-8 LSB Continuation of Label 110

19 Latitude 1.676380634 x 10-7  Signed Two’s Complement

20 Latitude 3.352761268 x 10-7 (Degrees)

21 Latitude 6.705522537 x 10-7

22 Latitude 1.341104507 x 10-6

23 Latitude 2.682209015 x 10-6

24 Latitude 5.36441803 x 10-6

25 Latitude 1.072883606 x 10-5

26 Latitude 2.145767212 x 10-5

27 Latitude 4.291534424 x 10-5

28 Latitude 8.583068848 x 10-5 MSB

29 Sign

30 SSM

31 SSM

32 Parity (Odd)

PART 6AC

**ARINC 429 FORMAT – GNSS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT LONGITUDE – FINE**

**LABEL 121**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 2 0

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 1 0

7 Label 3rd Digit 0

8 Label 3rd Digit 1

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Pad

17 Pad

18 Longitude 8.381903171 x 10-8 LSB Continuation of Label 111

19 Longitude 1.676380634 x 10-7  Signed Two’s Complement

20 Longitude 3.352761268 x 10-7  (Degrees)

21 Longitude 6.705522537 x 10-7

22 Longitude 1.341104507 x 10-6

23 Longitude 2.682209015 x 10-6

24 Longitude 5.36441803 x 10-6

25 Longitude 1.072883606 x 10-5

26 Longitude 2.145767212 x 10-5

27 Longitude 4.291534424 x 10-5

28 Longitude 8.583068848 x 10-5 MSB

29 Sign

30 SSM

31 SSM

32 Parity (Odd)

PART 6AD

**ARINC 429 FORMAT – INS/IRS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT GROUND SPEED**

**LABEL 312**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI

10 SDI

11 Pad

12 Pad

13 Pad

14 Ground Speed 0.125 Signed Two’s Complement

15 Ground Speed 0.25 (kts)

16 Ground Speed 0.5

17 Ground Speed 1

18 Ground Speed 2

19 Ground Speed 4

20 Ground Speed 8

21 Ground Speed 16

22 Ground Speed 32

23 Ground Speed 64

24 Ground Speed 128

25 Ground Speed 256

26 Ground Speed 512

27 Ground Speed 1024

28 Ground Speed 2048

29 Ground Speed Sign

30 SSM

31 SSM

32 Parity (Odd)

PART 6AE

**ARINC 429 FORMAT – INS/IRS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT TRUE TRACK ANGLE**

**LABEL 313**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 3 0

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI

10 SDI

11 Pad

12 Pad

13 Pad

14 True Track Angle 0.005493 Signed Two’s Complement

15 True Track Angle 0.010986 (Degrees)

16 True Track Angle 0.021973

17 True Track Angle 0.043945

18 True Track Angle 0.087891

19 True Track Angle 0.175781

20 True Track Angle 0.351563

21 True Track Angle 0.703125

22 True Track Angle 1.40625

23 True Track Angle 2.8125

24 True Track Angle 5.625

25 True Track Angle 11.25

26 True Track Angle 22.5

27 True Track Angle 45.0

28 True Track Angle 90.0

29 True Track Angle Sign [1]

30 SSM

31 SSM

32 Parity (Odd)

Note:

1. True Track Sign

|  |  |
| --- | --- |
| **BIT 29** | **MEANING** |
| 0 | Positive |
| 1 | Negative |

Per ARINC 429, the angular range 0 through 359.XXX degrees is encoded as 0 through ±179.XXX degrees, with the value of the most significant bit being one half of a semicircle (90°). Angles between 180° to 360° will be determined by taking the two’s complement of the fractional binary series for the result of subtracting each value from 360. Thus, the code for 181° is the two’s complement of the code for 179°. Throughout the negative semicircle, which includes 180°, the sign bit contains the negative sign.

The following examples illustrate the encoding of angles. As the examples show, angles can be considered to be signed two’s complement values over the range of   
(-180,180) or they can be considered to be unsigned values over the range (0, 360). Both paradigms result in the same encoding. For instance, Example 2 shows that the encoding for -84.375 degrees using the two’s complement paradigm is identical to the encoding of 275.625 degrees using the full circle paradigm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BIT | | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| **Weighting – two’s complement paradigm** | | **Sign** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
| **Weighting – 0-360 full circle paradigm** | | **180** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Example 1 | 95.625 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 2 | -84.375 (275.625) | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 3 | -95.625 (264.375) | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

PART 6AF

**ARINC 429 FORMAT – INS/IRS TO TCAS, TCAS TO DISPLAY**

**OWN AIRCRAFT TRUE HEADING**

**Label 314**

**BIT FUNCTION CODING DESCRIPTION NOTES**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 1 0

4 Label 2nd Digit 0

5 Label 2nd Digit 1

6 Label 3rd Digit 4 1

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 Pad

10 Pad

11 Spare

12 Spare

13 Spare

14 True Heading 0.005493 Signed Two’s Complement

15 True Heading 0.010986 (Degrees)

16 True Heading 0.021973

17 True Heading 0.043945

18 True Heading 0.087891

19 True Heading 0.175781

20 True Heading 0.351563

21 True Heading 0.703125

22 True Heading 1.40625

23 True Heading 2.8125

24 True Heading 5.625

25 True Heading 11.25

26 True Heading 22.5

27 True Heading 45.0

28 True Heading 90.0

29 True Heading Sign [1]

30 SSM

31 SSM

32 Parity (Odd)

Note:

1. True Heading Sign

|  |  |
| --- | --- |
| **BIT 29** | **MEANING** |
| 0 | Positive |
| 1 | Negative |

Per ARINC 429, the angular range 0 through 359.XXX degrees is encoded as 0 through ±179.XXX degrees, with the value of the most significant bit being one half of a semicircle (90°). Angles between 180° to 360° will be determined by taking the two’s complement of the fractional binary series for the result of subtracting each value from 360. Thus, the code for 181° is the two’s complement of the code for 179°. Throughout the negative semicircle, which includes 180°, the sign bit contains the negative sign.

The following examples illustrate the encoding of angles. As the examples show, angles can be considered to be signed two’s complement values over the range of   
(-180,180) or they can be considered to be unsigned values over the range (0, 360). Both paradigms result in the same encoding. For instance, Example 2 shows that the encoding for -84.375 degrees using the two’s complement paradigm is identical to the encoding of 275.625 degrees using the full circle paradigm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BIT | | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| **Weighting – two’s complement paradigm** | | **Sign** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
| **Weighting – 0-360 full circle paradigm** | | **180** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Example 1 | 95.625 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 2 | -84.375 (275.625) | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 3 | -95.625 (264.375) | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

PART 6AG

**ARINC 429 FORMAT – DISPLAY TO TCAS**

**TRAFFIC DESIGNATION COMMAND WORD**

**LABEL 272**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI [1]

10 SDI

11 Selected/ITP Reference traffic number 1 [3]

12 Selected/ITP Reference traffic number 2 [3]

13 Selected/ITP Reference traffic number 4 [3]

14 Selected/ITP Reference traffic number 8 [3]

15 Selected/ITP Reference traffic number 16 [3]

16 Selected/ITP Reference traffic number 32 [3]

17 Selected/ITP Reference traffic number 64 [3]

18 Selected/ITP Reference selection [3] [6]

19 Selected/ITP Reference Status [4]

20 Designated traffic number 1 [3]

21 Designated traffic number 2 [3]

22 Designated traffic number 4 [3]

23 Designated traffic number 8 [3]

24 Designated traffic number 16 [3]

25 Designated traffic number 32 [3]

26 Designated traffic number 64 [3]

27 Designation Status [5]

28 Designated/Coupled selection [2] [3]

29 Pad

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Designated/Coupled Selection

This information is a provision for ASAS applications. In order to be a Coupled target, an aircraft must first be Designated.

|  |  |
| --- | --- |
| **BIT 28** | **MEANING** |
| 0 | Designated |
| 1 | Coupled |

1. In this section, reference is made to the following four terms: Selected, ITP Reference, Designated, and Coupled. These definitions come from the ASAS MOPS (RTCA DO-317B) and are identified below.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Selected | Target for which additional information is requested by the flight crew. An example is an aircraft selected for which ownship desires position data (latitude, longitude, altitude). |
| ITP Reference | Target upon which an In Trail Procedure (ITP) maneuver is intended to be conducted. |
| Designated | Target upon which a procedure is intended to be conducted. An example is an aircraft selected which ownship intends to merge behind, in a merging and sequencing procedure. |
| Coupled | Target upon which a procedure is intended to be conducted with and where an automated maneuver has been launched. In order for a coupled operation to take place, an intended target must first be designated. An example of another aircraft being coupled is where ownship has engaged its control system (flight control, FMS) to ensure a spacing procedure is carried out with the coupled aircraft. |

1. Selected/ITP Reference Status. If set to 1, indicates that traffic has neither been selected, nor is an ITP Reference aircraft, and that bits 11 through 17 can be ignored. If set to 0, indicates that an aircraft is being selected or is an ITP reference aircraft, with the aircraft traffic number as indicated in bits 11 through 17.
2. Designation Status. If set to 1, indicates that no traffic is designated and that bits 20 to 26 have no meaning and should be ignored. If set to 0, indicates that an aircraft is being designated, with the aircraft traffic number as indicated in bits 20 through 26.
3. Selected/ITP Reference selection. If set to 0, indicates that bits 11 through 17 are the Selected traffic number. If set to 1, indicates that bits 11 through 17 are the ITP Reference traffic number.

PART 6AH

**ARINC 429 FORMAT – DISPLAY TO TCAS**

**DISPLAY SELECTIONS WORD 1**

**LABEL 276**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1 [1]

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI [2]

10 SDI

11 Selected Display Mode [3]

12 Selected Display Mode

13 Selected Display Mode

14 Selected Display Mode

15 Selected Range 0.125 nmile

16 Selected Range 0.25 nmile

17 Selected Range 0.5 nmile

18 Selected Range 1 nmile

19 Selected Range 2 nmile

20 Selected Range 4 nmile

21 Selected Range 8 nmile

22 Selected Range 16 nmile

23 Selected Range 32 nmile

24 Selected Range 64 nmile

25 Selected Range 128 nmile

26 Selected Range 256 nmile

27 Pad

28 Altitude Window [4]

29 Altitude Window

30 SSM [5]

31 SSM

32 Parity (Odd)

Notes:

1. Labels 276 and 277 are included to represent program-specific settings that may rely on a specific control panel type.
2. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Display Mode Matrix: This setting indicates a control panel selection of the source data type. This is intended to result in the same source(s) to be used for DTIF and other reporting means.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BITS** | | | | **MEANING** |
| **14** | **13** | **12** | **11** |
| 0 | 0 | 0 | 0 | TCAS Only Mode |
| 0 | 0 | 0 | 1 | ADS-B and TIS-B Only Mode |
| 0 | 0 | 1 | 0 | FIS-B Only Mode |
| 0 | 0 | 1 | 1 | TCAS, ADS-B, and TIS-B |
| 0 | 1 | 0 | 0 | ADS-B, TIS-B, and FIS-B |
| 0 | 1 | 0 | 1 | TCAS, ADS-B, TIS-B, and FIS-B |
| 0 | 1 | 1 | 1 | Reserved |
| 0 | 1 | 1 | 1 | Reserved |
| 1 | 0 | 0 | 0 | Reserved |
| 1 | 0 | 0 | 1 | Reserved |
| 1 | 0 | 1 | 0 | Reserved |
| 1 | 0 | 1 | 1 | Reserved |
| 1 | 1 | 0 | 0 | Reserved |
| 1 | 1 | 0 | 1 | Reserved |
| 1 | 1 | 1 | 0 | Reserved |
| 1 | 1 | 1 | 1 | Reserved |

1. Selected Altitude Window: Represents crew selection of direction of interest, corresponding to control panel switch settings.

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **27** | **26** |
| 0 | 0 | Normal |
| 0 | 1 | Above |
| 1 | 0 | Below |
| 1 | 1 | Unrestricted |

1. SSM Status

|  |  |  |
| --- | --- | --- |
| **SSM BIT 31** | **SSM BIT 30** | **MEANING** |
| 0 | 0 | Normal Operation (Verified Data) |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AI

**ARINC 429 FORMAT – DISPLAY TO TCAS**

**DISPLAY SELECTIONS WORD 2**

**LABEL 277**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1 [1]

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 7 1

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI [2]

10 SDI

11 Selected Horizontal Velocity Vector – 30 Sec [3]

12 Selected Horizontal Velocity Vector – 1 Min

13 Selected Horizontal Velocity Vector – 2 Min

14 Selected Horizontal Velocity Vector – 4 Min

15 Selected Data Tag – Traffic ID [4]

16 Selected Data Tag – Closure Rate

17 Selected Data Tag – Ground Speed

18 Selected Data Tag – Range

19 Selected Data Tag – Traffic Category

20 Pad

21 Pad

22 Pad

23 Pad

24 Pad

25 Pad

26 Pad

27 Pad

28 Pad

29 Pad

30 SSM [5]

31 SSM

32 Parity (Odd)

Notes:

1. Labels 276 and 277 are uniquely included as representing the TESIS program settings, relying on a specific control panel type.
2. SDI field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Velocity Vector Distance: This setting indicates a control panel selection of the length of time to extend the velocity vector. These settings are mutually exclusive. A velocity vector may be depicted as a straight line extending out in front of a traffic symbol. This vector represents where the traffic will be, based on the current ground speed and direction.
2. Selected Parameter: Represents crew selection of parameter of interest. These choices can be made through control panel and may produce corresponding depiction of this information on the display.
3. SSM Status

|  |  |  |
| --- | --- | --- |
| **SSM BIT 31** | **SSM BIT 30** | **MEANING** |
| 0 | 0 | Normal Operation (Verified Data) |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AJ

**ARINC 429 FORMAT TCAS TO DISPLAY**

**TRAFFIC SELECTION/STATUS WORD**

**LABEL 272**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 2 0

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 SDI [1]

10 SDI

11 Selected/ITP Reference traffic number 1 [3]

12 Selected/ITP Reference traffic number 2 [3]

13 Selected/ITP Reference traffic number 4 [3]

14 Selected/ITP Reference traffic number 8 [3]

15 Selected/ITP Reference traffic number 16 [3]

16 Selected/ITP Reference traffic number 32 [3]

17 Selected/ITP Reference traffic number 64 [3]

18 Selected/ITP Reference selection [3] [6]

19 Selected/ITP Reference Status [4]

20 Designated traffic number 1 [3]

21 Designated traffic number 2 [3]

22 Designated traffic number 4 [3]

23 Designated traffic number 8 [3]

24 Designated traffic number 16 [3]

25 Designated traffic number 32 [3]

26 Designated traffic number 64 [3]

27 Designation Status [5]

28 Designated/Coupled selection [2] [3]

29 Pad

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Designated/Coupled Selection

This information is a provision for ASAS applications. In order to be a Coupled target, an aircraft must first be Designated.

|  |  |
| --- | --- |
| **BIT 28** | **MEANING** |
| 0 | Designated |
| 1 | Coupled |

In this section, reference is made to the following four terms: Selected, ITP Reference, Designated, and Coupled. The ARINC 735C use of these terms is described in PART 6AG.

1. Selected/ITP Reference Status. If set to 1, indicates that traffic has neither been selected nor is an ITP Reference aircraft and that bits 11 through 17 can be ignored. If set to 0, indicates that an aircraft is being selected or is an ITP reference aircraft, with the aircraft traffic number as indicated in bits 11 through 17.
2. Designation Status. If set to 1, indicates that no traffic is designated and that bits 20 to 26 have no meaning and should be ignored. If set to 0, indicates that an aircraft is being designated, with the aircraft traffic number as indicated in bits 20 through 26.
3. Selected/ITP Reference selection. If set to 0, indicates that bits 11 through 17 are the Selected traffic number. If set to 1, indicates that bits 11 through 17 are the ITP Reference traffic number.

PART 6AK

**ARINC 429 FORMAT DISPLAY TO TCAS**

**ADS-B CURRENT APPLICATION WORD**

**LABEL 273**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 2 1

2 Label 1st Digit 0

3 Label 2nd Digit 7 1

4 Label 2nd Digit 1

5 Label 2nd Digit 1

6 Label 3rd Digit 3 0

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI [1]

10 SDI

11 Enhanced Visual Acquisition Application [2]

12 Ground Based Application

13 Spacing Operations Application

14 In Trail Procedure Application

15 Enhanced Visual Approach Application

16 ACAS Xo DNA

17 ACAS Xo CSPO-3000

18 Reserved for Future Applications

19 Reserved for Future Applications

20 Reserved for Future Applications

21 Reserved for Future Applications

22 Reserved for Future Applications

23 Reserved for Future Applications

24 Reserved for Future Applications

25 Reserved for Future Applications

26 Reserved for Future Applications

27 Reserved for Future Applications

28 Reserved for Future Applications

29 No Application is currently active

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Applications are defined per the below:

Enhanced Visual Acquisition Applications:

1. EV Acq – Enhanced Visual Acquisition
2. ATSA – AIRB – Enhanced Traffic Situational Awareness during Flight Operations

Ground Based Applications:

1. ASSA – Airport Surface Situational Awareness
2. ATSA SURF – Situational Awareness on the Airport Surface
3. FAROA – Final Approach and Runway Occupancy Awareness

Spacing Operations Applications:

1. M&S/S&M – Merging and Spacing/Sequencing and Merging
2. ASIA – Approach Spacing for Instrument Approaches
3. ICSPA – Closely Spaced Parallel Approach

In Trail Procedure Application:

1. ASPA – ITP, In Trail Procedure Application

Enhanced Visual Approach Applications:

1. EV App – Enhanced Visual Approach
2. ATSA VSA – Enhanced Visual Separation on Approach
3. CAVS – CDTI (Cockpit Display of Traffic Information) Assisted Visual Separation

Note that ADS-B alerting applications such as (a) Conflict Detection (CD) or (b) Airborne Conflict Management (ACM) are considered always active and not currently active. Thus, bit 29 refers to a condition by which alerting applications may be active but none of the above non-alerting applications are active.

ACAS Xo Modes:

1. DNA – Designated No Alerts
2. CSPO-3000 – Closely Spaced Operations down to 3000 feet runway separation

PART 6AL

**ARINC 429 FORMAT TCAS TO DISPLAY**

**ALERTING STATUS DISCRETE WORD**

**LABEL 160**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 6 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 0 |  |  |
| 6 | Label 3rd Digit | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI | LSB | |  | [1] |
| 10 | SDI | MSB | |  |  |
| 11 | Display of Undefined Data |  | | 0 = Blank, 1 = Dashes |  |
| 12 | CAS/Mach Flag |  | | 0 = CAS, 1 = Mach |  |
| 13 | Reserved |  | |  |  |
| 14 | Reserved |  | |  |  |
| 15 | Reserved |  | |  |  |
| 16 | Reserved |  | |  |  |
| 17 | Advisory Status |  | | 0 = Advisory Inactive, 1 = Advisory Active, White Speed command LED  Only on when command is not acknowledged. |  |
| 18 | Reserved |  | |  |  |
| 19 | Reserved |  | |  |  |
| 20 | Reserved |  | |  |  |
| 21 | Caution Status |  | | 0 = Caution Inactive, 1 = Caution Active, Amber Speed command LED |  |
| 22 | Reserved |  | |  |  |
| 23 | Reserved |  | |  |  |
| 24 | Reserved |  | |  |  |
| 25 | Warning Status |  | | 0 = Warning Inactive, 1 = Warning Active |  |
| 26 | Reserved |  | |  |  |
| 27 | Reserved |  | |  |  |
| 28 | Reserved |  | |  |  |
| 29 | Reserved |  | |  |  |
| 30 | SSM |  | |  | [2] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Sign Status Matrix (SSM) (DISC)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AM

**ARINC 429 FORMAT TCAS TO DISPLAY**

**GENERIC DISC WORD #1 DISCRETE WORD**

**LABEL 162**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 6 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 0 |  |  |
| 6 | Label 3rd Digit | 2 | 0 |  |  |
| 7 | Label 3rd Digit | 1 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI | 0 | |  | [1] |
| 10 | SDI | 0 | |  |  |
| 11 | Air/Ground Status |  | | 0 = In Air, 1 = On Ground |  |
| 12 | Gear Down |  | | 0 = Gear Up, 1 = Gear Down |  |
| 13 | Selected True/Mag Mode |  | | 0 = Magnetic Selected, 1 = True Selected |  |
| 14 | Selected Track/Heading Mode |  | | 0 = Heading Selected, 1 = Track Selected |  |
| 15 | ADS-B IN Status |  | | 0 = ADS-B IN Failed, 1 = ADS-B IN OK |  |
| 16 | CDTI Priority |  | | 0 = Left, 1 = Right |  |
| 17 | TIS-B/ADS-R Service Coverage Status |  | | 0 = Inactive, 1 = Active | [2] |
| 18 | Reserved |  | |  |  |
| 19 | Reserved |  | |  |  |
| 20 | Reserved |  | |  |  |
| 21 | Reserved |  | |  |  |
| 22 | Reserved |  | |  |  |
| 23 | Reserved |  | |  |  |
| 24 | Reserved |  | |  |  |
| 25 | Reserved |  | |  |  |
| 26 | Reserved |  | |  |  |
| 27 | Reserved |  | |  |  |
| 28 | Reserved |  | |  |  |
| 29 | Reserved |  | |  |  |
| 30 | SSM |  | |  | [3] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. 0 = Indication that the aircraft is not within TIS-B/ADS-R coverage, as indicated when the Service Status Message has not been received within the required time per RTCA DO-317B. 1 = Indication that the aircraft is within TIS-B/ADS-R coverage. If the ADS-B IN function is not enabled, this bit should be set to 0 (Inactive).
2. Sign Status Matrix (SSM) (DISC)

|  |  |  |
| --- | --- | --- |
| **SSM BIT 31** | **SSM BIT 30** | **MEANING** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AN

**ARINC 429 FORMAT TCAS TO DISPLAY**

**APPLICATION AVAILABILITY WORD**

**LABEL 163**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 6 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 0 |  |  |
| 6 | Label 3rd Digit | 3 | 0 |  |  |
| 7 | Label 3rd Digit | 1 |  |  |
| 8 | Label 3rd Digit | 1 |  |  |
| 9 | SDI | 0 | |  | [1] |
| 10 | SDI | 0 | |  |  |
| 11 | Availability of AIRB LSB |  | |  | [2] |
| 12 | Availability of AIRB |  | |  |  |
| 13 | Availability of AIRB MSB |  | |  |  |
| 14 | Availability of Interval Management LSB |  | |  | [2] |
| 15 | Availability of Interval Management |  | |  |  |
| 16 | Availability of Interval Management MSB |  | |  |  |
| 17 | Availability of SURF LSB |  | |  | [2] |
| 18 | Availability of SURF |  | |  |  |
| 19 | Availability of SURF MSB |  | |  |  |
| 20 | Availability of VSA LSB |  | |  | [2] |
| 21 | Availability of VSA |  | |  |  |
| 22 | Availability of VSA MSB |  | |  |  |
| 23 | Availability of ITP LSB |  | |  | [2] |
| 24 | Availability of ITP |  | |  |  |
| 25 | Availability of ITP MSB |  | |  |  |
| 26 | Availability of ACAS Xo DNA LSB |  | |  | [2] |
| 27 | Availability of ACAS Xo DNA |  | |  |  |
| 28 | Availability of ACAS Xo DNA MSB |  | |  |  |
| 29 | Reserved for future application |  | |  |  |
| 30 | SSM |  | |  | [3] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Indication of availability is based on a combination of factors: (a) functions included in the Traffic computer, (b) program pin setting or configuration setting, (c) Traffic computer conditions and input conditions. Availability is not based on the phase of flight or the current cockpit selection.

000 = Application Is Available To Run: application is present, has been configured, no faults are occurring related to this application, and ownship position is of sufficient quality level.

001 = Application Is Unavailable To Run: Application is present an configured, but an input position indication is NCD or of insufficient quality, thus preventing this application from being available.

010 = Application Is Unavailable – Application is present and configured, but a fault has occurred, either internal or external, to prevent this application from being available.

011 = Application Is Not Configured: application is either not present or has not been configured.

100 = Reserved

101 = Reserved

110 = Reserved

111 = Reserved

1. Sign Status Matrix (SSM)

|  |  |  |
| --- | --- | --- |
| **SSM BIT 31** | **SSM BIT 30** | **MEANING** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AO

**ARINC 429 FORMAT TCAS TO DISPLAY**

**APPLICATION AVAILABILITY WORD CONTINUED**

**LABEL 164**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 6 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 0 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI | 0 | |  | [1] |
| 10 | SDI | 0 | |  |  |
| 11 | Availability of ACAS Xo CSPO-3000 LSB |  | |  | [2] |
| 12 | Availability of ACAS Xo CSPO-3000 |  | |  |  |
| 13 | Availability of ACAS Xo CSPO-3000 MSB |  | |  |  |
| 14 | Reserved for future application |  | |  | [2] |
| 15 | Reserved for future application |  | |  |  |
| 16 | Reserved for future application |  | |  |  |
| 17 | Reserved for future application |  | |  | [2] |
| 18 | Reserved for future application |  | |  |  |
| 19 | Reserved for future application |  | |  |  |
| 20 | Reserved for future application |  | |  | [2] |
| 21 | Reserved for future application |  | |  |  |
| 22 | Reserved for future application |  | |  |  |
| 23 | Reserved for future application |  | |  | [2] |
| 24 | Reserved for future application |  | |  |  |
| 25 | Reserved for future application |  | |  |  |
| 26 | Reserved for future application |  | |  |  |
| 27 | Reserved for future application |  | |  |  |
| 28 | Reserved for future application |  | |  |  |
| 29 | Reserved for future application |  | |  |  |
| 30 | SSM |  | |  | [3] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Indication of availability is based on a combination of factors: (a) functions included in the Traffic computer, (b) program pin setting or configuration setting, (c) Traffic computer conditions and input conditions. Availability is not based on the phase of flight or the current cockpit selection.

000 = Application Is Available To Run: application is present, has been configured, no faults are occurring related to this application, and ownship position is of sufficient quality level.

001 = Application Is Unavailable To Run: Application is present an configured, but an input position indication is NCD or of insufficient quality, thus preventing this application from being available.

010 = Application Is Unavailable – Application is present and configured, but a fault has occurred, either internal or external, to prevent this application from being available.

011 = Application Is Not Configured: application is either not present or has not been configured.

100 = Reserved

101 = Reserved

110 = Reserved

111 = Reserved

1. When future application groupings are defined, it is anticipated that the same 3-bit indication of availability will be made:
2. Sign Status Matrix (SSM) (DISC)

|  |  |  |
| --- | --- | --- |
| **SSM BIT 31** | **SSM BIT 30** | **MEANING** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6AP

**ARINC 429 FORMAT TCAS TO DISPLAY**

**AIF TRANSACTION HEADER**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Number of Transaction Packets | 1 | | LSB | [1] |
| 10 | | | 2 | |  |  |
| 11 | | | 4 | |  |  |
| 12 | | | 8 | |  |  |
| 13 | | | 16 | |  |  |
| 14 | | | 32 | |  |  |
| 15 | Number of Transaction Packets | 64 | | MSB |  |
| 16 | AIF Version Number |  | | LSB | [2] |
| 17 | AIF Version Number |  | |  |  |
| 18 | AIF Version Number |  | | MSB |  |
| 19 | Pad |  | |  |  |
| 20 | AIF Type |  | | LSB | [3] |
| 21 | AIF Type |  | |  |  |
| 22 | AIF Type |  | |  |  |
| 23 | AIF Type |  | | MSB |  |
| 24 | Pad |  | |  |  |
| 25 | Pad |  | |  |  |
| 26 | Pad |  | |  |  |
| 27 | Pad |  | |  |  |
| 28 | Pad |  | |  |  |
| 29 | Pad |  | |  |  |
| 30 | Pad |  | |  |  |
| 31 | Pad |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. The maximum number of Transaction Packets is 127. A zero (0) number of transactions is an empty DISPLAY Block Data Transfer.
2. The AIF Version Number is used to allow multiple meanings of AIF Type data.
3. AIF Type

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BITS** | | | | **MEANING** |
| **23** | **22** | **21** | **20** |
| 0 | 0 | 0 | 0 | Type 0: Traffic List |
| 0 | 0 | 0 | 1 | Undefined |
| 0 | 0 | 1 | 0 | Undefined |
| 0 | 0 | 1 | 1 | Undefined |
| 0 | 1 | 0 | 0 | Undefined |
| 0 | 1 | 0 | 1 | Undefined |
| 0 | 1 | 1 | 0 | Undefined |
| 0 | 1 | 1 | 1 | Undefined |
| 1 | 0 | 0 | 0 | Undefined |
| 1 | 0 | 0 | 1 | Undefined |
| 1 | 0 | 1 | 0 | Undefined |
| 1 | 0 | 1 | 1 | Undefined |
| 1 | 1 | 0 | 0 | Undefined |
| 1 | 1 | 0 | 1 | Undefined |
| 1 | 1 | 1 | 0 | Undefined |
| 1 | 1 | 1 | 1 | Undefined |

PART 6AQ

**ARINC 429 FORMAT TCAS TO DISPLAY**

**AIF PACKET HEADER**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Packet ID |  | | LSB | [1] |
| 10 | | |  | |  |  |
| 11 | | |  | |  |  |
| 12 | | |  | |  |  |
| 13 | | |  | |  |  |
| 14 | Packet ID |  | | MSB |  |
| 15 | Number of Words in Packet |  | | LSB | [2] |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | | |  | |  |  |
| 19 | | |  | |  |  |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | | |  | |  |  |
| 25 | Number of Words in Packet |  | | MSB |  |
| 26 | Message ID | 1 | | LSB | [3] |
| 27 | | | 2 | |  |  |
| 28 | | | 4 | |  |  |
| 29 | | | 8 | |  |  |
| 30 | Message ID | 16 | | MSB |  |
| 31 | Pad |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. The Packet IDs defined per the below table:

|  |  |  |
| --- | --- | --- |
| **Description** | **Transaction ID** | **Number of Labels** |
| CAVS Coupled from EFB | 1 (reserved) |  |
| Entered M&S Data Display to TCAS | 2 | 10 |
| Stop Application from EFB | 3 (reserved) |  |
| M&S Command Data TCAS to Display | 4 | 7 |
| Differential Groundspeed TCAS to Display | 5 | 2 |
| Supplier Reserved | 6 (reserved) |  |
| Supplier Reserved | 7 (reserved) |  |
| Supplier Reserved | 8 (reserved) |  |
| Supplier Reserved | 9 (reserved) |  |
| Supplier Reserved | 10 (reserved) |  |
| Supplier Reserved | 11 (reserved) |  |

1. This is the Number of Labels in the Packet including the Packet Header.
2. The Message ID here is a counter that is incremented each time a new transaction of type Transaction ID is sent. The value is incremented 0 to 31 and then wraps to 0. The receiver of this transaction can acknowledge the message by returning the transaction with a word count of 1 and Message ID equal to what was received.

PART 6AR

**ARINC 429 FORMAT DISPLAY TO TCAS**

**AIF TRANSACTION 2, WORD 1, M&S FLIGHT ID CHARS 1, 2, 3**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Word Count | 1 | | LSB | [1] |
| 10 | Word Count | 0 | | MSB |  |
| 11 | Pad |  | |  |  |
| 12 | Pad |  | |  |  |
| 13 | Character 1 | LSB | |  | [2] |
| 14 | | |  | |  |  |
| 15 | | |  | |  |  |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | Character 1 | MSB | |  |  |
| 19 | Character 2 | LSB | |  | [2] |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | Character 2 | MSB | |  |  |
| 25 | Character 3 | LSB | |  | [2] |
| 26 | | |  | |  |  |
| 27 | | |  | |  |  |
| 28 | | |  | |  |  |
| 29 | | |  | |  |  |
| 30 | Character 3 | MSB | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [3] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. Word Count identifies which set of flight ID characters are present where:

00 = Reserved

01 = Word 1, Characters 1, 2, and 3

10 = Word 2, Characters 4, 5, and 6

11 = Word 3, Characters 7 and 8

1. Encoded as a 6-bit subset as specified in RTCA DO-181E Section 2.2.19.1.13.
2. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AS

**ARINC 429 FORMAT DISPLAY TO TCAS**

**AIF TRANSACTION 2, WORD 2, M&S FLIGHT ID CHARS 4, 5, 6**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Word Count | 0 | | LSB | [1] |
| 10 | Word Count | 1 | | MSB |  |
| 11 | Pad | 0 | |  |  |
| 12 | Pad | 0 | |  |  |
| 13 | Character 4 | LSB | |  | [2] |
| 14 | | |  | |  |  |
| 15 | | |  | |  |  |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | Character 4 | MSB | |  |  |
| 19 | Character 5 | LSB | |  | [2] |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | Character 5 | MSB | |  |  |
| 25 | Character 6 | LSB | |  | [2] |
| 26 | | |  | |  |  |
| 27 | | |  | |  |  |
| 28 | | |  | |  |  |
| 29 | | |  | |  |  |
| 30 | Character 6 | MSB | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [3] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. Word Count identifies which set of flight ID characters are present where:
2. 00 = Reserved
3. 01 = Word 1, Characters 1, 2, and 3
4. 10 = Word 2, Characters 4, 5, and 6
5. 11 = Word 3, Characters 7 and 8
6. Encoded as a 6-bit subset as specified in RTCA DO-181E Section 2.2.19.1.13.
7. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AT

**ARINC 429 FORMAT DISPLAY TO TCAS**

**AIF TRANSACTION 2, WORD 3, M&S FLIGHT ID CHARS 7, 8**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Word Count | 1 | | LSB | [1] |
| 10 | Word Count | 1 | | MSB |  |
| 11 | Pad |  | |  |  |
| 12 | Pad |  | |  |  |
| 13 | Character 7 | LSB | |  | [2] |
| 14 | | |  | |  |  |
| 15 | | |  | |  |  |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | Character 7 | MSB | |  |  |
| 19 | Character 8 | LSB | |  | [2] |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | Character 8 | MSB | |  |  |
| 25 | Pad | LSB | |  |  |
| 26 | Pad |  | |  |  |
| 27 | Pad |  | |  |  |
| 28 | Pad |  | |  |  |
| 29 | Pad |  | |  |  |
| 30 | Pad | MSB | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [3] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. Word Count identifies which set of flight ID characters are present where:
2. 00 = Reserved
3. 01 = Word 1, Characters 1, 2, and 3
4. 10 = Word 2, Characters 4, 5, and 6
5. 11 = Word 3, Characters 7 and 8
6. Encoded as a 6-bit subset as specified in RTCA DO-181E   
   Section 2.2.19.1.13.
7. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AU

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 4, M&S MERGE POINT LATITUDE**

**LABEL 174**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |  |
| 2 | Label 1st Digit | 1 |  |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |  |
| 4 | Label 2nd Digit | 1 |  |  |  |
| 5 | Label 2nd Digit | 1 |  |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |  |
| 7 | Label 3rd Digit | 0 |  |  |  |
| 8 | Label 3rd Digit | 0 |  |  |  |
| 9 | Pad |  | | |  |  |
| 10 | Pad |  | | |  |  |
| 11 | Pad |  | | |  |  |
| 12 | Pad |  | | |  |  |
| 13 | Latitude | 1.0728836 x 10-5 | | | LSB | [1] |
| 14 | Latitude | 2.1457672 x 10-5 | | |  |  |
| 15 | Latitude | 4.2915344 x 10-5 | | |  |  |
| 16 | Latitude | 8.5830688 x 10-5 | | |  |  |
| 17 | Latitude | 1.7166138 x 10-4 | | |  |  |
| 18 | Latitude | 3.4332275 x 10-4 | | |  |  |
| 19 | Latitude | 6.8664551 x 10-4 | | |  |  |
| 20 | Latitude | 0.00137329 | | |  |  |
| 21 | Latitude | 0.00274658 | | |  |  |
| 22 | Latitude | 0.00549316 | | |  |  |
| 23 | Latitude | 0.0109863 | | |  |  |
| 24 | Latitude | 0.0219726 | | |  |  |
| 25 | Latitude | 0.0439453 | | |  |  |
| 26 | Latitude | 0.0878906 | | |  |  |
| 27 | Latitude | 0.175781 | | |  |  |
| 28 | Latitude | 0.351563 | | |  |  |
| 29 | Latitude | 0.703125 | | |  |  |
| 30 | Latitude | 1.40625 | | | (Latitude continued on next word) |  |
| 31 | Data Type Continuation Bit | 0 | | |  | [2] |
| 32 | Parity (Odd) |  | | |  |  |

Notes:

1. Latitude is Two’s Complement ± 90 Degrees.
2. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AV

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 5, M&S MERGE POINT LATITUDE/LONGITUDE**

**LABEL 174**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | | **DESCRIPTION** | **NOTES** | |
| 1 | Label 1st Digit | 1 | 0 |  |  |  | |
| 2 | Label 1st Digit | 1 |  |  |  | |
| 3 | Label 2nd Digit | 7 | 1 |  |  |  | |
| 4 | Label 2nd Digit | 1 |  |  |  | |
| 5 | Label 2nd Digit | 1 |  |  |  | |
| 6 | Label 3rd Digit | 4 | 1 |  |  |  | |
| 7 | Label 3rd Digit | 0 |  |  |  | |
| 8 | Label 3rd Digit | 0 |  |  |  | |
| 9 | Latitude | 2.8125 | | | (Latitude is continued from prior word) |  | |
| 10 | Latitude | 5.625 | | |  |  | |
| 11 | Latitude | 11.25 | | |  |  | |
| 12 | Latitude | 22.5 | | |  |  | |
| 13 | Latitude | 45 | | | MSB | [1] | |
| 14 | Sign |  | | |  |  | |
| 15 | Longitude | 1.0728836 x 10-5 | | | LSB | [1] |
| 16 | Longitude | 2.1457672 x 10-5 | | |  |  |
| 17 | Longitude | 4.2915344 x 10-5 | | |  |  |
| 18 | Longitude | 8.5830688 x 10-5 | | |  |  |
| 19 | Longitude | 1.7166138 x 10-4 | | |  |  |
| 20 | Longitude | 3.4332275 x 10-4 | | |  |  |
| 21 | Longitude | 6.8664551 x 10-4 | | |  |  |
| 22 | Longitude | 0.00137329 | | |  |  | |
| 23 | Longitude | 0.00274658 | | |  |  | |
| 24 | Longitude | 0.00549316 | | |  |  | |
| 25 | Longitude | 0.0109863 | | |  |  | |
| 26 | Longitude | 0.0219726 | | |  |  | |
| 27 | Longitude | 0.0439453 | | |  |  | |
| 28 | Longitude | 0.0878906 | | |  |  | |
| 29 | Longitude | 0.175781 | | |  |  | |
| 30 | Longitude | 0.351563 | | | (Longitude continued on next word) |  | |
| 31 | Data Type Continuation Bit | 0 | | |  | [2] | |
| 32 | Parity (Odd) |  | | |  |  | |

Notes:

1. Latitude and Longitude are Two’s Complement ± 90 Degrees.
2. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AW

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 6, M&S MERGE POINT LONG/FAS**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Longitude | 0.703125 | | (Longitude is continued from prior word) | [1] |
| 10 | Longitude | 1.40625 | |  |  |
| 11 | Longitude | 2.8125 | |  |  |
| 12 | Longitude | 5.625 | |  |  |
| 13 | Longitude | 11.25 | |  |  |
| 14 | Longitude | 22.5 | |  |  |
| 15 | Longitude | 45 | |  |  |
| 16 | Longitude | 90 | | MSB |  |
| 17 | Sign | 5.625 | |  |  |
| 18 | Final Approach Speed (kts) | 1 | | LSB |  |
| 19 | Final Approach Speed (kts) |  | |  |  |
| 20 | Final Approach Speed (kts) |  | |  |  |
| 21 | Final Approach Speed (kts) |  | |  |  |
| 22 | Final Approach Speed (kts) |  | |  |  |
| 23 | Final Approach Speed (kts) |  | |  |  |
| 24 | Final Approach Speed (kts) |  | |  |  |
| 25 | Final Approach Speed (kts) |  | |  |  |
| 26 | Final Approach Speed (kts) |  | |  |  |
| 27 | Final Approach Speed (kts) | 512 | | MSB |  |
| 28 | Latitude/Longitude Status |  | | 0 = Invalid, 1 = Valid |  |
| 29 | Reserved |  | |  |  |
| 30 | Reserved |  | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [2] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. Longitude is Two’s Complement ± 90 Degrees.
2. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AX

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 7, M&S MERGE POINT ID CHARS 1, 2, 3**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Word Count | 1 | | LSB | [1] |
| 10 | Word Count | 0 | | MSB |  |
| 11 | Merge Point ID Status |  | | 0 = Invalid, 1 = Valid |  |
| 12 | Pad |  | |  |  |
| 13 | Character 1 | LSB | |  | [2] |
| 14 | | |  | |  |  |
| 15 | | |  | |  |  |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | Character 1 | MSB | |  |  |
| 19 | Character 2 | LSB | |  | [2] |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | Character 2 | MSB | |  |  |
| 25 | Character 3 | LSB | |  | [2] |
| 26 | | |  | |  |  |
| 27 | | |  | |  |  |
| 28 | | |  | |  |  |
| 29 | | |  | |  |  |
| 30 | Character 3 | MSB | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [3] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. Word Count identifies which set of Merge Point ID characters are present.
2. Encoded as a 6-bit subset as specified in RTCA DO-181E, Section 2.2.19.1.13.
3. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AY

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 8, M&S MERGE POINT ID CHARS 4, 5, 6**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Word Count | 0 | | LSB | [1] |
| 10 | Word Count | 1 | | MSB |  |
| 11 | Merge Point ID Status |  | | 0 = Invalid, 1 = Valid |  |
| 12 | Pad |  | |  |  |
| 13 | Character 4 | LSB | |  | [2] |
| 14 | | |  | |  |  |
| 15 | | |  | |  |  |
| 16 | | |  | |  |  |
| 17 | | |  | |  |  |
| 18 | Character 4 | MSB | |  |  |
| 19 | Character 5 | LSB | |  | [2] |
| 20 | | |  | |  |  |
| 21 | | |  | |  |  |
| 22 | | |  | |  |  |
| 23 | | |  | |  |  |
| 24 | Character 5 | MSB | |  |  |
| 25 | Character 6 | LSB | |  | [2] |
| 26 | | |  | |  |  |
| 27 | | |  | |  |  |
| 28 | | |  | |  |  |
| 29 | | |  | |  |  |
| 30 | Character 6 | MSB | |  |  |
| 31 | Data Type Continuation Bit | 0 | |  | [3] |
| 32 | Parity(Odd) |  | |  |  |

Notes:

1. Word Count identifies which set of Merge Point ID characters are present.
2. Encoded as a 6-bit subset as specified in RTCA DO-181E, Section 2.2.19.1.13.
3. The Data Type Continuation bit should be set to ZERO – indicating that this data type has not been terminated.

PART 6AZ

**ARINC 429 FORMAT FROM DISPLAY**

**AIF TRANSACTION 2, WORD 9, M&S MINIMUM DISTANCE AND SPACING INTERVAL**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Spacing Interval (in seconds) | 1 | | LSB |  |
| 10 | | | 2 | |  |  |
| 11 | | | 4 | |  |  |
| 12 | | | 8 | |  |  |
| 13 | | | 16 | |  |  |
| 14 | | | 32 | |  |  |
| 15 | | | 64 | |  |  |
| 16 | | | 128 | |  |  |
| 17 | | | 256 | |  |  |
| 18 | | | 512 | |  |  |
| 19 | Spacing Interval (in seconds) | 1024 | | MSB |  |
| 20 | Minimum Distance (in Nm) | 0.03125 | | LSB |  |
| 21 | | | 0.0625 | |  |  |
| 22 | | | 0.125 | |  |  |
| 23 | | | 0.25 | |  |  |
| 24 | | | 0.5 | |  |  |
| 25 | | | 1 | |  |  |
| 26 | | | 2 | |  |  |
| 27 | | | 4 | |  |  |
| 28 | | | 8 | |  |  |
| 29 | | | 16 | |  |  |
| 30 | Minimum Distance (in Nm) | 32 | | MSB |  |
| 31 | Data Type Continuation Bit | 1 | |  | [1] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. The Data Type Continuation bit should be set to One – indicating that this data type has been terminated.

PART 6BA

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 1, M&S COMPUTED AIRSPEED TARGET**

**LABEL 174 [1]**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Pad | 0 | |  |  |
| 10 | Pad | 0 | |  |  |
| 11 | Display |  | |  | [3] |
| 12 | Pad | 0 | |  |  |
| 13 | Pad | 0 | |  |  |
| 14 | Pad | 0 | |  |  |
| 15 | Airspeed (kts) | 0.0625 | | LSB – Airspeed 1024 Knots |  |
| 16 | | | 0.125 | | Two’s Complement |  |
| 17 | | | 0.25 | |  |  |
| 18 | | | 0.5 | |  |  |
| 19 | | | 1 | |  |  |
| 20 | | | 2 | |  |  |
| 21 | | | 4 | |  |  |
| 22 | | | 8 | |  |  |
| 23 | | | 16 | |  |  |
| 24 | | | 32 | |  |  |
| 25 | | | 64 | |  |  |
| 26 | | | 128 | |  |  |
| 27 | | | 256 | |  |  |
| 28 | Airspeed (kts) | 512 | | MSB |  |
| 29 | Sign |  | |  |  |
| 30 | Pad |  | |  |  |
| 31 | Data Type Continuation Bit |  | |  | [2] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. The displayed data could be either CAS or Mach. Both are made available to the display.
2. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.
3. 0 = Do Not Display Value  
   1 = Display Value
4. This separate speed command valid bit is used to determine if this speed command is displayable.

PART 6BB

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 2, M&S MACH TARGET**

**LABEL 174 [1]**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Label | | 174 |  | M&S Mach Value Block Data | | | | |
|  | | | | | | | | |
| **BIT** | **FUNCTION** | | | | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | | | | 1 | 0 |  |  |
| 2 | Label 1st Digit | | | | 1 |  |  |
| 3 | Label 2nd Digit | | | | 7 | 1 |  |  |
| 4 | Label 2nd Digit | | | | 1 |  |  |
| 5 | Label 2nd Digit | | | | 1 |  |  |
| 6 | Label 3rd Digit | | | | 4 | 1 |  |  |
| 7 | Label 3rd Digit | | | | 0 |  |  |
| 8 | Label 3rd Digit | | | | 0 |  |  |
| 9 | Pad | | | |  | |  |  |
| 10 | Pad | | | |  | |  |  |
| 11 | Display | | | |  | |  | [3] |
| 12 | Pad | | | |  | |  |  |
| 13 | Pad | | | |  | |  |  |
| 14 | Mach LSB | | | | 0.0000625 | | Mach Value 2.048/215 |  |
| 15 | | | | | | 0.000125 | | Two’s Complement |  |
| 16 | | | | | | 0.00025 | |  |  |
| 17 | | | | | | 0.0005 | |  |  |
| 18 | | | | | | 0.001 | |  |  |
| 19 | | | | | | 0.002 | |  |  |
| 20 | | | | | | 0.004 | |  |  |
| 21 | | | | | | 0.008 | |  |  |
| 22 | | | | | | 0.016 | |  |  |
| 23 | | | | | | 0.032 | |  |  |
| 24 | | | | | | 0.064 | |  |  |
| 25 | | | | | | 0.128 | |  |  |
| 26 | | | | | | 0.256 | |  |  |
| 27 | | | | | | 0.512 | |  |  |
| 28 | Mach MSB | | | | 1.024 | |  |  |
| 29 | Sign | | | |  | |  |  |
| 30 | Pad | | | |  | |  |  |
| 31 | Data Type Continuation Bit | | | | 0 | |  | [2] |
| 32 | Parity (Odd) | | | |  | |  |  |

Notes:

1. The displayed data could be either CAS or Mach. Both are made available to the display.
2. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.
3. 0 = Do Not Display Value  
   1 = Display Value
4. This separate speed command valid bit is used to determine if this speed command is displayable.

PART 6BC

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 3, M&S CURRENT COMPUTED AIRSPEED**

**LABEL 174 [1]**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Pad |  | |  |  |
| 10 | Pad |  | |  |  |
| 11 | Display |  | |  | [3] |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Pad |  | |  |  |
| 15 | Airspeed (kts) | 0.0625 | | LSB – Airspeed 1024 Knots |  |
| 16 | | | 0.125 | | Two’s Complement |  |
| 17 | | | 0.25 | |  |  |
| 18 | | | 0.5 | |  |  |
| 19 | | | 1 | |  |  |
| 20 | | | 2 | |  |  |
| 21 | | | 4 | |  |  |
| 22 | | | 8 | |  |  |
| 23 | | | 16 | |  |  |
| 24 | | | 32 | |  |  |
| 25 | | | 64 | |  |  |
| 26 | | | 128 | |  |  |
| 27 | | | 256 | |  |  |
| 28 | Airspeed (kts) | 512 | | MSB |  |
| 29 | Sign |  | |  |  |
| 30 | Pad |  | |  |  |
| 31 | Data Type Continuation Bit |  | |  | [2] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. The displayed data could be either CAS or Mach. Both are made available to the display.
2. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.
3. 0 = Do Not Display Value  
   1 = Display Value
4. This separate speed command valid bit is used to determine if this speed command is displayable.

PART 6BD

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 4, M&S CURRENT MACH**

**LABEL 174 [1]**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Label | | 174 |  | M&S Mach Value Block Data | | | | |
|  | | | | | | | | |
| **BIT** | **FUNCTION** | | | | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | | | | 1 | 0 |  |  |
| 2 | Label 1st Digit | | | | 1 |  |  |
| 3 | Label 2nd Digit | | | | 7 | 1 |  |  |
| 4 | Label 2nd Digit | | | | 1 |  |  |
| 5 | Label 2nd Digit | | | | 1 |  |  |
| 6 | Label 3rd Digit | | | | 4 | 1 |  |  |
| 7 | Label 3rd Digit | | | | 0 |  |  |
| 8 | Label 3rd Digit | | | | 0 |  |  |
| 9 | Pad | | | |  | |  |  |
| 10 | Pad | | | |  | |  |  |
| 11 | Display | | | |  | |  | [3] |
| 12 | Pad | | | |  | |  |  |
| 13 | Pad | | | |  | |  |  |
| 14 | Mach | | | | 0.0000625 | | LSB – Mach Value 2.048/215 |  |
| 15 | | | | | | 0.000125 | | Two’s Complement |  |
| 16 | | | | | | 0.00025 | |  |  |
| 17 | | | | | | 0.0005 | |  |  |
| 18 | | | | | | 0.001 | |  |  |
| 19 | | | | | | 0.002 | |  |  |
| 20 | | | | | | 0.004 | |  |  |
| 21 | | | | | | 0.008 | |  |  |
| 22 | | | | | | 0.016 | |  |  |
| 23 | | | | | | 0.032 | |  |  |
| 24 | | | | | | 0.064 | |  |  |
| 25 | | | | | | 0.128 | |  |  |
| 26 | | | | | | 0.256 | |  |  |
| 27 | | | | | | 0.512 | |  |  |
| 28 | Mach | | | | 1.024 | | MSB |  |
| 29 | Pad | | | |  | |  |  |
| 30 | Pad | | | |  | |  |  |
| 31 | Data Type Continuation Bit | | | |  | |  | [2] |
| 32 | Parity (Odd) | | | |  | |  |  |

Notes:

1. The displayed data could be either CAS or Mach. Both are made available to the display.
2. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.
3. 0 = Do Not Display Value  
   1 = Display Value
4. This separate speed command valid bit is used to determine if this speed command is displayable.

PART 6BE

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 5, M&S SPACING DISTANCE ERROR**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Pad |  | |  |  |
| 10 | Pad |  | |  |  |
| 11 | Display |  | |  | [2] |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Pad |  | |  |  |
| 15 | Spacing Distance Error (nmi) | 0.0025 | | LSB – Spacing Distance Error 40.96 nm/214 | [4] |
| 16 | | | 0.005 | | Two’s Complement |  |
| 17 | | | 0.01 | |  |  |
| 18 | | | 0.02 | |  |  |
| 19 | | | 0.04 | |  |  |
| 20 | | | 0.08 | |  |  |
| 21 | | | 0.16 | |  |  |
| 22 | | | 0.32 | |  |  |
| 23 | | | 0.64 | |  |  |
| 24 | | | 1.28 | |  |  |
| 25 | | | 2.56 | |  |  |
| 26 | | | 5.12 | |  |  |
| 27 | | | 10.24 | |  |  |
| 28 | Spacing Distance Error (nmi) | 20.48 | | MSB |  |
| 29 | Sign |  | |  | [3] |
| 30 | Pad |  | |  |  |
| 31 | Data Type Continuation Bit |  | |  | [1] |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.
2. 0 = Do Not Display Value  
   1 = Display Value
3. Negative value indicates target is too close (icon of ideal position would appear behind ownship), i.e., this value represents current distance minus commanded distance.
4. Represents delta target spacing distance, comparing current distance compared to pilot’s commanded time interval

PART 6BF

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 4, WORD 6, M&S STATUS MESSAGE**

**LABEL 174**

| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| --- | --- | --- | --- | --- | --- |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | Pad |  | |  |  |
| 10 | Pad |  | |  |  |
| 11 | M&S Status |  | | 0 = Inactive  1 = Active Represents pilot selection AND software status |  |
| 12 | Speed Change Indicator |  | | 0 = Speed Not Changed  1 = Speed Changed A speed command has been issued different than a previous command. Causes a message to be posted. |  |
| 13 | Speed Command Valid |  | | 1 = Valid  0 = Invalid Applies to either mach or airspeed. Dashes if invalid. |  |
| 14 | Ownship Data Error |  | | 0 = No Error  1 = Error Pilot may elect to abort operation or attempt later |  |
| 15 | TTF Data Error |  | | 0 = No Error  1 = Error Pilot may elect to follow a different aircraft or the TTF may have gotten out of range. |  |
| 16 | Waiting for TTF Error |  | | 0 = No Error  1 = Error Not yet acquired. |  |
| 17 | TTF behind Ownship Error |  | | 0 = No Error  1 = Error Attempt to gain visual contact with intended coupling target |  |
| 18 | Bad Geometry Error |  | | 0 = No Error  1 = Error Attempt to gain visual contact target who may be on a different course than expected. Algorithm will not converge. |  |
| 19 | Minimum Distance Error |  | | 0 = No Error  1 = Error Following too close, after several speed command changes, tied in with minimum distance. |  |
| 20 | Configuration Data Error |  | | 0 = No Error  1 = Error algorithm requires some configuration data, i.e., aircraft data that the current operation requires. Received at startup. |  |
| 21 | Spare |  | |  |  |
| 22 | Spare |  | |  |  |
| 23 | Spare |  | |  |  |
| 24 | Spare |  | |  |  |
| 25 | DISPLAY Data Error |  | | 1 = Error, 0 = No Error Bad DISPLAY communication (optional). |  |
| 26 | Speed Change – Second Level |  | | Significant speed change may drive a more urgent message; could drive an aural. |  |
| 27 | Excessive Speed Change |  | | 1 = Excessive, 0 = Not Excessive Aircraft speed is too variant compared to the command, thus convergence has not been achieved. |  |
| 28 | CAS/Mach Flag |  | | 1 = Mach Selected, 0 = CAS Selected to EFB, corresponds the Label 160 output bit 12 |  |
| 29 | DISPLAY Message Status |  | | 1 = Message Active, 0 = Message Not Active Could be used to flag the fact that a message is available. |  |
| 30 | Pad |  | |  |  |
| 31 | Data Type Continuation Bit | 1 | |  | [1] |
| 32 | Parity (Odd) |  | |  |  |

Note:

1. 0 = Indicates that this data type has not been terminated.  
   1 = Indicates that this data type has been terminated.

PART 6BG

**ARINC 429 FORMAT TO DISPLAY**

**AIF TRANSACTION 5, WORD 1, M&S DIFFERENTIAL GROUND SPEED**

**LABEL 174**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI |  | | LSB | [1] |
| 10 | SDI |  | | MSB |  |
| 11 | Pad |  | |  |  |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Pad |  | |  |  |
| 15 | Pad |  | |  |  |
| 16 | M&S Differential GS Status |  | | 0 = Invalid, 1 = Valid |  |
| 17 | M&S Differential GS (kts) | 0.5 | | LSB - Max. Range: 2048 – 1 LSB |  |
| 18 | | | 1.0 | | Two’s Complement Binary |  |
| 19 | | | 2.0 | |  |  |
| 20 | | | 4.0 | |  |  |
| 21 | | | 8.0 | |  |  |
| 22 | | | 16.0 | |  |  |
| 23 | | | 32.0 | |  |  |
| 24 | | | 64.0 | |  |  |
| 25 | | | 128.0 | |  |  |
| 26 | | | 256.0 | |  |  |
| 27 | | | 512.0 | |  |  |
| 28 | M&S Differential GS (kts) | 1024.0 | | MSB |  |
| 29 | M&S Differential GS |  | | Sign | [2] |
| 30 | Pad |  | |  |  |
| 31 | Data Type Continuation Bit |  | | Set to 1 |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Sign Field

0 = Departing from Ownship

1 = Closing on Ownship

PART 6BH

**ARINC 429 FORMAT TO/FROM DISPLAY**

**APPLICATION INFORMATION FILE – START OF TRANSMISSION (STX) WORD**

**LABEL 175**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 5 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 1 |  |  |
| 9 | Number of Words in CDTI Block | 1 | |  | [1] [2] |
| 10 | | | 2 | |  |  |
| 11 | | | 4 | |  |  |
| 12 | | | 8 | |  |  |
| 13 | | | 16 | |  |  |
| 14 | | | 32 | |  |  |
| 15 | | | 64 | |  |  |
| 16 | | | 128 | |  |  |
| 17 | | | 256 | |  |  |
| 18 | | | 512 | |  |  |
| 19 | Number of Words in CDTI Block | 1024 | |  |  |
| 20 | Pad |  | |  |  |
| 21 | Pad |  | |  |  |
| 22 | Pad |  | |  |  |
| 23 | Pad |  | |  |  |
| 24 | Pad |  | |  |  |
| 25 | ISO #5 Char STX (0/2) LSB | 0 | |  |  |
| 26 | | | 1 | |  |  |
| 27 | | | 0 | |  |  |
| 28 | | | 0 | |  |  |
| 29 | | | 0 | |  |  |
| 30 | | | 0 | |  |  |
| 31 | ISO #5 Char STX (0/2) MSB | 0 | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. This field contains the total number of ARINC 429 words, including the STX/ETX control words and the CDTI Block Data Transfer Header, in the CDTI Block Data Transfer File.
2. The number of words in the CDTI Block Data Transfer can range from a minimum of 3 words (STX, file header, and ETX) to a maximum of 2048 words.

PART 6BI

**ARINC 429 FORMAT TO/FROM DISPLAY**

**APPLICATION INFORMATION FILE – END OF TRANSMISSION (ETX) WORD**

**LABEL 175**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 1 | 0 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 5 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 1 |  |  |
| 9 | Number of Words in CDTI Block | 1 | | LSB | [1] [2] |
| 10 | | | 2 | |  |  |
| 11 | | | 4 | |  |  |
| 12 | | | 8 | |  |  |
| 13 | | | 16 | |  |  |
| 14 | | | 32 | |  |  |
| 15 | | | 64 | |  |  |
| 16 | | | 128 | |  |  |
| 17 | | | 256 | |  |  |
| 18 | | | 512 | |  |  |
| 19 | Number of Words in CDTI Block | 1024 | | MSB |  |
| 20 | Pad |  | |  |  |
| 21 | Pad |  | |  |  |
| 22 | Pad |  | |  |  |
| 23 | Pad |  | |  |  |
| 24 | Pad |  | |  |  |
| 25 | ISO #5 Char ETX (0/3) LSB | 1 | |  |  |
| 26 | | | 1 | |  |  |
| 27 | | | 0 | |  |  |
| 28 | | | 0 | |  |  |
| 29 | | | 0 | |  |  |
| 30 | | | 0 | |  |  |
| 31 | ISO #5 Char ETX (0/3) MSB | 0 | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. This field contains the total number of ARINC 429 words, including the STX/ETX control words and the CDTI Block Data Transfer Header, in the CDTI Block Data Transfer File.
2. The number of words in the CDTI Block Data Transfer can range from a minimum of 3 words (STX, file header, and ETX) to a maximum of 2048 words.

PART 6BJ

**ARINC 429 FORMAT TO DISPLAY**

**M&S COMMAND SPEED – CAS BNR WORD**

**LABEL 370**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 3 | 1 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI | LSB | |  | [1] |
| 10 | SDI | MSB | |  |  |
| 11 | Flash Field |  | |  | [2] |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Pad |  | |  |  |
| 15 | M&S Command Speed CAS | 0.0625 | | LSB Maximum Range is 1024 Knots – 1 LSB |  |
| 16 | | | 0.125 | | Two’s Complement Binary |  |
| 17 | | | 0.25 | |  |  |
| 18 | | | 0.5 | |  |  |
| 19 | | | 1 | |  |  |
| 20 | | | 2 | |  |  |
| 21 | | | 4 | |  |  |
| 22 | | | 8 | |  |  |
| 23 | | | 16 | |  |  |
| 24 | | | 32 | |  |  |
| 25 | | | 64 | |  |  |
| 26 | | | 128 | |  |  |
| 27 | | | 256 | |  |  |
| 28 | M&S Command Speed CAS | 512 | | MSB |  |
| 29 | Sign |  | | 0 = Positive, 1 = Undefined |  |
| 30 | SSM |  | |  | [3] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. 0 = Continuous, 1 = Flashing

Flash is used to indicate the need for a second level speed change.

1. Sign Status Matrix (SSM) (BNR)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

PART 6BK

**ARINC 429 FORMAT TO DISPLAY**

**M&S COMMAND SPEED – MACH BNR WORD**

**LABEL 372**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 3 | 1 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 2 | 0 |  |  |
| 7 | Label 3rd Digit | 1 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI | LSB | |  | [1] |
| 10 | SDI | MSB | |  |  |
| 11 | Flash Field |  | | 0 = Continuous, 1 = Flashing |  |
| 12 | Pad |  | |  |  |
| 13 | M&S Command Speed Mach | 0.0000625 | | LSB Maximum Range is 4.096 – 1 LSB Mach |  |
| 14 | | | 0.000125 | | Two’s Complement Binary |  |
| 15 | | | 0.00025 | |  |  |
| 16 | | | 0.0005 | |  |  |
| 17 | | | 0.001 | |  |  |
| 18 | | | 0.002 | |  |  |
| 19 | | | 0.004 | |  |  |
| 20 | | | 0.008 | |  |  |
| 21 | | | 0.016 | |  |  |
| 22 | | | 0.032 | |  |  |
| 23 | | | 0.064 | |  |  |
| 24 | | | 0.128 | |  |  |
| 25 | | | 0.256 | |  |  |
| 26 | | | 0.512 | |  |  |
| 27 | | | 1.024 | |  |  |
| 28 | M&S Command Speed Mach | 2.048 | | MSB |  |
| 29 | Sign |  | | 0 = Positive, 1 = Undefined |  |
| 30 | SSM |  | |  | [2] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Sign Status Matrix (SSM) (BNR)

|  |  |  |
| --- | --- | --- |
| **BIT 31** | **BIT 30** | **MEANING** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

PART 6BL

**ARINC 429 FORMAT TO DISPLAY**

**M&S DIFFERENTIAL GROUND SPEED BNR WORD [3]**

**LABEL 373**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 3 | 1 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 3 | 0 |  |  |
| 7 | Label 3rd Digit | 1 |  |  |
| 8 | Label 3rd Digit | 1 |  |  |
| 9 | SDI | LSB | |  | [1] |
| 10 | SDI | MSB | |  |  |
| 11 | Flash Field |  | | 0 = Continuous, 1 = Flashing | [4] |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Pad |  | |  |  |
| 15 | Pad |  | |  |  |
| 16 | Pad |  | |  |  |
| 17 | M&S Differential GS | 0.5 | | Kts LSB Maximum Range is 2048 – 1 LSB |  |
| 18 | | | 1.0 | | Two’s Complement Binary |  |
| 19 | | | 2.0 | |  |  |
| 20 | | | 4.0 | |  |  |
| 21 | | | 8.0 | |  |  |
| 22 | | | 16.0 | |  |  |
| 23 | | | 32.0 | |  |  |
| 24 | | | 64.0 | |  |  |
| 25 | | | 128.0 | |  |  |
| 26 | | | 256.0 | |  |  |
| 27 | | | 512.0 | |  |  |
| 28 | M&S Differential GS | 1024.0 | | MSB |  |
| 29 | Sign |  | | 0 = Own aircraft faster than target (+)  1 = Own aircraft slower than target (-) |  |
| 30 | SSM |  | |  | [2] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Sign Status Matrix (SSM) (BNR)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. This label is filled only when M&S aircraft have been selected. This label is not filled when M&S highlight only has occurred.
2. This field allows the ACAS X traffic computer to control whether the speed guidance is displayed continually or it is flashing.

PART 6BM

**ARINC 429 FORMAT TO DISPLAY**

**M&S DISTANCE (SLANT RANGE) BNR WORD**

**LABEL 374**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **DESCRIPTION** | **NOTES** |
| 1 | Label 1st Digit | 3 | 1 |  |  |
| 2 | Label 1st Digit | 1 |  |  |
| 3 | Label 2nd Digit | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit | 1 |  |  |
| 6 | Label 3rd Digit | 4 | 1 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit | 0 |  |  |
| 9 | SDI |  | | LSB | [1] |
| 10 | SDI |  | | MSB |  |
| 11 | Flash Field |  | | 0 = Continuous, 1 = Flashing | [3] |
| 12 | Pad |  | |  |  |
| 13 | Pad |  | |  |  |
| 14 | Distance (nmi) | 0.015625 | | LSB Max Range is 512 – 1 LSB |  |
| 15 | | | 0.03125 | | Two’s Complement Binary |  |
| 16 | | | 0.0625 | |  |  |
| 17 | | | 0.125 | |  |  |
| 18 | | | 0.25 | |  |  |
| 19 | | | 0.5 | |  |  |
| 20 | | | 1.0 | |  |  |
| 21 | | | 2.0 | |  |  |
| 22 | | | 4.0 | |  |  |
| 23 | | | 8.0 | |  |  |
| 24 | | | 16.0 | |  |  |
| 25 | | | 32.0 | |  |  |
| 26 | | | 64.0 | |  |  |
| 27 | | | 128.0 | |  |  |
| 28 | Distance (nmi) | 256.0 | | MSB |  |
| 29 | Pad |  | |  |  |
| 30 | SSM |  | |  | [2] |
| 31 | SSM |  | |  |  |
| 32 | Parity (Odd) |  | |  |  |

Notes:

1. SDI Field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 10** | **SDI BIT 9** | **MEANING** |
| 0 | 0 | All-Call |
| 0 | 1 | Reserved |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Sign Status Matrix (SSM) (BNR)

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. This field allows the ACAS X traffic computer to control whether the M&S Distance is displayed continually or it is flashing.

PART 6BN

**ARINC 429 FORMAT DISPLAY TO TCAS**

**TRAFFIC DESIGNATION/COMMAND WORD**

**LABEL 024 [7]**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 0 0

2 Label 1st Digit 0

3 Label 2nd Digit 2 0

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 4 1

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 SDI [1]

10 SDI

11 Selected/ITP Reference traffic number 1 [3]

12 Selected/ITP Reference traffic number 2 [3]

13 Selected/ITP Reference traffic number 4 [3]

14 Selected/ITP Reference traffic number 8 [3]

15 Selected/ITP Reference traffic number 16 [3]

16 Selected/ITP Reference traffic number 32 [3]

17 Selected/ITP Reference traffic number 64 [3]

18 Selected/ITP Reference selection [3] [6]

19 Selected/ITP Reference Status [4]

20 Designated traffic number 1 [3]

21 Designated traffic number 2 [3]

22 Designated traffic number 4 [3]

23 Designated traffic number 8 [3]

24 Designated traffic number 16 [3]

25 Designated traffic number 32 [3]

26 Designated traffic number 64 [3]

27 Designation Status [5]

28 Designated/Coupled selection [2] [3]

29 Pad

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI field

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | Not used |
| 1 | 0 | CAPT side |
| 0 | 1 | F/O side |
| 1 | 1 | Not used |

1. Designated/Coupled Selection

This information is a provision for ASAS applications. In order to be a Coupled target, an aircraft must first be Designated.

|  |  |
| --- | --- |
| **BIT 28** | **MEANING** |
| 0 | Designated |
| 1 | Coupled |

1. In this section, reference is made to the following four terms: Selected, ITP Reference, Designated, and Coupled. The ARINC 735C use of these terms is described in PART 6AG.
2. Selected/ITP Reference Status. If set to 1, indicates that traffic has neither been selected nor is an ITP Reference aircraft and that bits 11 through 17 can be ignored. If set to 0, indicates that an aircraft is being selected or is an ITP reference aircraft, with the aircraft traffic number as indicated in bits 11 through 17.
3. Designation Status. If set to 1, indicates that no traffic is designated and that bits 20 to 26 have no meaning and should be ignored. If set to 0, indicates that an aircraft is being designated, with the aircraft traffic number as indicated in bits 20 through 26.
4. Selected/ITP Reference selection. If set to 0, indicates that bits 11 through 17 are the Selected traffic number. If set to 1, indicates that bits 11 through 17 are the ITP Reference traffic number.
5. This label is identical in content to the Label 272 described in PART 6AG and PART 6AJ. It is being put into place as an alternate to accommodate displays which may already be consuming Label 272 as an output.

PART 6BO

**ARINC 429 FORMAT DISPLAY TO TCAS**

**DISPLAYED TRAFFIC WORD 1**

**LABEL 144**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 4 1

4 Label 2nd Digit 0

5 Label 2nd Digit 0

6 Label 3rd Digit 4 1

7 Label 3rd Digit 0

8 Label 3rd Digit 0

9 SDI [1]

10 SDI

11 Pad

12 Pad

13 Report Validity [2]

14 traffic number X + 0 [3]

15 traffic number X + 1

16 traffic number X + 2

17 traffic number X + 3

18 traffic number X + 4

19 traffic number X + 5

20 traffic number X + 6

21 traffic number X + 7

22 traffic number X + 8

23 traffic number X + 9

24 traffic number X + 10

25 traffic number X + 11

26 traffic number X + 12

27 traffic number X + 13

28 traffic number X + 14

29 traffic number X + 15

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI field

This label is sent out 4 consecutive times with one label each from the set shown below. This allows Label 144 to represent traffic numbers 0 through 63. In tandem with Label 157, all 128 potential traffic members potentially displayed can be communicated from display to TCAS computer for the TCAS use in determining sequences of traffic for highlighting and selecting.

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | X = 0, traffic number 0 to 15 |
| 1 | 0 | X = 16, traffic number 16 to 31 |
| 0 | 1 | X = 32, traffic number 32 to 47 |
| 1 | 1 | X = 48, traffic number 48 to 63 |

1. Report Validity
2. 0 = Invalid  
   1 = Valid
3. If a bit is set to 1 it indicates that the traffic with this corresponding traffic number in the DTIF is currently displayed. If the bit is set to zero then that traffic is not displayed.
4. For example, the DTIF may contain 90 traffic elements, but only 8 traffic elements are presented to the pilot on a display. This word identifies which of those 90 are presented on the display. Not all the traffic provided in the DTIF to the display are necessarily presented to the pilot (e.g., due to range setting of the display, above/below/normal filtering, or design choice of the display to present only the first 8 traffic in the DTIF).

PART 6BP

**ARINC 429 FORMAT DISPLAY TO TCAS**

**DISPLAYED TRAFFIC WORD 2**

**LABEL 157**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit 1 0

2 Label 1st Digit 1

3 Label 2nd Digit 5 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 7 1

7 Label 3rd Digit 1

8 Label 3rd Digit 1

9 SDI [1]

10 SDI

11 Pad

12 Pad

13 Report Validity [2]

14 traffic number X + 0 [3]

15 traffic number X + 1

16 traffic number X + 2

17 traffic number X + 3

18 traffic number X + 4

19 traffic number X + 5

20 traffic number X + 6

21 traffic number X + 7

22 traffic number X + 8

23 traffic number X + 9

24 traffic number X + 10

25 traffic number X + 11

26 traffic number X + 12

27 traffic number X + 13

28 traffic number X + 14

29 traffic number X + 15

30 SSM

31 SSM

32 Parity (Odd)

Notes:

1. SDI Field

This label is sent out 4 consecutive times with one label each from the set shown below. This allows Label 157 to represent traffic numbers 64 through 127. In tandem with Label 144, all 128 potential traffic members potentially displayed can be communicated from display to TCAS computer for the TCAS use in determining sequences of traffic for highlighting and selecting.

|  |  |  |
| --- | --- | --- |
| **SDI BIT 9** | **SDI BIT 10** | **MEANING** |
| 0 | 0 | X = 64, traffic number 64 to 79 |
| 1 | 0 | X = 80, traffic number 80 to 95 |
| 0 | 1 | X = 96, traffic number 96 to 111 |
| 1 | 1 | X = 112, traffic number 112 to 127 |

1. Report Validity
2. 0 = Invalid  
   1 = Valid
3. If a bit is set to 1, it indicates that the traffic with this corresponding traffic number in the DTIF is currently displayed. If the bit is set to zero, then that traffic is not displayed.
4. For example, the DTIF may contain 90 traffic elements, but only 8 traffic elements are presented to the pilot on a display. This word identifies which of those 90 are presented on the display. Not all the traffic provided in the DTIF to the display are necessarily presented to the pilot (e.g., due to range setting of the display, above/below/normal filtering, or design choice of the display to present only the first 8 traffic in the DTIF).

PART 6BQ

**ARINC 429 FORMAT TRANSPONDER TO TCAS**

**ADS-B CONFIGURATION DATA LABEL 354**

**Purpose: This word is used to provide TCAS with ADS-B Configuration information when such information has been provided to the Transponder by the installation**.

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1  2 | Label 1st Digit  Label 1st Digit | 3 1  1 |  |
| 3  4  5 | Label 2nd Digit  Label 2nd Digit  Label 2nd Digit | 5 1  0  1 |  |
| 6  7  8 | Label 3rd Digit  Label 3rd Digit  Label 3rd Digit | 4 1  0  0 |  |
| 9 | SDI LSB |  | [1] |
| 10 | SDI MSB |
| 11 | Length/Width Code LSB |  | [2] |
| 12 | Length/Width Code |
| 13 | Length/Width Code |
| 14 | Length/Width Code MSB |
| 15 | GPS Antenna Position LSB |  | [3] |
| 16 | GPS Antenna Position |
| 17 | GPS Antenna Position |
| 18 | GPS Antenna Position |
| 19 | GPS Antenna Position MSB |
| 20 | NACV LSB |  | [4] |
| 21 | NACV |
| 22 | NACV MSB |
| 23 | SDA LSB |  | [5] |
| 24 | SDA |
| 25 | SDA MSB |
| 26 | Aircraft Category LSB |  | [6] |
| 27 | Aircraft Category |
| 28 | Aircraft Category MSB |
| 29 | Reserved |  |  |
| 30 | SSM LSB |  | [7] |
| 31 | SSM MSB |
| 32 | Parity (Odd) |  |  |

Notes:

|  |  |  |
| --- | --- | --- |
| SDI ENCODING | | |
| **BIT** | | **MEANING** |
| **10** | **9** |
| 0 | 0 | Not Used |
| 0 | 1 | Side 1 |
| 1 | 0 | Side 2 |
| 1 | 1 | Not Used |

|  |  |  |
| --- | --- | --- |
| VALUE | MEANING | |
|  | Length (m) | Width (m) |
| 0 | No Data | No Data |
| 1 | < 15 | < 23 |
| 2 | < 25 | < 28.5 |
| 3 | < 25 | < 34 |
| 4 | < 35 | < 33 |
| 5 | < 35 | < 38 |
| 6 | < 45 | < 39.5 |
| 7 | < 45 | < 45 |
| 8 | < 55 | < 45 |
| 9 | < 55 | < 52 |
| 10 | < 65 | < 59.5 |
| 11 | < 65 | < 67 |
| 12 | < 75 | < 72.5 |
| 13 | < 75 | < 80 |
| 14 | > 75 | < 80 |
| 15 | > 75 | > 80 |
|  |  |

|  |  |
| --- | --- |
| VALUE | MEANING |
| 0 | “0” or No Antenna Position Data |
| 1 | Position Offset Applied by Sensor |
| 2 | 2 m |
| 3 | 4 m |
| … | … |
| 28 | 54 m |
| 29 | 56 m |
| 30 | 58 m |
| 31 | > 58m |

|  |  |
| --- | --- |
| NACV ENCODING  (see Note 54 in Attachment 2B-3 and 2C-3) | |
| **Value** | **Horizontal Velocity Error** |
| 0 | Unknown or > 10 meters/second |
| 1 | < 10 meters/second |
| 2 | < 3 meters/second |
| 3 | < 1 meter/second\_NOT USED |

|  |  |
| --- | --- |
| SDA ENCODING  (see Note 55 in Attachment 2B-3 and 2C-3) | |
| **Value** | **Supported Failure Condition** |
| 0 | Unknown or No Safety Effect |
| 1 | Minor (This encoding is NOT USED) |
| 2 | Major |
| 3 | Hazardous |

1. Encode Aircraft Category according to SET “A” in RTCA DO-260B, Table 2-19 or RTCA DO-260C, Table 2-16.

|  |  |  |
| --- | --- | --- |
| DISCRETE SSM | | |
| **BIT** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |
| Table Note:  The SSM of this Label 354 shall always be set to Normal (e.g., 00). | | |

PART 6BR

**ARINC 429 FORMAT TCAS TO TRANSPONDER**

**BLOCK TRANSFER OF CONFIGURATION DATA**

**LABEL 305**

**Purpose: The 305 Block Transfer is used in those installations where the configuration information is only provided to the Traffic computer function that is physically a part of the TCAS computer. The block transfer is then used to transfer the configuration information to the Transponder which needs the information to structure ADS-B Out messages.**

**Part 6BRa – Label 305 Block Transfer Word 0:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BIT | FUNCTION | CODING | | NOTES |
| 1  2 | Label 1st Digit  Label 1st Digit | 3 1  1 |  | |
| 3  4  5 | Label 2nd Digit  Label 2nd Digit  Label 2nd Digit | 0 0  0  0 |  | |
| 6  7  8 | Label 3rd Digit  Label 3rd Digit  Label 3rd Digit | 5 1  0  1 |  | |
| 9 | ADS-B Emitter Category Set LSB | 0-3 | [1] | |
| 10 | ADS-B Emitter Category Set MSB |
| 11 | Aircraft Category LSB | 0-7 | [2] | |
| 12 | Aircraft Category |
| 13 | Aircraft Category MSB |
| 14 | Length/Width Code LSB | 0-15 | [3] | |
| 15 | Length/Width Code |
| 16 | Length/Width Code |
| 17 | Length/Width Code MSB |
| 18 | 1090 ES In | 0/1 | [4] | |
| 19 | UAT In | 0/1 | [5] | |
| 20 | ADS-B Function Fail  Illuminates Control Panel Fail Lamp | 0/1 | [6] | |
| 21 | Configuration Version Number LSB | 1 | [9] | |
| 22 | Configuration Version Number MSB | 0 |
| 23 | Number of Navigation Sources LSB | 0-7 | [7] | |
| 24 | Number of Navigation Sources |
| 25 | Number of Navigation Sources MSB |
| 26 | Word Number LSB | 0 |  | |
| 27 | Word Number | 0 |  | |
| 28 | Word Number | 0 |  | |
| 29 | Word Number MSB | 0 |  | |
| 30 | SSM LSB |  | [8] | |
| 31 | SSM MSB |
| 32 | Parity (Odd) |  | | |

Notes:

1. Encode ADS-B Category Set as per the following table   
   (Reference: RTCA DO-260B/C, 2.2.3.2.5.2).

|  |  |  |
| --- | --- | --- |
| ADS-B EMITTER CATEGORY SET ENCODING | | |
| **BIT** | | **MEANING** |
| **10** | **9** |
| 0 | 0 | Emitter Category Set D |
| 0 | 1 | Emitter Category Set C |
| 1 | 0 | Emitter Category Set B |
| 1 | 1 | Emitter Category Set A |
| Table Notes:  1. ARINC 718A associated aircraft typically use Category Set A.  2. Category Set D is undefined in DO-260C. | | |

1. Encode Aircraft Category according to RTCA DO-260B, Table 2-19 or RTCA DO-260C Table 2-16.

|  |  |  |  |
| --- | --- | --- | --- |
| ADS-B EMITTER CATEGORY SET ENCODING | | | |
| BIT | 13 | 12 | 11 |
| “ME” BIT | 6 | 7 | 8 |

1. Encode Length/Width Code according to RTCA DO-260B, Table 2-74 or RTCA DO-260C, Table 2-71.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AIRCRAFT/VEHICLE LENGTH/WIDTH ENCODING | | | | |
| BIT | 17 | 16 | 15 | 14 |
| “ME” BIT | 21 | 22 | 23 | 24 |

1. 0 = Aircraft does not have ADS-B 1090 Extended Squitter Receive Capability.
2. 1 = Aircraft does have ADS-B 1090 Extended Squitter Receive Capability.
3. 0 = Aircraft does not have ADS-B UAT Receive Capability.
4. 1 = Aircraft does have ADS-B UAT Receive Capability.
5. 0 = Transponder will not illuminate the ATC/TCAS Control Panel Fail Lamp when and ADS-B Function Failure is active.
6. 1 = Transponder will illuminate the ATC/TCAS Control Panel Fail Lamp when an ADS-B Function Failure is active.
7. Navigation Source Configuration Data, Label 305 Words 1 and 2, may be provided for 0 to 7 Navigation Data Sources. When data is provided for more than 1 source, Words 1 and 2 are repeated for each source.

|  |  |  |
| --- | --- | --- |
| DISCRETE SSM | | |
| **BIT** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

1. Configuration Version Number is encoded as follows:

|  |  |  |
| --- | --- | --- |
| CONFIGURATION VERSION NUMBER ENCODING | | |
| **BIT** | | **MEANING** |
| **22** | **21** |
| 0 | 0 | Version 0: Used by some suppliers prior to publication of ARINC Characteristic 718A Supplement 3. |
| 0 | 1 | Version 1: Established during ARINC Characteristic 718A Supplement 3 to declare the Version of the Configuration Data being transferred in the Word.  This version also applies to ARINC Characteristic 718A Supplement 4. |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

**Part 6BRb – Label 305 Block Transfer Word 1:**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1  2 | Label 1st Digit  Label 1st Digit | 3 1  1 |  |
| 3  4  5 | Label 2nd Digit  Label 2nd Digit  Label 2nd Digit | 0 0  0  0 |  |
| 6  7  8 | Label 3rd Digit  Label 3rd Digit  Label 3rd Digit | 5 1  0  1 |  |
| 9 | Source Integrity Level (SIL) LSB | 0-3 | [1] |
| 10 | Source Integrity Level (SIL) MSB |
| 11 | SIL Supplement | 0/1 | [2] |
| 12 | Lateral GPS Antenna Offset LSB |  | [3] |
| 13 | Lateral GPS Antenna Offset |
| 14 | Lateral GPS Antenna Offset MSB |
| 15 | Longitudinal GPS Antenna Offset LSB |  | [4] |
| 16 | Longitudinal GPS Antenna Offset |
| 17 | Longitudinal GPS Antenna Offset |
| 18 | Longitudinal GPS Antenna Offset |
| 19 | Longitudinal GPS Antenna Offset MSB |
| 20 | Spare | 0 |  |
| 21 | Spare | 0 |  |
| 22 | Spare | 0 |  |
| 23 | Spare | 0 |  |
| 24 | Spare | 0 |  |
| 25 | Spare | 0 |  |
| 26 | Word Number LSB | 1 | [5] |
| 27 | Word Number | 0 |  |
| 28 | Word Number | 0 |  |
| 29 | Word Number MSB | 0 |  |
| 30 | SSM LSB |  | [6] |
| 31 | SSM MSB |
| 32 | Parity (Odd) |  | |

Notes:

1. Encode Source Integrity Level (SIL) as per the following table (Reference: RTCA DO-260B, Table 2-72 and RTCA DO-260C, Table 2-70).

|  |  |  |
| --- | --- | --- |
| SIL Coding | | Probability of Exceeding the  NIC Containment Radius (RC) |
| **(Binary)**  **(Bit 10,9)** | **(Decimal)** |
| 00 | 0 | Unknown or > 1 × 10-3  per flight hour or per sample |
| 01 | 1 | ≤ 1 × 10-3  per flight hour or per sample |
| 10 | 2 | ≤ 1 × 10-5  per flight hour or per sample |
| 11 | 3 | ≤ 1 × 10-7  per flight hour or per sample |

1. 0 = Probability of exceeding NIC radius of containment is based on per hour.
2. 1 = Probability of exceeding NIC radius of containment is based on per sample   
   (Reference: RTCA DO-260B, Table 2-41 and RTCA DO-260C Table 2-32).
3. If the Navigation Source is GPS, encode the Lateral GPS Antenna Offset as per the following table:
4. If the Navigation Source is Not GPS, then encode ALL ZERO’s which means NO DATA   
   (Reference: RTCA DO-260B, Table 2-66 and RTCA DO-260C, Table 2-59).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Lateral GPS Antenna Offset Encoding | | | | |
| **ME Bit**  **(Message Bit)** | | | **Upper Bound of the**  **GPS Antenna Offset**  **Along Lateral (Pitch) Axis**  **Left or Right of Longitudinal (Roll) Axis** | |
| **33**  **(65)** | **34**  **(66)** | **35**  **(67)** |
| **Label 305 Encoding** | | |
| **Bit 14** | **Bit 13** | **Bit 12** | **Direction** | **(meters)** |
| 0  (left) | 0 | 0 | LEFT | NO DATA |
| 0 | 1 | ≤ 2 |
| 1 | 0 | ≤ 4 |
| 1 | 1 | > 4 |
| 1  (right) | 0 | 0 | RIGHT | 0 |
| 0 | 1 | ≤ 2 |
| 1 | 0 | ≤ 4 |
| 1 | 1 | > 4 |
| **Table Notes:** | | | | |
| 1. Left means toward the left wing tip moving from the longitudinal center line of the aircraft.  2. Right means toward the right wing tip moving from the longitudinal center line of the aircraft.  3. The No Data case is indicated by encoding of 000 as above, while the ZERO offset case is represented by encoding of 100 as above.  4. The accuracy requirement is assumed to be better than 2 meters, consistent with the data resolution. | | | | |

1. If the Navigation Source is GPS, encode the Longitudinal GPS Antenna Offset as per the following table:
2. If the Navigation Source is Not GPS, then encode ALL ZERO’s which means NO DATA   
   (Reference: RTCA DO-260B, Table 2-67 and RTCA DO-260C, Table 2-60).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Longitudinal Axis GPS Antenna Offset Encoding | | | | | |
| **ME Bit**  **(Message Bit)** | | | | | **Upper Bound of the**  **GPS Antenna Offset**  **Along Longitudinal (Roll) Axis**  **Aft From Aircraft Nose** |
| **36**  **(68)** | **37**  **(69)** | **38**  **(70)** | **39**  **(71)** | **40**  **(72)** |
| **Label 305 Encoding** | | | | |
| **Bit 19** | **Bit 18** | **Bit 17** | **Bit 16** | **Bit**  **15** | **(meters)** |
| 0 | 0 | 0 | 0 | 0 | NO DATA |
| 0 | 0 | 0 | 0 | 1 | Position Offset Applied by Sensor |
| 0 | 0 | 0 | 1 | 0 | ≤ 2 |
| 0 | 0 | 0 | 1 | 1 | ≤ 4 |
| 0 | 0 | 1 | 0 | 0 | ≤ 6 |
| \* | \* | \* | \* | \* | \*\*\* |
| \* | \* | \* | \* | \* | \*\*\* |
| 1 | 1 | 1 | 1 | 0 | ≤ 58 |
| 1 | 1 | 1 | 1 | 1 | > 58 |
| **Table Notes:** | | | | | |
| 1. The accuracy is assumed to be better than 2 meters, consistent with the data resolution. | | | | | |

1. If there is Configuration Data for more than one Navigation Source, Label 305 Word 1 Word Number will increment 1,3,5…

|  |  |  |
| --- | --- | --- |
| DISCRETE SSM | | |
| **BIT** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

**Part 6BRc – Label 305 Block Transfer Word 2:**

|  |  |  |  |
| --- | --- | --- | --- |
| BIT | FUNCTION | CODING | NOTES |
| 1  2 | Label 1st Digit  Label 1st Digit | 3 1  1 |  |
| 3  4  5 | Label 2nd Digit  Label 2nd Digit  Label 2nd Digit | 0 0  0  0 |  |
| 6  7  8 | Label 3rd Digit  Label 3rd Digit  Label 3rd Digit | 5 1  0  1 |  |
| 9 | Receiver Number/Navigation Source Type LSB |  | [1] |
| 10 | Receiver Number/Navigation Source Type |
| 11 | Receiver Number/Navigation Source Type |
| 12 | Receiver Number/Navigation Source Type MSB |
| 13 | Receiver Number or Navigation Source Type | 0/1 | [1] |
| 14 | System Design Assurance (SDA) LSB | 0-3 | [2] |
| 15 | System Design Assurance (SDA) MSB |
| 16 | Navigation Accuracy Category Velocity (NACV) LSB | 0-7 | [3] |
| 17 | Navigation Accuracy Category Velocity (NACV) |
| 18 | Navigation Accuracy Category Velocity (NACV) MSB |
| 19 | Manufacturer Defined 1 | 0/1 | [4] |
| 20 | Manufacturer Defined 2 | 0/1 | [4] |
| 21 | Spare | 0 |  |
| 22 | Spare | 0 |  |
| 23 | Spare | 0 |  |
| 24 | Spare | 0 |  |
| 25 | Spare | 0 |  |
| 26 | Word Number LSB | 0 | [5] |
| 27 | Word Number | 1 |  |
| 28 | Word Number | 0 |  |
| 29 | Word Number MSB | 0 |  |
| 30 | SSM LSB |  | [6] |
| 31 | SSM MSB |
| 32 | Parity (Odd) |  | |

Notes:

1. Receiver Number or Navigation Source Type:
2. If Bit 13 = “0,” then the configuration data in Words 1 and 2 applies to the Navigation Source which is connected to the ARINC 429 receiver number indicated in Bits 9 – 12.
3. If Bit 13 = “1,” then the configuration data in Words 1 and 2 applies to the Navigation Source Type in accordance with the following table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Navigation Source Type Encoding | | | | |
| **Label 305 Encoding** | | | | **Navigation Source Type** |
| **Bit**  **12** | **Bit**  **11** | **Bit**  **10** | **Bit**  **9** |
| 0 | 0 | 0 | 0 | GPS 1 |
| 0 | 0 | 0 | 1 | GPS 2 |
| 0 | 0 | 1 | 0 | IRS |
| 0 | 0 | 1 | 1 | FMS |
| 0 | 1 | 0 | 0 | Hybrid GPS/IRS |
| 0 | 1 | 0 | 1 | Reserved |
| All Other combinations | | | | Undefined |

1. Encode System Design Assurance (SDA) as per the following table (Reference: RTCA DO-260B, Table 2-65 and RTCA DO-260C, Table 2-58).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| System Design Assurance (SDA) Encoding | | | | |
| **SDA Value** | | **Supported Failure Condition Note 2** | **Probability of Undetected Fault causing transmission of False or Misleading Information Note 3,4** | **Software & Hardware Design Assurance Level Note 1,3** |
| **(decimal)** | **(binary)**  **(Bit 15,14)** |
| 0 | 0 0 | Unknown/ No safety effect | > 1x10-3 per flight hour or Unknown | N/A |
| 1 | 0 1 | Minor | ≤ 1x10-3 per flight hour | D |
| 2 | 1 0 | Major | ≤ 1x10-5 per flight hour | C |
| 3 | 1 1 | Hazardous | ≤ 1x10-7 per flight hour | B |
| Table Notes: | | | | |
| 1. Software Design Assurance per RTCA DO-178B/C (EUROCAE ED-12B/C). Airborne Electronic Hardware Design Assurance per RTCA DO-254 (EUROCAE ED-80).  2. Supported Failure Classification defined in AC-23.1309-1E, AC-25.1309-1A, and AC 29-2C.  3. Because the broadcast position can be used by any other ADS-B equipped aircraft or by ATC, the provisions in AC 23-1309-1E that allow reduction in failure probabilities and design assurance level for aircraft under 6000 pounds do not apply.  4. Includes probability of transmitting false or misleading latitude, longitude, or associated accuracy and integrity metrics. | | | | |

1. Encode Navigation Accuracy Category\_Velocity (NACV) as per the following table (Reference: RTCA DO-260B, Table 2-22 and RTCA DO-260C, Table 2-18).

|  |  |  |
| --- | --- | --- |
| Navigation Accuracy Category for Velocity | | |
| **Coding** | | **Horizontal Velocity Error** |
| **(Binary)**  **(Bit 20, 19, 18)** | **(Decimal)** |
| 0 0 0 | 0 | Unknown or > 10 m/s |
| 0 0 1 | 1 | < 10 m/s |
| 0 1 0 | 2 | < 3 m/s |
| 0 1 1 | 3 | < 1 m/s |
| 1 0 0 | 4 | < 0.3 m/s |
| 1 0 1 | 5 | Unknown |
| 1 1 0 | 6 | Unknown |
| 1 1 1 | 7 | Navigation Source Provides NACV Parameter Information |

1. Provisions should be provided to set Supplier Defined bits to either state.
2. If there is Configuration Data for more than one Navigation Source, Label 350 Word 2 Word Number will increment 2, 4, 6, and so forth.

|  |  |  |
| --- | --- | --- |
| **DISCRETE SSM** | | |
| **BIT** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6BS

**ARINC 429 FORMAT WORD TCAS TO DISPLAY**

**RELATIVE ALTITUDE OF THE MOST THREATENING TRAFFIC PRESENT IN TIF/DTIF**

**LABEL 134**

|  |  |  |  |
| --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | **NOTES** |
| 1 | Label 1st Digit (MSB) | 1 0 |  |
| 2 | Label 1st Digit (LSB) | 1 |  |
| 3 | Label 2nd Digit (MSB) | 3 0 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |
| 6 | Label 3rd Digit (MSB) | 4 1 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |
| 9 | PAD |  |  |
| 10 | PAD |  |  |
| 11 | Display Matrix |  | [1] |
| 12 | Display Matrix |  |  |
| 13 | Display Matrix |  |  |
| 14 | Intruder Vertical Sense |  | [2] |
| 15 | Intruder Vertical Sense |  |  |
| 16 | Spare |  |  |
| 17 | Spare |  |  |
| 18 | Spare |  |  |
| 19 | Spare |  |  |
| 20 | Spare |  |  |
| 21 | Non Altitude Reporting traffic |  | [3] |
| 22 | Relative Altitude | 100 |  |
| 23 | Relative Altitude | 200 Binary, |  |
| 24 | Relative Altitude | 400 Two’s |  |
| 25 | Relative Altitude | 800 Complement |  |
| 26 | Relative Altitude | 1600 Range = |  |
| 27 | Relative Altitude | 3200 ± 12,700 ft. |  |
| 28 | Relative Altitude | 6400 |  |
| 29 | Relative Altitude | Sign |  |
| 30 | SSM |  | [4] [5] [6] |
| 31 | SSM |  |  |
| 32 | Parity (Odd) |  |  |

Notes:

1. Display Matrix

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **13** | **12** | **11** |
| 0 | 0 | 0 | Others traffic |
| 0 | 0 | 1 | Traffic Advisory |
| 0 | 1 | 0 | Resolution Advisory |
| 0 | 1 | 1 | Proximate Advisory |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. Sense of Intruders Vertical Rate

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **15** | **14** |
| 0 | 0 | Level Flight |
| 0 | 1 | Climbing |
| 1 | 0 | Descending |
| 1 | 1 | No Data |

1. Non Altitude Reporting (NAR) traffic

|  |  |
| --- | --- |
| **BIT 21** | **MEANING** |
| 0 | Most threatening traffic is reporting altitude, provided in bits 22 to 29 |
| 1 | Most threatening traffic is NOT reporting altitude. Bits 22 to 29 should be disregarded (set to 0) |

1. Sign Status Matrix (SSM) [BNR]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Failure Warning |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Normal Operation |

1. Failure Warning should be reported in the SSM field only if the TCAS computer itself has failed. Refer also to Note 1 of Table 6A‑2.
2. The No Computed Data reported in the SSM field indicates that no intruder is present in the TIF/DTIF.

PART 6BT

**ARINC 429 FORMAT WORD FMS TO ACAS Xu**

**PERFORMANCE LIMIT, VERTICAL RATE LIMITS WORD**

**LABEL 272**

|  |  |  |  |
| --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | **NOTES** |
| 1 | Label 1st Digit (MSB) | 2 1 |  |
| 2 | Label 1st Digit (LSB) | 0 |  |
| 3 | Label 2nd Digit (MSB) | 7 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |
| 6 | Label 3rd Digit (MSB) | 2 0 |  |
| 7 | Label 3rd Digit | 1 |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |
| 9 | SDI BIT 0 |  |  |
| 10 | SDI BIT 1 |  |  |
| 11 | Descent Rate Limit   LSB | 128 | [1] |
| 12 | Descent Rate Limit | 256 |  |
| 13 | Descent Rate Limit | 512 |  |
| 14 | Descent Rate Limit | 1024 |  |
| 15 | Descent Rate Limit | 2048 |  |
| 16 | Descent Rate Limit | 4096 |  |
| 17 | Descent Rate Limit | 8192 |  |
| 18 | Descent Rate Limit   MSB | 16384 |  |
| 19 | Spare |  |  |
| 20 | Spare |  |  |
| 21 | Spare |  |  |
| 22 | Climb Rate Limit LSB | 128 | [2] |
| 23 | Climb Rate Limit | 256 |  |
| 24 | Climb Rate Limit | 512 |  |
| 25 | Climb Rate Limit | 1024 |  |
| 26 | Climb Rate Limit | 2048 |  |
| 27 | Climb Rate Limit | 4096 |  |
| 28 | Climb Rate Limit | 8192 |  |
| 29 | Climb Rate Limit MSB | 16384 |  |
| 30 | SSM |  | [3] |
| 31 | SSM |  |  |
| 32 | Parity (Odd) |  |  |

Notes:

1. Performance Limit on descent rate in feet/minute
2. Performance Limit on climb rate in feet/minute
3. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6BU

**ARINC 429 FORMAT WORD FMS TO ACAS Xu**

**PERFORMANCE LIMIT, TURN RATE LIMIT WORD**

**LABEL 273**

|  |  |  |  |
| --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | **NOTES** |
| 1 | Label 1st Digit (MSB) | 2 1 |  |
| 2 | Label 1st Digit (LSB) | 0 |  |
| 3 | Label 2nd Digit (MSB) | 7 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |
| 6 | Label 3rd Digit (MSB) | 3 0 |  |
| 7 | Label 3rd Digit | 1 |  |
| 8 | Label 3rd Digit (LSB) | 1 |  |
| 9 | SDI BIT 0 |  |  |
| 10 | SDI BIT 1 |  |  |
| 11 | Turn Rate Limit   LSB | 0.3515625 | [1] |
| 12 | Turn Rate Limit | 0.703125 |  |
| 13 | Turn Rate Limit | 1.40625 |  |
| 14 | Turn Rate Limit | 2.8125 |  |
| 15 | Turn Rate Limit | 5.625 |  |
| 16 | Turn Rate Limit | 11.25 |  |
| 17 | Turn Rate Limit | 22.5 |  |
| 18 | Turn Rate Limit | 45 |  |
| 19 | Turn Rate Limit | 90 |  |
| 20 | Turn Rate Limit   MSB | 180 |  |
| 21 | Spare |  |  |
| 22 | Spare |  |  |
| 23 | Spare |  |  |
| 24 | Spare |  |  |
| 25 | Spare |  |  |
| 26 | Spare |  |  |
| 27 | Spare |  |  |
| 28 | Spare |  |  |
| 29 | Spare |  |  |
| 30 | SSM |  | [2] |
| 31 | SSM |  |  |
| 32 | Parity (Odd) |  |  |

Notes:

1. Performance Limit on turn rate in degrees/second
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

PART 6BV

**ARINC 429 FORMAT WORD ACAS Xa TO DISPLAY**

**Designated Intruder Mode and Status**

**LABEL 165**

|  |  |  |  |
| --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | **NOTES** |
| 1 | Label 1st Digit (MSB) | 1 0 |  |
| 2 | Label 1st Digit (LSB) | 1 |  |
| 3 | Label 2nd Digit (MSB) | 6 1 |  |
| 4 | Label 2nd Digit | 1 |  |
| 5 | Label 2nd Digit (LSB) | 0 |  |
| 6 | Label 3rd Digit (MSB) | 5 1 |  |
| 7 | Label 3rd Digit | 0 |  |
| 8 | Label 3rd Digit (LSB) | 1 |  |
| 9 | SDI BIT 0 |  |  |
| 10 | SDI BIT 1 |  |  |
| 11 | Designated Intruder Xo Mode LSB |  | [1] |
| 12 | Designated Intruder Xo Mode |  |  |
| 13 | Designated Intruder Xo Mode MSB |  |  |
| 14 | Designated Intruder Actual Logic Mode LSB |  | [2] |
| 15 | Designated Intruder Actual Logic Mode |  |  |
| 16 | Designated Intruder Actual Logic Mode MSB |  |  |
| 17 | Designated Intruder Designation Status LSB |  | [3] |
| 18 | Designated Intruder Designation Status |  |  |
| 19 | Designated Intruder Designation Status |  |  |
| 20 | Designated Intruder Designation Status |  |  |
| 21 | Designated Intruder Designation Status |  |  |
| 22 | Designated Intruder Designation Status |  |  |
| 23 | Designated Intruder Designation Status |  |  |
| 24 | Designated Intruder Designation Status MSB |  |  |
| 25 | Spare |  |  |
| 26 | Spare |  |  |
| 27 | Spare |  |  |
| 28 | Spare |  |  |
| 29 | Spare |  |  |
| 30 | SSM |  | [4] |
| 31 | SSM |  |  |
| 32 | Parity (Odd) |  |  |

Notes:

1. Designated Intruder - ACAS Xo Mode

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **13** | **12** | **11** |
| 0 | 0 | 0 | ACAS Xa\* |
| 0 | 0 | 1 | DNA |
| 0 | 1 | 0 | CSPO-3000 |
| 0 | 1 | 1 | Not Used |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. \*ACAS Xa is not a designated mode but rather indicates there is no designated intruder.
2. Designated Intruder - Actual Logic Mode

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **16** | **15** | **14** |
| 0 | 0 | 0 | ACAS Xa\* |
| 0 | 0 | 1 | DNA |
| 0 | 1 | 0 | CSPO-3000 |
| 0 | 1 | 1 | Multi-Threat\*\* |
| 1 | 0 | 0 | Not Used |
| 1 | 0 | 1 | Not Used |
| 1 | 1 | 0 | Not Used |
| 1 | 1 | 1 | Not Used |

1. \*ACAS Xa is not a designated mode but rather indicates there is no designated intruder.
2. \*\*Multi-Threat logic mode is only displayed for DNA traffic. It explains the presence of an RA on DNA traffic.
3. Designated Intruder – Designation Status

|  |  |  |  |
| --- | --- | --- | --- |
| **Code\*** | **MEANING** | **Alert** | **Xo Mode** |
| 0x00 | Nothing Abnormal to Report | No | DNA or  CSPO-3000 |
| **Designation Processing Delayed** | | | |
| 0x11 | Due to Active RA | No | DNA or  CSPO-3000 |
| **Designation Processing Suspended** | | | |
| 0x21 | Due to multi-threat RA involving designated traffic  Processing will be restored after condition no longer holds. | No | DNA |
| 0x22 | Traffic is invalid for TA and RA processing  Designation is being coasted. | No | DNA or  CSPO-3000 |
| 0x23 | Traffic was dropped  Designation is being coasted. | No | DNA or  CSPO-3000 |
| 0x24 | Designation is being coasted | No | DNA or  CSPO-3000 |
| **Automatically Undesignated** | | | |
| 0x31 | Due to Xo mode becoming Unavailable to Run | Yes | CSPO-3000 |
| 0x32 | Due to satisfying geometric constraints for undesignation | No | DNA or  CSPO-3000 |
| 0x33 | Dropped traffic was undesignated | No | DNA or  CSPO-3000 |
| 0x34 | Due to timout of coasting designation | Yes | DNA or  CSPO-3000 |
| 0x35 | Due to loss of bearing | Yes | DNA |

1. \*The Designation Status Code is comprised of two hex digits (bits 24-21 (first digit) and bits 20-17 (second digit)).
2. Sign Status Matrix (SSM) [DISC]

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| **31** | **30** |
| 0 | 0 | Normal Operation |
| 0 | 1 | No Computed Data |
| 1 | 0 | Functional Test |
| 1 | 1 | Failure Warning |

ATTACHMENT 7A INPUT/OUTPUT CIRCUIT STANDARDS



|  |  |  |
| --- | --- | --- |
| OUTPUT SYSTEM CAPABILITY | VALUE | UTILIZATION DEVICE STANDARDS |
|  |  |  |
| Resistance (total system\*) | 400 to 8,000 ohms | R1 ≥ 12,000 ohms |
| Capacitance (total system\*) | 1,000 to 30,000 pF | C1 ≤ 50 pF |
| Space Capacitance Unbalance | Not defined. Unbalance due to aircraft interwiring should be kept to a minimum | R or R ≥ 12,000 ohms  C and C ≤ 50 pF |
| RS = 75 ± 5 ohms |  |  |

Notes:

\* Includes aircraft interwiring

\*\* Shields to be grounded in aircraft at both ends of all breaks.

ATTACHMENT 7B ARINC 429 TRANSMITTER LOGIC STATES



ATTACHMENT 8 SUPPRESSION PULSE SYSTEM CHARACTERISTICS

The use of suppression pulses may be required on aircraft using several pulse equipment aboard. In order to provide compatibility between the suppression pulse outputs from the suppressor equipment and suppression pulse inputs of the suppressee (or utilization) equipment, it is necessary to provide a standard suppression network.

In considering a suppression pulse to be used for transport aircraft, one of the main considerations is to suppress each equipment for as little time as possible in order to leave it enough time to adequately perform its intended function.

Since several equipment (both suppressors and suppresses) need to be accommodated in the suppression chain, certain standard characteristics of input and output should be adhered to. This characteristic defines a single suppression jack on the rear of the equipment which is intended to serve as the suppression pulse output and input. The specific paragraphs on the suppression system and the individual parameters of suppressor and suppressee voltages and impedances have been coordinated among a group of interested manufacturers.

Several additional requirements and recommendations should be considered by pulse equipment manufacturers and installers.

1. Equipment connected into the suppression chain should not be damaged nor its operation impaired in any manner if the suppression system is loaded with an impedance of greater than 2000 ohms or even if it is unterminated or inadvertently shorted.
2. It is recommended that suppressee equipment suppression pulse input impedance be kept as close as possible to 2000 ohms, in order to help provide satisfactory operation when only a single suppressor is used on the suppression bus.
3. It is recommended that suppressor equipment be designed so that the output voltage does not rise above 70 volts if the total suppressee load is above 2000 ohms (while a maximum total resistance of 2000 ohms is specified, a single suppressee which does not follow recommendation b) may present a resistance greater than 2000 ohms, and should not be damaged under this condition).
4. It is recommended that suppressee equipment incorporate AC coupling to prevent continual suppression or damage to the equipment if a fault occurs in the suppressor equipment. The charging time constant of the coupling circuit should be greater than one millisecond in order to ensure adequate acceptance of suppression pulses up to 100 microseconds in duration.

The discharge time constant should be held to a maximum of 50% of the charging time constant. The input circuit should be designed to accept a continuous DC signal at a maximum amplitude of 70 volts.

1. SUPPRESSION SYSTEM PARAMETERS

Number of Suppression Pulse Recipients (Suppression): 6 Maximum

Number of Suppression Pulse Donors (Suppressors): 6 Maximum

System Impedance: The load impedance (for positive pulses) presented to any one suppressor output circuit by the entire inter-equipment suppression system should be not more than 2000 ohms nor less than 300 ohms resistance shunted by not more than 1850 pF capacitance.

System Cabling Capacitance: The capacitance of the inter-equipment cabling system should not exceed 1400 pF.

Note: The minimum resistive impedance (300 ohms) would occur in a system of six 2000 ohm suppressee loads in parallel with five 20,000 ohms suppressor loads. The maximum resistive impedance would occur with only one suppressee load. Since suppressee loads may be higher than 2000 ohms, this would imply that in some unlikely circumstances it would be necessary to add a load resistor to the system to prevent the occurrence of excessively high suppression pulse voltage levels.

The maximum capacitance of 1850 pF would occur in a system of six 50 pF suppressee loads, five 30 pF suppressor loads, and maximum inter-equipment cabling capacitance of 1400 pF. It is recognized that in the unlikely circumstance where the maximum system capacitance of 1850 pF exists, a resistance loading of 2000 ohms could conceivably also exist and in this case, the decay time would be four times as long as suggested in Item 2 (following). In this case, it is understood that a dummy resistance load may be required in the junction box.

Some limiting may be necessary in utilization equipment (suppresses) to accommodate a voltage range of 18 to 70 volts on the suppression pulse input. This voltage may vary over this range with different equipment. This limiting needs to be done in such a way that the time constant does not unduly stretch the suppression time applied to any suppressee, and also that the internal impedance of the suppressee be retained higher than 2000 ohms and the internal shunt capacitance 50 pF or less with any voltages under 70 volts.

2. SUPPRESSION PULSE OUTPUT FROM SUPPRESSOR EQUIPMENT

Amplitude: Not less than 18 volts nor more than 70 volts as measured with loads from 300 to 2000 ohms resistance in parallel with capacitance from zero to 1850 pF.

Polarity: Positive

Generator Impedance: The impedance of the suppressor output circuit to positive pulses up to 70 volts amplitude should be not less than 20,000 ohms resistance shunted by not more than 30 pF capacitance.

Synchronization: The suppressor pulse should reach 18 volts amplitude level within the period 0.8 to 5 microseconds preceding the point at which the voltage of the transmitted RF pulse reaches the 10% level.

Duration (TACAN/DME): For pulse-for-pulse suppression, the suppression pulse should remain at 18 volts or greater amplitude for at least 7.0 microseconds after the 10% level point on the leading edge of the transmitted RF edge. For blanketing pulse suppression, the suppression pulse should remain at 18 volts or greater amplitude for at least 19 microseconds for X channels or at least 43 microseconds for Y channels after the 10% level point on the leading edge of the first transmitted RF pulse. In any case, the total duration at 18 volts or greater amplitude should not exceed 60 microseconds.

Note: The introduction of the DME Y Channels (which have an interrogation pulse spacing of 36 microseconds necessitates that the length of the blanket pulse be a minimum of 43 microseconds measured from the leading edge of the first pulse. It is permissible, but not required, to use the 43 to 60 microseconds pulse on both X and Y Channels. The choice of either the long blanket pulse for both X and Y or a shorter pulse for X channels than for Y channels is subject to circuit complexity considerations applicable to the individual design.

Duration (ATCRBS/Mode S Transponder): The suppressor pulse should remain at 18 volts or greater amplitude until the trailing edge of the last pulse of the transmitted reply train has decayed to the 10% level point. Total duration of the suppressor pulse (at the 18 volt level) should not exceed 33 microseconds for ATCRBS replies. For 56-bit Mode S replies, duration should not exceed 75 microseconds. For 112-bit Mode S replies, duration should not exceed 140 microseconds.

COMMENTARY

Installation of TCAS equipment co-located with certain Mode S transponders capable of Extended Length Messages (ELM) should expect to be provided with suppression in excess of 1 millisecond. Equipment need not remain in suppression for this entire period, but should not be damaged by being subjected to ELM transmissions.

Rise Time: Equal to or greater than 20 volts per microsecond.

Decay Time: Equal to or greater than 10 volts per microsecond.

Duration (TCAS II): The suppression pulse should remain at 18 volts or greater amplitude for the duration of the suppression pulse. The TCAS II equipment should issue a 70 ± 1 microsecond suppression pulse to other onboard aircraft equipment beginning at each interrogation transmitted from the top-mounted antenna. The TCAS II equipment should issue a 90 ± 1 microsecond suppression pulse to other equipment for each interrogation from the bottom antenna.

Spurious Output from Suppressor: Neither the DC steady state output potential of nor the instantaneous peak AC potential of spurious signals should exceed 1.0 volt, either polarity, as measured with system loads as described above.

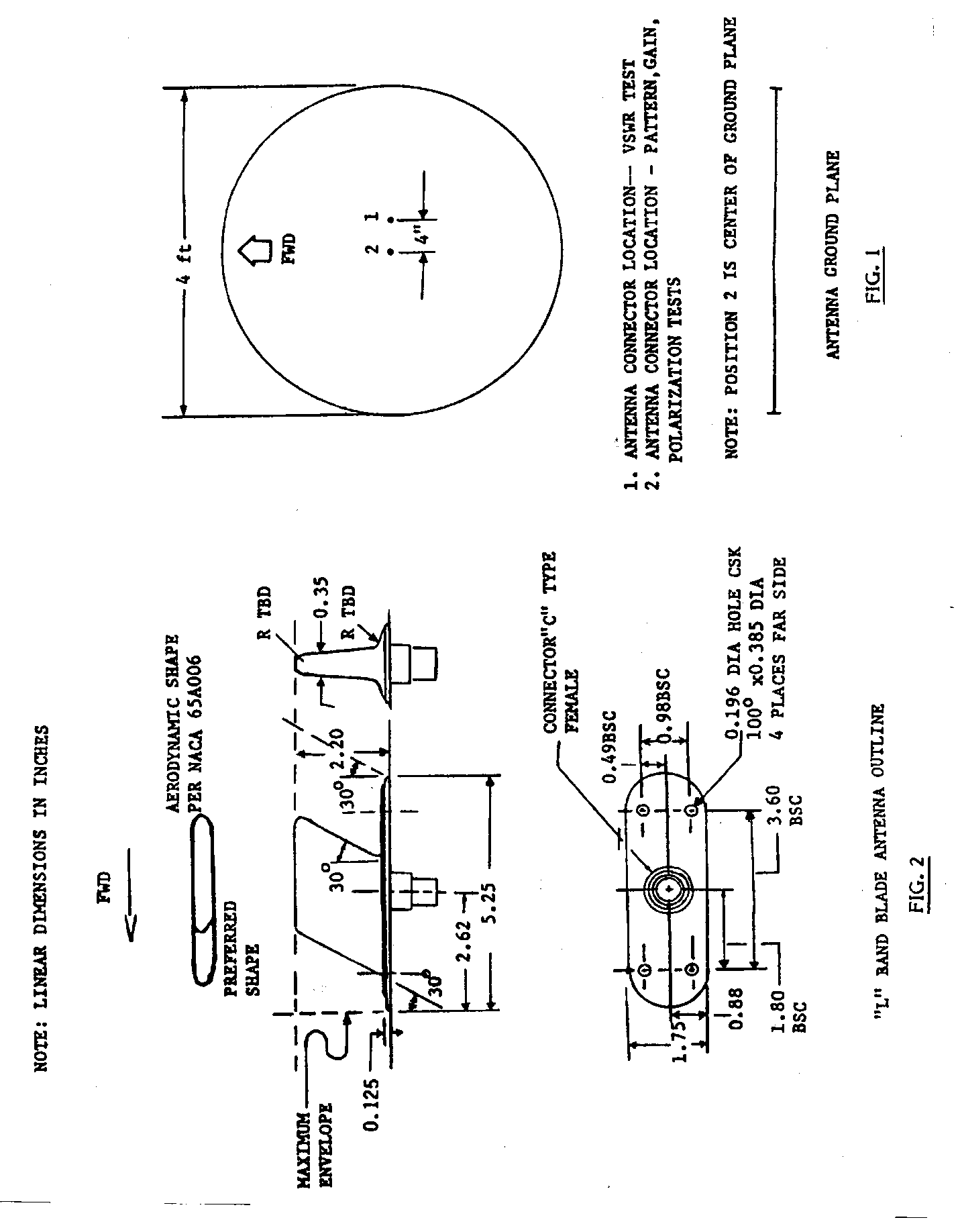
3. SUPPRESSION PULSE INPUT AT SUPPRESSEE EQUIPMENT

Each suppressee equipment should be provided with circuitry suitable for receiving suppression pulses as specified above and employing these pulses to prevent the transmissions of the suppressor equipment from causing spurious transmissions, reduction in sensitivity or other effects interfering with the proper operation of the suppressee equipment. The circuitry of the suppressee should be designed to accommodate such factors as receiver delay time, internal pulse rise time and the like.

Impedance: The impedance of the suppression pulse input circuit, as displayed to positive polarity pulses, should be not less than 2000 ohms resistance shunted by not more than 50 pF capacitance.

Spurious Output: Any spurious output from the suppressee equipment appearing on the suppression pulse input connector should be not greater than 0.02 volts peak amplitude as measured with system loads as described above.

ATTACHMENT 9A TYPICAL BLADE ANTENNA



ATTACHMENT 9B BEARING ANTENNA MOUNTING LAYOUT



ATTACHMENT 9C TCAS ANTENNA ENVELOPE



ATTACHMENT 9D AIRCRAFT INSTALLATIONS



ATTACHMENT 10 TCAS ANTENNA CONFIGURATION



ATTACHMENT 11 ACAS X-TRANSPONDER INTERFACE BUS

1.0 Introduction

The transfer of data between the transponder and ACAS X takes place on two unidirectional buses, where data from the transponder to ACAS X is transmitted on the XT data bus, and data from ACAS X to the transponder is transmitted on the TX bus. These buses are high-speed ARINC 429 data buses.

This section defines the special protocol used in the data transfer. The purpose of this protocol is to provide for acknowledgment (ACK) or no acknowledgment (NAK) of coordination data so that a loss of communication between the transponder and ACAS X is detected immediately.

The special protocol retains all of the features of the ARINC 429 data bus, both electrically and in format with the exception of the SDI bits, i.e., each word has a unique label, parity, and sign status matrix. The ACK/NAK word is simply an additional word which is used as described below.

1.1 Data Integrity

The interface between the transponder and the ACAS X system should be designed to provide communications in the normal operational aircraft environment while assuring error rates of less than one detected error in 103 messages and less than one undetected error in 107 messages for transfers in both directions.

The ACAS X system is responsible for providing a means to acknowledge all non-periodic messages sent to or received from the Mode S transponder.

1.2 Communications Timing

The round-trip bus times should be consistent with the overall coordination requirements described in RTCA DO-385 and DO-386.

2.0 Timing for Data Provided by the ACAS X to the Mode S Transponder

The interface between ACAS X and the Mode S transponder should be designed such that:

1. A changed value of sensitivity level will be reported in any special surveillance reply, DF = 0, 16, made one second or more after the change occurs within the ACAS X.
2. A changed resolution capability will be reported in any special surveillance reply, DF = 0, 16, made one second or more after the change occurs within ACAS X.
3. A changed resolution advisory or resolution advisory complement will be indicated by a change in the downlink request field of surveillance and COMM‑B replies, DF = 4, 5, 20, 21, made one second or more after the change occurs within the ACAS X.
4. If the integrity monitoring function determines that the interface is no longer able to operate or that the interface capability is turned off, this fact will be conveyed to the system no later than one second after such failure.

3.0 Protocol Description

The following protocol description applies to both the ACAS X system and the transponder. The data words consist of two general types: periodic data and non-periodic data. Tables 6A-10 and 6B-2 provide a listing of words used on the TX and XT data buses. These figures list the labels, data types, data rates, and other information associated with these buses. Attachment 6 PART 6L through PART 6U and Attachments 14A through 14G contain the data word formats.

To indicate the compatibility with RTCA DO-385 or RTCA DO-386 of the transponder to ACAS X the version indicator (VI) field of Label 276, XTWORD6, is set during bus start-up procedures. Likewise, Label 274, TXWORD2, is used to indicate the capability of the ACAS X to the transponder, by setting the VI field to the appropriate state, during bus start-up procedures.

Upon determining that the transponder/ACAS X system is DO-385 or DO-386 compatible, the XGD/TGD protocols should be used to transfer data between the transponder and ACAS X computer. The XGD protocol is used for transponder to ACAS X data transfers while the TGD protocol is used for ACAS X to transponder data transfers.

A special data word is defined as Acknowledge (ACK) or No Acknowledge (NAK), determined by setting a prescribed bit. When a non-periodic word is transmitted, the receiver sends ACK if the word was received and valid. If the word was received not valid, the receiver sends NAK. The sender must receive either ACK or NAK no later than 2 milliseconds after placing the word on the bus. If there is no response in 2 milliseconds or NAK is received, the sender retransmits the word a second time. If there is no response in 2 milliseconds or NAK is received, an internal bus protocol failure flag is set.

Some non-periodic word data transfers are sent as multi-word sets. Each word of the multi-word set must be acknowledged either after the first transmission or after the retransmission, before the next word in the set is transmitted.

Periodic data words do not require ACK or NAK.

Each periodic word should be transmitted at its specified rate. For a periodic word pair, the update rate specified is applied to each word of the pair. The sender may send ACK/NAK in the interval between a pair of periodic words if non-periodic data has been received just after placing the first word of a periodic word pair on the bus, since ACK/NAK has highest priority. No other data may be sent in the inter-word gap of periodic or non-periodic words.

3.1 Transmission Priority

If the sender has the choice of sending more than one type of data at a given time, the following priority rules apply:

1. ACK and NAK have priority over the sending of any other word.
2. Non-periodic data has priority over periodic data, except that if the first word of a periodic word pair has already been transmitted, the second word of the pair should be sent before the non-periodic data is sent.

4.0 Bus Failure

There are two types of failures that require ACAS X and the transponder to initiate a recovery process. These failures concern the received periodic words and the transmitted non-periodic words. Bus protocol failures declared by the ACAS X should be conveyed to the transponder by setting the RI field of Label 274 on the TX bus to zero. The transponder should confirm the received RI field at zero to the ACAS X, by clearing bit 10 of Label 276 on the XT bus.

Bus protocol failures declared by the transponder should be conveyed to the ACAS X by setting the RI Echo bit, bit 10 of Label 276 on the XT bus, to zero. The ACAS X should confirm the received RI Echo bit at zero to the transponder by clearing the RI Field of Label 274 on the XT Bus to zero.

4.1 Received Periodic Failures

When the received periodic data does not conform to the reasonability criteria, the protocol is declared failed and the recovery process should be initiated.

COMMENTARY

Reasonability tests are defined as tests that check the update rate, status (including field values where applicable), and parity of the periodic words for a given duration. This time period should not present incompatibilities between different manufacturers. The manufacturer is free to choose reasonableness criteria for determining the availability of ACAS X which exceeds those defined in this document. The manufacturer is responsible for verifying that responses related to additional reasonableness checks do not negatively impact the interchangeability of the LRUs between the different manufacturers.

4.2 Non‑Periodic Transmitted Failures

A data bus protocol failure is declared after receipt of a NAK or failure to receive an ACK or NAK for non-periodic words as described in Section 3.

5.0 Start‑up and Recovery

In the event of a data bus protocol failure or a failure at start-up, the following conditions must be satisfied before data bus integrity can be restored.

1. ACAS X determines the reasonability criteria have been met by the received periodic data on the XT bus.
2. The transponder receives a non-zero value in the “RI” field of Label 274 on the TX data bus.
3. ACAS X receives “RI Echo” of 1 in label 276 on the XT bus.

Upon satisfying condition a above, ACAS X should set the RI field of Label 274 on the TX bus to its appropriate value as defined in RTCA DO-385/386, and should monitor bit 10 of Label 276 on the XT data bus to insure that the transponder confirms the status of the XT and TX buses and the values of the RI field. If the above bit is not set within 500 milliseconds after the transmission of the above label, ACAS X should set the RI field to zero and reinitiate the recovery process.

COMMENTARY

The actual value that RI is set to is defined in RTCA DO-385 or   
DO-386.

Once condition b above is satisfied, the transponder should immediately set bit 10 of Label 276 on the XT data bus to 1. However, the transponder should not indicate ACAS X capability to the outside world unless it has received data words containing a valid non-zero RI field for a period of at least one second.

6.0 Dual Mode S Transponder Interface Operation

The following discussion describes the interface between an ARINC 735 ACAS X and two ARINC 718 Mode S transponders.

Transponder Operation:

Data should be transmitted in the following manner from the Mode S transponders to the ACAS X computer unit over the ARINC 429 XT data buses.

The standby transponder should send periodic data with SSM set to NCD, but excluding words passed through from the Control Panel. The transmission of altitude data words is defined in ARINC Characteristic 718.

The standby transponder should respond to non-periodic words from ACAS X using ACK/NAK words in the same manner as the Active Transponder, except the ACK/NAK words are sent with SSM set to NCD.

The standby transponder also processes all data sent to it by ACAS X computer.

As defined in ARINC Characteristic 718, the active transponder should send altitude data to the ACAS X computer with the SSM set to NCD if it is in Altitude Reporting mode and it is not receiving valid altitude data inputs.

The transponder should respond to all data sent to it from the ACAS X computer with the SSM field set to Functional Test as if it were NCD data and assume that ACAS X computer is in Standby mode.

Transponder Failure Modes:

In the event of a transponder failure, either active or standby, the transponder should set its SSM to Fail on all ARINC 429 words sent to ACAS X computer except Control Panel words.

Control Panel words passed through the transponder should be passed with the SSM as it was received from the Control Panel.

As defined in ARINC Characteristic 718, the active transponder should send altitude data to the ACAS X computer unit.

Functional Test:

Control Panel words containing an SSM indicating Functional Test are passed through the transponder to the ACAS X computer with the Functional Test SSM. This should be done even if the transponder has failed or is in standby. Thus, the selected transponder and the ACAS X computer unit are commanded to perform a Functional Test. During their functional test sequences, the transponder and ACAS X computer should continue to transmit all periodic and non-periodic data necessary to maintain valid XT and TX bus interfaces.

ACAS X Computer Operation When Not in Standby

Data should be transmitted in the following manner from the ACAS X computer to the Mode S transponders over the ARINC 429 TX buses when it has been manually selected to a mode other than Standby (valid Label 016 received with SL = 0, or 2 to 7). The data should be transmitted in the following manner even when the ACAS X computer is operating in Standby mode due to a detected system failure or due to automatic or discrete selection.

The ACAS X computer should determine the active transponder by listening for the transponder that is transmitting Label 276 with its SSM field set to Normal. ACAS X uses control and altitude data from the active transponder. The active transponder should respond to non-periodic transmissions with an ACK as described below. The ACAS X computer should consider the transponder failed if it fails to respond to non-periodic data or Label 276 is received with SSM set to Failure Warn or is not received.

The ACAS X computer should send non-periodic data to both transponders. The active transponder should respond with an ACK/NAK word as described in Section 3 of this attachment with SSM set to Normal.

The standby transponder should respond with an ACK/NAK word as described in Section 3 of this Attachment, with SSM set to NCD.

If the ACAS X computer does not get a response from the standby transponder, it reports this to the maintenance computer on the CFDIU buses. However, the ACAS X computer still functions properly having one good active transponder.

During a switch of active transponder, both or neither transponder may transmit Label 276 with its SSM field set to Normal. The ACAS X should continue to operate over a period (400ms - 500ms is suggested) during which both or neither transponder is active and use altitude and control data from the last active transponder. If no transponder is active after this period the ACAS X computer should annunciate a non operative state (standby or failed).

ACAS X Computer Operation When in Standby:

Data should be transmitted in the following manner from the ACAS X computer to the Mode S transponders over the ARINC 429 TX data buses when it has been manually selected to Standby mode (valid Label 016 received with SL = 1).

Data should be transmitted to the transponders with SSM set to valid. Word 274 should be transmitted with SL = 1 and RI = 0.

ACAS X Failure Modes:

The ACAS X computer should set the SSM to fail on all ARINC 429 words sent to the transponders if it has failed.

If the ACAS X computer has not failed, but has detected a ACAS X System Level failure, it should continue to transmit data to the transponders with the SSM set to Valid or NCD, as appropriate. Word 274 should be transmitted with SL = 1 and RI = 0. The ACAS X System Status Discrete output should be set to open, and the detected cause of the system failure should be reported in Label 350.

7.0 Software Logic Plan Diagrams

Figure A12-1 is a top level plan diagram illustrating the software logic required to implement the protocol for transmitting.

Figure A12-2 is a top level plan diagram illustrating the software logic required to implant the protocol for receiving.

The diagrams apply to both ACAS X and transponder.



Figure A12-1 – XT-TX Start-Up Timing-Transponder Operating Correctly



Figure A12-2 – XT-TX Start-Up Timing – Transponder Does Not Set Label 276 Bit Correctly



Figure A12-3 – XT-TX Start-Up Timing – TCAS-Transponder ARINC 429 Interface Protocol – Transmitting



Figure A12-4 – XT-TX Start-Up Timing – TCAS-Transponder ARINC 429 Interface Protocol – Receiving

ATTACHMENT 12 ENVIRONMENTAL TEST CATEGORIES

The following RTCA DO-160 categories apply to the environmental specification of the ACAS X computer unit. ACAS X equipment designers should note that the latest version of RTCA DO-160 applies.

|  |  |  |  |
| --- | --- | --- | --- |
| ENVIRONMENT | DO-160G  Section | ACAS X Traffic Computer | Antenna |
| Temperature & Altitude | 4 | CAT A1 | CAT D2 |
| Temperature Variation | 5 | CAT C | CAT A |
| Humidity | 6 | CAT A | CAT B |
| Shock | 7 |  |  |
| Vibration [1] | 8 | CAT 0 or B [2] | CAT J or C |
| Explosion | 9 | CAT X | CAT E |
| Waterproofness [3] | 10 | CAT X | CAT W |
| Fluid Susceptibility | 11 | CAT X | CAT F |
| Sand & Dust | 12 | CAT X | CAT D |
| Fungus | 13 | CAT X | CAT F |
| Salt Spray | 14 | CAT X | CAT S |
| Magnetic Effect | 15 | CAT X | CAT X |
| Power Input | 16 | CAT A | CAT A |
| Conducted Voltage Transient | 17 | CAT A | CAT A |
| Audio Frequency Conducted | 18 | CAT A | CAT A |
| Susceptibility |  |  |  |
| Induced Signal | 19 | CAT Z | CAT Z |
| Susceptibility |  |  |  |
| Radio Frequency  Susceptibility | 20 | CAT W | -- |
| (Radio & Conducted) |  |  |  |
| Spurious Radio Frequency | 21 | CAT Z | CAT Z |
| Emission |  |  |  |
| Lightning | 22 | CAT K | CAT L |

1. The use of alternative categories may be necessary if the installation is to be made in other than turbine powered fixed wing aircraft. Refer to RTCA DO-160 directly.
2. Allows the alternative already provided by RTCA DO-160 (sine wave or random).
3. Rack mounted and cockpit mounted units should withstand spillages of liquids (beverages).

COMMENTARY

Temperature and altitude category A1 is designed for the rack and cockpit mounted equipment because the installation should provide a temperature environment of less than +55 °C. However, the users feel a major course of high maintenance costs for avionics equipment is operation on the ground when temperatures in excess of +55 °C may be encountered. The users, therefore, strongly urge the equipment designers to accommodate operation in ambient temperatures up to +71 °C for the purpose of achieving the highest possible operating life of the equipment.

Regarding the decompression test, the equipment is required to operate after (but not during) the exposure to abnormally high altitudes.

ATTACHMENT 13 ACAS X SYSTEM FUNCTIONAL TEST NORMAL OUTPUT DEFINITION

The following data should be transmitted by the ACAS X computer to the indicators on the ARINC 429 output data buses (high-speed and/or low-speed, as appropriate) during the ACAS X Functional Test Sequence.

Octal

Label Data Word Content SSM Value

274 Actual Data (SSM set to Valid)

377 Actual Data (SSM set to Normal Operations)

203 Actual Data (SSM set to Normal Operations)

320 Actual Data (SSM set to Normal Operations)

350 Actual Data (SSM set to Normal Operations)

015 Actual Data (SSM set to Normal Operations)

013 Data should be set to reflect actual control panel settings

SSM = Passed through by ACAS X computer

016 Data should be set to reflect actual control panel settings

SSM = Passed through by ACAS X computer

170 (ACAS Xu only)

BITS

11-23 These bits should be set for a RWC band between -97.5 degrees and -67.5 degrees (bits 11 and 12 set to 1)

30-31 Functional Test (0,1)

171 (ACAS Xu only)

BITS

11-29 These bits should be set to zero as no vertical RWC guidance should be sent during vertical RA

30-31 Functional Test (0, 1)

172 (ACAS Xu only)

BITS

11-22 These bits should be set to zero as no vertical RWC guidance should be sent during vertical RA

30-31 Functional Test (0, 1)

COMMENTARY

The above settings for labels 170, 171 and 172 result in a yellow RWC band at bearing of the TA symbol. Label 271, described below, indicates the depiction of the horizontal RA during the self test.

270

BITS

11-17 0 ft/min advisory rate to maintain

18-20 Up Advisory Corrective (0,0,1)

21-23 Adv is not one of the following (0,0,0)

24-26 Don’t descend (0,1,0)

27-29 No Down Sense (0,0,0)

30-31 Functional Test (0,1)

COMMENTARY

The above settings for label 270 result in a ‘no down sense’ RA.



271 (ACAS Xu only)

BITS

11-16 These bits should be set to a track angle 310 degrees relative to current own aircraft true heading

18-20 Turn LEFT (1, 1, 0)

30-31 Functional Test (0,1)

COMMENTARY

The above settings for label 271 result in a red band from about -50 degrees to +180 degrees relative to own aircraft. This places a red band at same bearing as standard RA symbol. Green wedge is -50 degrees to -65 degrees relative to own aircraft which is 25 degrees from the standard TA symbol..

357 RTS/ETX transmitted with word count = 14

BITS

19-14 In the RTS word, these bits should be set appropriately to indicate

state of corresponding ACAS X computer program pins.

The following data words constitute Intruder File contents:

All intruder SSMs = Functional Test

Intruder #1 (Transmitted in Intruder number field)

130 2.0 NM

131 No Vertical rate, relative altitude = +200 feet (= -1000 for alternate test

pattern).

132 RA, Bearing = +90 degrees

Intruder #2 (Transmitted in Intruder number field)

130 2.0 NM

131 Vertical Rate = Climbing, Relative altitude = -200 feet.

132 TA, Bearing = -90 degrees

Intruder #3 (Transmitted in Intruder number field)

130 3.625 NM

131 Vertical rate = Descending, Relative altitude = -1000 feet (= +200 for

alternate test pattern).

132 Prox Traffic, Bearing = +33.75 degrees

Intruder #4 (Transmitted in Intruder number field)

130 3.625 NM

131 No Vertical rate, Relative altitude = +1,000 feet

Other Traffic, Bearing = -33.75 degrees

When the ADS-B function is activated (RMP-5E strapped or bit 15 of Label 013 is set to 1) the TCAS shall transmit the test pattern as defined in the previous paragraph (on Labels 357, 130, 131, 132), but in addition it shall also transmit DTIF protocol (Labels 367, 366) with the following pattern

367 with header indication of Type 0,1 and 3 data.

Intruder #1 (Transmitted in Intruder number field)

366 packet RA

366 type 0 Flight identification = INT1, Aircraft category = L

366 type 1 Range 2 NM, No vertical rate

366 type 1 Bearing = +90 degrees, relative altitude = +200 feet (= -1000 for

alternate test pattern)

366 type 3 Ground speed = 300 kts

366 type 3 Track angle = 0 deg

Intruder #2 (Transmitted in Intruder number field)

366 packet TA

366 type 0 Flight identification = INT2, Aircraft category = M

366 type 1 Range 2 NM, Vertical rate = Climbing

366 type 1 Bearing = -90 degrees, relative altitude = -200 feet

366 type 3 Ground speed = 400 kts

366 type 3 Track angle = 90 deg

Intruder #3 (Transmitted in Intruder number field)

366 packet Prox traffic

366 type 0 Flight identification = INT3, Aircraft category = H

366 type 1 Range 3.625 NM, Vertical rate = Descending

366 type 1 Bearing = +33.75 degrees, relative altitude = -1000 feet (= +200 for

alternate test pattern)

366 type 3 Ground speed = 300 kts

366 type 3 Track angle = 180 deg

Intruder #4 (Transmitted in Intruder number field)

366 packet Other traffic

366 type 0 Flight identification = INT4, No aircraft category information

366 type 1 Range 3.625 NM, No vertical rate

366 type 1 Bearing = -33.75 degrees, relative altitude = +1000 feet

366 type 3 Ground speed = 300 kts

366 type 3 Track angle = 270 deg

COMMENTARY

In a Heading Up display view, depiction of intruder direction will vary as track angle is relative to True North.  For a consistent self-test pattern, display systems may choose to zero out the heading data to the display or change display view to a North Up view during a system functional self-test.

ATTACHMENT 14 TGD DATA WORD Definition

The data words defined in this attachment conform to RTCA DO-385 and DO-386 ACAS X/Transponder specific protocol and specifically define the TGD/XGD protocol and data words as follows:

Attachment 14A - TGD Definition

Attachment 14B – Resolution Advisories Report

Attachment 14C – Data Link Capability Report

Attachment 14D – ACAS X Request for GICB Data

Attachment 14E – Unit and Part Number

Attachment 14F – Operational Coordination Message (ACAS Xu Only)

Attachment 14G – XGD Definition

ATTACHMENT 14A TCAS TO TRANSPONDER (TX) TGD PROTOCOL RTCA DO-385/386 COMPATIBLE EQUIPMENT

Table 14A-1 – LABEL 270 – SEGMENTS 0 THROUGH 15

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 Data Field #1 Bit\_7 (MSB) 1-41 2-57 3-73 [1], [2], [6] |
| 10 Data Field #1 Bit\_6 1-42 2-58 3-74 [1], [2], [6] |
| 11 Data Field #1 Bit\_5 1-43 2-59 3-75 [1], [2], [6] |
| 12 Data Field #1 Bit\_4 1-44 2-60 3-76 [1], [2], [6] |
| 13 Data Field #1 Bit\_3 1-45 2-61 3-77 [1], [2], [6] |
| 14 Data Field #1 Bit\_2 1-46 2-62 3-78 [1], [2], [6] |
| 15 Data Field #1 Bit\_1 1-47 2-63 3-79 [1], [2], [6] |
| 16 Data Field #1 Bit\_0 (LSB) 1-48 2-64 3-80 [1], [2], [6] |
| 17 Data Field #2 Bit\_7 (MSB) 0-33 1-49 2-65 3-81 [1], [3] |
| 18 Data Field #2 Bit\_6 0-34 1-50 2-66 3-82 [1], [3] |
| 19 Data Field #2 Bit\_5 0-35 1-51 2-67 3-83 [1], [3] |
| 20 Data Field #2 Bit\_4 0-36 1-52 2-68 3-84 [1], [3] |
| 21 Data Field #2 Bit\_3 0-37 1-53 2-69 3-85 [1], [3] |
| 22 Data Field #2 Bit\_2 0-38 1-54 2-70 3-86 [1], [3] |
| 23 Data Field #2 Bit\_1 0-39 1-55 2-71 3-87 [1], [3] |
| 24 Data Field #2 Bit\_0 (LSB) 0-40 1-56 2-72 3-88 [1], [3] |
| 25 Segment Number Bit\_0 (LSB) [4] |
| 26 Segment Number Bit\_1 |
| 27 Segment Number Bit\_2 |
| 28 Segment Number Bit\_3 (MSB) |
| 29 Continuation Bit Continue = 1 [5], [6] |
| Do Not Continue = 0 |
| 30 Request/Delivery Bit Request for Data = 1 [6], [7] |
| Data Delivery = 0 |
| 31 Pad [9] |
| 32 Parity (Odd) |

Notes: The TGD protocol provides capability for the ACAS X to directly deliver the entire contents of MB/MV fields to the Transponder. Data for the 56-bit MB/MV field is transferred from ACAS X to the Transponder via four consecutive segments of the 270 word, with each segment containing 16 data bits. The general definition for the TGD Protocol word is provided in Section 3.3.3.1.1.

1. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used for RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
2. For Segment 0, Data Field #1 should contain the GICB Register within the Transponder where the MB/MV message received from ACAS X should be stored. Coding of the GICB Register should be Most Significant Bit (MSB) first.
3. For Segments 1, 2, and 3, Data Field #1 should contain the appropriate MB/MV data designated to be transmitted as the RF bit referenced in the RF Message Bit column.
4. For Segments 0, 1, 2, and 3, Data Field #2 should contain the appropriate MB/MV data designated to be transmitted as the RF bit referenced in the RF Message Bit column.
5. Segments of the 270 word are numbered 0 through 15 (decimal). This provides for 16 segments, each organized to provide two 8-bit data fields, or 16 data bits per segment.
6. Currently only segments 0 through 3 are defined. Segments 4 through 15 are Reserved. The transponder should NAK any segment greater than 3. Likewise, the transponder should NAK a segment 3 received with the Continuation Bit set to 1.
7. The Continuation Bit is used to indicate that multiple segments are implemented to transfer data from the TCAS to the Transponder, and should be set to 1 whenever the next segment contains a continuation of the current message data.
8. The Request/Delivery Bit is used to indicate to the Transponder that the TCAS is Requesting BDS data from the Transponder.
9. To request data from the Transponder, TCAS should send only Segment 0 of the TGD protocol having the Request/Delivery Bit set   
   to 1, Data Field #1 set to the number of the Transponder GICB Register or Buffer containing the desired data, and the Continuation Bit set to 0.
10. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it. Status of the TCAS/Transponder system is provided to the Transponder by the TCAS via TXWORD2 (Label 274) and TXWORD3 (Label 275).

ATTACHMENT 14B TCAS TO TRANSPONDER (TX) RESOLUTION ADVISORIES REPORT

The TCAS to Transponder (TX) Resolution Advisories report consists of a part 1 report transmitted by both ACAS Xa and ACAS Xu systems and a part 2 report only transmitted by ACAS Xu systems. The part 1 report is formatted differently depending on which system, ACAS Xa or ACAS Xu, is implemented.

ATTACHMENT 14B-1 TCAS TO TRANSPONDER (TX) RESOLUTION ADVISORIES REPORT PART 1 FOR ACAS Xa (RTCA DO-385) COMPATIBLE EQUIPMENT

Table 14B-1a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) 3 0 [1] |
| 10 GICB1 0 [1] |
| 11 GICB1 1 [1] |
| 12 GICB1 (LSB) 1 [1] |
| 13 GICB2 (MSB) 0 0 [1] |
| 14 GICB2 0 [1] |
| 15 GICB2 0 [1] |
| 16 GICB2 (LSB) 0 [1] |
| 17 BDS1 (MSB) 3 0 33 [1], [2] |
| 18 BDS1 0 34 [1], [2] |
| 19 BDS1 1 35 [1], [2] |
| 20 BDS1 (LSB) 1 36 [1], [2] |
| 21 BDS2 (MSB) 0 0 37 [1], [2] |
| 22 BDS2 0 38 [1], [2] |
| 23 BDS2 0 39 [1], [2] |
| 24 BDS2 (LSB) 0 40 [1], [2] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [17] |
| 31 Pad 0 [17] |
| 32 Parity (Odd) |

Table 14B-1b – LABEL 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 AVRA Bit\_41 As Required 41 [2], [3], [5] |
| 10 AVRA Bit\_42 As Required 42 [2], [3], [5] |
| 11 AVRA Bit\_43 As Required 43 [2], [3], [5] |
| 12 AVRA Bit\_44 As Required 44 [2], [3], [5] |
| 13 AVRA Bit\_45 As Required 45 [2], [3], [5] |
| 14 AVRA Bit\_46 As Required 46 [2], [3], [5] |
| 15 AVRA Bit\_47 As Required 47 [2], [3], [5] |
| 16 AHRA Bit\_48 As Required 48 [2], [3], [5] |
| 17 AHRA Bit\_49 As Required 49 [2], [3], [6] |
| 18 AHRA Bit\_50 As Required 50 [2], [3], [6] |
| 19 LDI Bit\_51 As Required 51 [2], [3], [7] |
| 20 LDI Bit\_52 As Required 52 [2], [3], [7] |
| 21 RMF Bit\_53 As Required 53 [2], [3], [8] |
| 22 RMF Bit\_54 As Required 54 [2], [3], [8] |
| 23 RAC Bit\_4 As Required 55 [2], [3], [9] |
| 24 RAC Bit\_3 As Required 56 [2], [3], [9] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 1 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [17] |
| 31 Pad 0 [17] |
| 32 Parity (Odd) |

Table 14B-1c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 RAC Bit\_2 As Required 57 [2], [3], [9] |
| 10 RAC Bit\_1 As Required 58 [2], [3], [9] |
| 11 Resolution Advisory Indicator (RAI) Active = 0 59 [10] |
| 12 Multiple Threat Encounter (MTE) Multiple = 1 60 [2], [11] |
| 13 Continuation Bit (CNT) 0 61 [4], [12] |
| 14 Threat Type Indicator (TTI) As Required 62 [4], [13] |
| 15 TID Bit\_24 (MSB) or TIDA Bit\_10 (MSB) As Required 63 [3], [4], [14] |
| 16 TID Bit\_23 or TIDA Bit\_9 As Required 64 [3], [4], [14] |
| 17 TID Bit\_22 or TIDA Bit\_8 As Required 65 [3], [4], [14] |
| 18 TID Bit\_21 or TIDA Bit\_7 As Required 66 [3], [4], [14] |
| 19 TID Bit\_20 or TIDA Bit\_6 As Required 67 [3], [4], [14] |
| 20 TID Bit\_19 or TIDA Bit\_5 As Required 68 [3], [4], [14] |
| 21 TID Bit\_18 or TIDA Bit\_4 As Required 69 [3], [4], [14] |
| 22 TID Bit\_17 or TIDA Bit\_3 As Required 70 [3], [4], [14] |
| 23 TID Bit\_16 or TIDA Bit\_2 As Required 71 [3], [4], [14] |
| 24 TID Bit\_15 or TIDA Bit\_1 As Required 72 [3], [4], [14] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 2 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [17] |
| 31 Pad 0 [17] |
| 32 Parity (Odd) |

Table 14B-1d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 TID Bit\_14 or TIDA Bit\_0 (LSB) As Required 73 [3], [4], [14] |
| 10 TID Bit\_13 or TIDR Bit\_6 (MSB) As Required 74 [3], [4], [14] |
| 11 TID Bit\_12 or TIDR Bit\_5 As Required 75 [3], [4], [14] |
| 12 TID Bit\_11 or TIDR Bit\_4 As Required 76 [3], [4], [14] |
| 13 TID Bit\_10 or TIDR Bit\_3 As Required 77 [3], [4], [14] |
| 14 TID Bit\_9 or TIDR Bit\_2 As Required 78 [3], [4], [14] |
| 15 TID Bit\_8 or TIDR Bit\_1 As Required 79 [3], [4], [14] |
| 16 TID Bit\_7 or TIDR Bit\_0 (LSB) As Required 80 [3], [4], [14] |
| 17 TID Bit\_6 or TIDB Bit\_5 (MSB) As Required 81 [3], [4], [14] |
| 18 TID Bit\_5 or TIDB Bit\_4 As Required 82 [3], [4], [14] |
| 19 TID Bit\_4 or TIDB Bit\_3 As Required 83 [3], [4], [14] |
| 20 TID Bit\_3 or TIDB Bit\_2 As Required 84 [3], [4], [14] |
| 21 TID Bit\_2 or TIDB Bit\_1 As Required 85 [3], [4], [14] |
| 22 TID Bit\_1 (LSB) or TIDB Bit\_0 (LSB) As Required 86 [3], [4], [14] |
| 23 Designation Indicator (DSI) As Required 87 [4],[15] |
| 24 Suppression Indicator (SPI) As Required 88 [4],[16] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 3 0 |
| 29 Continuation Bit 0 |
| 30 Request/Delivery Bit 0 [17] |
| 31 Pad 0 [17] |
| 32 Parity (Odd) |

Notes:

1. For the Resolution Advisories Report, Segment 0, the GICB Register Number is equivalent to the BDS Buffer Number. This may or may not be the case for other messages to be transferred via the TGD protocol.
2. These bits are sent by own transponder in DF = 16, 20, and 21.
3. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used in RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
4. These bits are sent by own transponder in DF = 20 and 21. These bits are set to zero in the MV field of DF = 16 replies.
5. The Active Vertical Resolution Advisory (AVRA) subfield defines the vertical component of the active resolution advisory.
6. The Active Horizontal Resolution Advisory (AHRA) subfield defines the horizontal component of the active resolution advisory.
7. The Low-Level Descend Inhibit (LDI) indicates whether low level descend inhibit costs are being applied. The coding is as follows:

Bit\_1 Bit\_0 Value Meaning

0 0 = 0 No Ras are inhibited in the vertical dimension

0 1 = 1 Increased rate descend Ras are inhibited

1 0 = 2 All positive descend Ras are inhibited

1 1 = 3 All Ras are inhibited in the vertical and

horizontal dimensions

1. The RA Message Format (RMF) subfield indicates the CA system used to generate the RA and is coded as follows:

Bit\_1 Bit\_0 Value Meaning

0 0 = 0 TCAS II

0 1 = 1 ACAS Xa

1 0 = 2 ACAS Xu

1 1 = 3 Not Assigned

1. The Resolution Advisory Complements (RAC) bits indicate the currently active RA complements (if any) received from other aircraft equipped with an on-board CAS with resolution capability. The RA complements are received by ownship via TCAS Resolution Messages and OCMs.

The RAC bits have the following meanings:

Bit RAC

1. = 1 Do not pass below received by ownship
2. = 1 Do not pass above received by ownship
3. = 1 Do not turn left received by ownship

1 = 1 Do not turn right received by ownship

1. The Resolution Advisory Indicator (RAI) bit This bit is set to zero by ACAS X to indicate there is an Active Resolution Advisory. Otherwise, this bit should be set to one by the ACAS X. This bit is not sent directly as RF Message Bit 59. Rather, the Resolution Advisory Terminated (RAT) bit is set by the transponder as RF Message Bit 59 and for the most part replicates the RAI bit provided by ACAS X.
2. The Multiple Threat Encounter (MTE) bit indicates whether two or more simultaneous threats are currently being processed by the ACAS X threat resolution logic.

Coding:

= 0

One threat is being processed by the resolution logic (when ARA bit 41=1); or no threat is being processed by the resolution logic (when ARA bit 41=0).

= 1

Two or more simultaneous threats are being processed by the resolution logic.

1. The Continuation (CNT) bit indicates whether a follow-on RF message is being generated to report additional RA or TA related information. CNT=1 indicates a follow-on RF message exists.

The Threat Type Indicator (TTI) defines the type of identity data contained in the TID subfield. When TTI=0, the TID contains altitude, range and bearing data. When TTI=1, the TID contains an ICAO 24-bit Aircraft Address.

The Threat Identity Data (TID) field contains either the reported 24-bit aircraft address (TID) of a Mode S equipped threat when the TTI = 1, or the most recently reported Mode C altitude code (TIDA), range (TIDR) and bearing (TIDB) received from a non-Mode S equipped threat when the TTI = 0.

The Designation Indicator (DI) bit indicates that the the threat defined in the TID is not designated for Xo when DI=0 or that it is designated for Xo when DI=1.

The Suppression Indicator (SPI) indicates the following:

For single-threat encounters:

= 0 – the RA is not suppressed

= 1 – the RA is suppressed (not announced to the flight crew)

For multi-threat encounters, suppression does not apply, so the SPI subfield is used to indicate designation as follows:

= 0 - no threat other than the one defined in TID is designated for Xo

= 1 – another threat is designated for Xo, and the designation is in force

1. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it. Status of the TCAS/Transponder system is provided to the Transponder by the TCAS via TXWORD2 (Label 274) and TXWORD3 (Label 275).

ATTACHMENT 14B-2 TCAS TO TRANSPONDER (TX) RESOLUTION ADVISORIES REPORT PART 1 for ACAS Xu (RTCA DO-386) COMPATIBLE EQUIPMENT

Table 14B-2a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) 3 0 [1] |
| 10 GICB1 0 [1] |
| 11 GICB1 1 [1] |
| 12 GICB1 (LSB) 1 [1] |
| 13 GICB2 (MSB) 0 0 [1] |
| 14 GICB2 0 [1] |
| 15 GICB2 0 [1] |
| 16 GICB2 (LSB) 0 [1] |
| 17 BDS1 (MSB) 3 0 33 [1], [2] |
| 18 BDS1 0 34 [1], [2] |
| 19 BDS1 1 35 [1], [2] |
| 20 BDS1 (LSB) 1 36 [1], [2] |
| 21 BDS2 (MSB) 0 0 37 [1], [2] |
| 22 BDS2 0 38 [1], [2] |
| 23 BDS2 0 39 [1], [2] |
| 24 BDS2 (LSB) 0 40 [1], [2] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [15] |
| 31 Pad 0 [15] |
| 32 Parity (Odd) |

Table 14B-2b – LABEL 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 AVRA Bit\_41 As Required 41 [2], [3], [5] |
| 10 AVRA Bit\_42 As Required 42 [2], [3], [5] |
| 11 AVRA Bit\_43 As Required 43 [2], [3], [5] |
| 12 AVRA Bit\_44 As Required 44 [2], [3], [5] |
| 13 AVRA Bit\_45 As Required 45 [2], [3], [5] |
| 14 AVRA Bit\_46 As Required 46 [2], [3], [5] |
| 15 AVRA Bit\_47 As Required 47 [2], [3], [5] |
| 16 AHRA Bit\_48 As Required 48 [2], [3], [6] |
| 17 AHRA Bit\_49 As Required 49 [2], [3], [6] |
| 18 AHRA Bit\_50 As Required 50 [2], [3], [6] |
| 19 AHRA Bit\_51 As Required 51 [2], [3], [6] |
| 20 AHRA Bit\_52 As Required 52 [2], [3], [6] |
| 21 RA Msg. Format (RMF) (MSB) As Required 53 [2], [3], [7] |
| 22 RA Msg. Format (RMF) (LSB) As Required 54 [2], [3], [7] |
| 23 AHRA Bit\_55 As Required 55 [2], [3], [6] |
| 24 AHRA Bit\_56 As Required 56 [2], [3], [6] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 1 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [15] |
| 31 Pad 0 [15] |
| 32 Parity (Odd) |

Table 14B-2c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 AHRA As Required 57 [2], [3], [6] |
| 10 AHRA Bit\_58 As Required 58 [2], [3], [6] |
| 11 Resolution Advisory Indicator (RAI) Active = 0 59 [8] |
| 12 VMTE As Required 60 [2], [9] |
| 13 HMTE As Required 61 [4], [10] |
| 14 TTI As Required 62 [4], [11] |
| 15 TID Bit 24 (MSB) or TIDA bit 11 (MSB) As Required 63 [3], [4], [12] |
| 16 TID Bit 23 or TIDA bit 10 As Required 64 [3], [4], [12] |
| 17 TID Bit 22 or TIDA bit 9 As Required 65 [3], [4], [12] |
| 18 TID Bit 21 or TIDA bit 8 As Required 66 [3], [4], [12] |
| 19 TID Bit 20 or TIDA bit 7 As Required 67 [3], [4], [12] |
| 20 TID Bit 19 or TIDA bit 6 As Required 68 [3], [4], [12] |
| 21 TID Bit 18 or TIDA bit 5 As Required 69 [3], [4], [12] |
| 22 TID Bit 17 or TIDA bit 4 As Required 70 [3], [4], [12] |
| 23 TID Bit 16 or TIDA bit 3 As Required 71 [3], [4], [12] |
| 24 TID Bit 15 or TIDA bit 2 As Required 72 [3], [4], [12] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 2 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [15] |
| 31 Pad 0 [15] |
| 32 Parity (Odd) |

Table 14B-2d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 TID Bit 14 or TIDA bit 1 (LSB) As Required 73 [3], [4], [12] |
| 10 TID Bit 13 or TIDR bit 7 (MSB) As Required 74 [3], [4], [12] |
| 11 TID Bit 12 or TIDR bit 6 As Required 75 [3], [4], [12] |
| 12 TID Bit 11 or TIDR bit 5 As Required 76 [3], [4], [12] |
| 13 TID Bit 10 or TIDR bit 4 As Required 77 [3], [4], [12] |
| 14 TID Bit 9 or TIDR bit 3 As Required 78 [3], [4], [12] |
| 15 TID Bit 8 or TIDR bit 2 As Required 79 [3], [4], [12] |
| 16 TID Bit 7 or TIDR bit 1 (LSB) As Required 80 [3], [4], [12] |
| 17 TID Bit 6 or TIDB bit 6 (MSB) As Required 81 [3], [4], [12] |
| 18 TID Bit 5 or TIDB bit 5 As Required 82 [3], [4], [12] |
| 19 TID Bit 4 or TIDB bit 4 As Required 83 [3], [4], [12] |
| 20 TID Bit 3 or TIDB bit 3 As Required 84 [3], [4], [12] |
| 21 TID Bit 2 or TIDB bit 2 As Required 85 [3], [4], [12] |
| 22 TID Bit 1 (LSB) or TIDB bit 1 (LSB) As Required 86 [3], [4], [12] |
| 23 VRAT As Required 87 [4], [13] |
| 24 HRAT As Required 88 [4], [14] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 3 0 |
| 29 Continuation Bit 0 |
| 30 Request/Delivery Bit 0 [15] |
| 31 Pad 0 [15] |
| 32 Parity (Odd) |

Notes:

1. For the Resolution Advisories Report, Segment 0, the GICB Register Number is equivalent to the BDS Buffer Number. This may or may not be the case for other messages to be transferred via the TGD protocol.
2. These bits are sent by own transponder in DF = 16, 20, and 21.
3. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used in RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
4. These bits are sent by own transponder in DF = 20 and 21.
5. The Active Vertical Resolution Advisory (AVRA) subfield defines the vertical component of the active resolution advisory.
6. The Active Horizontal Resolution Advisory (AHRA) subfield defines the horizontal component of the active resolution advisory.
7. The RA Message Format (RMF) subfield indicates the CA system used to generate the RA and is coded as follows:

Bit\_1 Bit\_0 Value Meaning

0 0 = 0 TCAS II

0 1 = 1 ACAS Xa

1 0 = 2 ACAS Xu

1 1 = 3 Not Assigned

1. The Resolution Advisory Indicator (RAI) bit This bit is set to zero by ACAS X to indicate there is an Active Resolution Advisory. Otherwise, this bit should be set to one by the ACAS X. This bit is not sent directly as RF Message Bit 59. Rather, the Resolution Advisory Terminated (RAT) bit is set by the transponder as RF Message Bit 59 and for the most part replicates the RAI bit provided by ACAS X.
2. The Vertical Multiple Threat Encounter (VMTE) bit indicates whether two or more simultaneous threats are currently contributing to the vertical complement of the RA.

Coding:

= 0

A single threat is contributing to the vertical component of the RA (when AVRA bit 41=1); or no vertical RA component is being generated (when AVRA bit 41=0).

= 1

Two or more simultaneous threats are currently contributing to the vertical component of the RA, or there is a single threat in the vertical dimension and a different single threat in the horizontal dimension.

1. The Horizontal Multiple Threat Encounter (HMTE) bit indicates whether two or more simultaneous threats are currently contributing to the horizontal complement of the RA.

Coding:

= 0

A single threat is contributing to the horizontal component of the RA (when AVRA bit 41=1); or no horizontal RA component is being generated (when AVRA bit 41=0).

= 1

Two or more simultaneous threats are currently contributing to the horizontal component of the RA, or there is a single threat in the horizontal dimension and a different single threat in the vertical dimension.

1. The Threat Type Indicator (TTI) defines the type of identity data contained in the TID subfield. When TTI=0, the TID contains altitude, range and bearing data. When TTI=1, the TID contains an ICAO 24-bit Aircraft Address.
2. The Threat Identity Data (TID) field contains either the reported 24-bit aircraft address (TID) of a Mode S equipped threat when the TTI = 1, or the most recently reported Mode C altitude code (TIDA), range (TIDR) and bearing (TIDB) received from a non-Mode S equipped threat when the TTI = 0.
3. The Vertical RA Terminated (VRAT) bit is coded as follows:

= 0 The RA indicated by the AVRA subfield is active

= 1 The vertical component of the RA had been terminated but the horizontal component of the RA is still active.

1. The Horizontal RA Terminated (HRAT) bit is coded as follows:

= 0 The RA indicated by the AHRA subfield is active

= 1 The vertical component of the RA had been terminated but the vertical component of the RA is still active.

1. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it. Status of the TCAS/Transponder system is provided to the Transponder by the TCAS via TXWORD2 (Label 274) and TXWORD3 (Label 275).

ATTACHMENT 14B-3 TCAS TO TRANSPONDER (TX) RESOLUTION ADVISORIES REPORT PART 2 FOR ACAS Xu (RTCA DO-386) COMPATIBLE EQUIPMENT

Table 14B-3a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) 3 0 [1] |
| 10 GICB1 0 [1] |
| 11 GICB1 1 [1] |
| 12 GICB1 (LSB) 1 [1] |
| 13 GICB2 (MSB) 1 0 [1] |
| 14 GICB2 0 [1] |
| 15 GICB2 0 [1] |
| 16 GICB2 (LSB) 1 [1] |
| 17 BDS1 (MSB) 3 0 33 [1], [2] |
| 18 BDS1 0 34 [1], [2] |
| 19 BDS1 1 35 [1], [2] |
| 20 BDS1 (LSB) 1 36 [1], [2] |
| 21 BDS2 (MSB) 1 0 37 [1], [2] |
| 22 BDS2 0 38 [1], [2] |
| 23 BDS2 0 39 [1], [2] |
| 24 BDS2 (LSB) 1 40 [1], [2] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [13] |
| 31 Pad 0 [13] |
| 32 Parity (Odd) |

Table 14B-3b – LABEL 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 LDI Bit\_1 As Required 41 [2], [3], [4] |
| 10 LDI Bit\_0 As Required 42 [2], [3], [4] |
| 11 HRI As Required 43 [2], [5] |
| 12 RAC Bit\_4 As Required 44 [2], [3], [6] |
| 13 RAC Bit\_3 As Required 45 [2], [3], [6] |
| 14 RAC Bit\_2 As Required 46 [2], [3], [6] |
| 15 RAC Bit\_1 As Required 47 [2], [3], [6] |
| 16 CCB Bit\_7 As Required 48 [2], [3], [7] |
| 17 CCB Bit\_6 As Required 49 [2], [3], [7] |
| 18 CCB Bit\_5 As Required 50 [2], [3], [7] |
| 19 CCB Bit\_4 As Required 51 [2], [3], [7] |
| 20 CCB Bit\_3 As Required 52 [2], [3], [7] |
| 21 CCB Bit\_2 As Required 53 [2], [3], [7] |
| 22 CCB Bit\_1 As Required 54 [2], [3], [7] |
| 23 ICO As Required 55 [2], [8] |
| 24 CCB2 Bit\_7 As Required 56 [2], [3], [9] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 1 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [13] |
| 31 Pad 0 [13] |
| 32 Parity (Odd) |

Table 14B-3c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 CCB2 Bit\_6 As Required 57 [2], [3], [9] |
| 10 CCB2 Bit\_5 As Required 58 [2], [3], [9] |
| 11 CCB2 Bit\_4 As Required 59 [2], [3], [9] |
| 12 CCB2 Bit\_3 As Required 60 [2], [3], [9] |
| 13 CCB2 Bit\_2 As Required 61 [2], [3], [9] |
| 14 CCB2 Bit\_1 As Required 62 [2], [3], [9] |
| 15 ICO2 As Required 63 [2], [10] |
| 16 TTI2 As Required 64 [2], [11] |
| 17 TID2 Bit\_24 (MSB) or TIDA2 Bit 11 (MSB) As Required 65 [2], [3], [12] |
| 18 TID2 Bit\_23 or TIDA2 Bit\_10 As Required 66 [2], [3], [12] |
| 19 TID2 Bit\_22 or TIDA2 Bit\_9 As Required 67 [2], [3], [12] |
| 20 TID2 Bit\_21 or TIDA2 Bit\_8 As Required 68 [2], [3], [12] |
| 21 TID2 Bit\_20 or TIDA2 Bit\_7 As Required 69 [2], [3], [12] |
| 22 TID2 Bit\_19 or TIDA2 Bit\_6 As Required 70 [2], [3], [12] |
| 23 TID2 Bit\_18 or TIDA2 Bit\_5 As Required 71 [2], [3], [12] |
| 24 TID2 Bit\_17 or TIDA2 Bit\_4 As Required 72 [2], [3], [12] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 2 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [13] |
| 31 Pad 0 [13] |
| 32 Parity (Odd) |

Table 14B-3d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 TID2 Bit\_16 or TIDA2 Bit\_3 As Required 73 [2], [3], [12] |
| 10 TID2 Bit\_15 or TIDA2 Bit\_2 As Required 74 [2], [3], [12] |
| 11 TID2 Bit\_14 or TIDA2 Bit\_1 (LSB) As Required 75 [2], [3], [12] |
| 12 TID2 Bit\_13 or TIDR2 Bit\_7 (MSB) As Required 76 [2], [3], [12] |
| 13 TID2 Bit\_12 or TIDR2 Bit\_6 As Required 77 [2], [3], [12] |
| 14 TID2 Bit\_11 or TIDR2 Bit\_5 As Required 78 [2], [3], [12] |
| 15 TID2 Bit\_10 or TIDR2 Bit\_4 As Required 79 [2], [3], [12] |
| 16 TID2 Bit\_9 or TIDR2 Bit\_3 As Required 80 [2], [3], [12] |
| 17 TID2 Bit\_8 or TIDR2 Bit\_2 As Required 81 [2], [3], [12] |
| 18 TID2 Bit\_7 or TIDR2 Bit\_1 (LSB) As Required 82 [2], [3], [12] |
| 19 TID2 Bit\_6 or TIDB2 Bit\_6 (MSB) As Required 83 [2], [3], [12] |
| 20 TID2 Bit\_5 or TIDB2 Bit\_5 As Required 84 [2], [3], [12] |
| 21 TID2 Bit\_4 or TIDB2 Bit\_4 As Required 85 [2], [3], [12] |
| 22 TID2 Bit\_3 or TIDB2 Bit\_3 As Required 86 [2], [3], [12] |
| 23 TID2 Bit\_2 or TIDB2 Bit\_2 As Required 87 [2], [3], [12] |
| 24 TID2 Bit\_1 (LSB) or TIDB2 Bit\_1 (LSB) As Required 88 [2], [3], [12] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 3 0 |
| 29 Continuation Bit 0 |
| 30 Request/Delivery Bit 0 [13] |
| 31 Pad 0 [13] |
| 32 Parity (Odd) |

Notes:

1. For the Resolution Advisories Report Part 2, Segment 0, the GICB Register Number is equivalent to the BDS Buffer Number. This may or may not be the case for other messages to be transferred via the TGD protocol.
2. These bits are sent by own transponder in DF = 20 and 21.
3. ARINC 429 data word fields for which there are corresponding RF fields are transmitted with the MSB first in order to maintain consistency between RF and ARINC 429 data. Normal ARINC 429 protocol calls for the transmission of the LSB of the field first. Since much of the data to be transferred via the TGD protocol may be used in RF downlink in the future, the Data Fields are defined as shown with the MSB being transmitted first.
4. The Low-Level Descend Inhibit (LDI) indicates whether low level descend inhibit costs are being applied. The coding is as follows:

Bit\_1 Bit\_0 Value Meaning

0 0 = 0 No Ras are inhibited in the vertical dimension

0 1 = 1 Increased rate descend Ras are inhibited

1 0 = 2 All positive descend Ras are inhibited

1 1 = 3 All Ras are inhibited in the vertical and

horizontal dimensions

1. The Horizontal Resolution Advisory Inhibit Indicator HRI) indicates whether or not ownship is below the altitude at which the horizontal components of RAs are provided by the ACAS Xu system.

Coding: 0 = No RAs are inhibited in the horizontal dimension.

1 = All RAs are inhibited in the horizontal dimension.

1. The RA Complements (RAC) bits indicate the currently active RA complements (if any) received from other aircraft equipped with an on-board CAS with resolution capability. The RA complements are received by ownship via TCAS Resolution Messages and OCMs.

The RAC bits have the following meanings:

Bit RAC

4 = 1 Do not pass below received by ownship

3 = 1 Do not pass above received by ownship

2 = 1 Do not turn left received by ownship

1 = 1 Do not turn right received by ownship

1. The Collision Avoidance Coordination Capability Bits (CCB) contain the CCCB settings received from the threat identified in the TID.
2. The ICAO 24 Bit Address (ICO) subfield indicates whether the 24 bit address in the TID is an ICAO address. When TTI = 1:

ICO = 0 indicates the TID contains a Non-ICAO (random) address

ICO = 1 indicates the TID contains an ICAO address

1. The Collision Avoidance Coordination Capability Bits 2 (CCB2) contain the CCCB settings received from the threat identified in the TID2. If there is only one threat, these bits are set to zeros.
2. The ICAO 24 Bit Address 2 (ICO2) subfield indicates whether the 24 bit address in the TID2 is an ICAO address. When TTI2 = 1:

ICO2 = 0 indicates the TID2 contains a Non-ICAO (random) address

ICO2 = 1 indicates the TID2 contains an ICAO address

1. The Threat Type Indicator 2 (TTI2) subfield defines the typ of identity data contained in TID2. If there is only one threat, this subfield is set to zero.

Coding:

0 TID2 contains altitude, range and bearing data

1 TID2 contains a 24 bit Aircraft Address

1. The Threat Identity Data 2 (TID2) field contains either the reported 24-bit aircraft address (TID2) of a Mode S equipped threat when the TTI2 = 1, or the most recently reported Mode C altitude code (TIDA2), range (TIDR2) and bearing (TIDB2) received from a non-Mode S equipped threat when the TTI2= 0.
2. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it. Status of the TCAS/Transponder system is provided to the Transponder by the TCAS via TXWORD2 (Label 274) and TXWORD3 (Label 275).

ATTACHMENT 14C TCAS TO TRANSPONDER (TX) DATA LINK CAPABILITY   
RTCA DO-385/DO-386 COMPATIBLE EQUIPMENT

Table 14C-1a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION**  **CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) 1 0 [1] |
| 10 GICB1 0 [1] |
| 11 GICB1 0 [1] |
| 12 GICB1 (LSB) 1 [1] |
| 13 GICB2 (MSB) 0 0 [1] |
| 14 GICB2 0 [1] |
| 15 GICB2 0 [1] |
| 16 GICB2 (LSB) 0 [1] |
| 17 BDS1 (MSB) 1 0 33 [1] |
| 18 BDS1 0 34 [1] |
| 19 BDS1 0 35 [1] |
| 20 BDS1 (LSB) 1 36 [1] |
| 21 BDS2 (MSB) 0 0 37 [1] |
| 22 BDS2 0 38 [1] |
| 23 BDS2 0 39 [1] |
| 24 BDS2 (LSB) 0 40 [1] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [2] |
| 31 Pad 0 [2] |
| 32 Parity (Odd) |

**Table 14C-1b – LABEL 270 – SEGMENT 1**

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BIT | FUNCTION | CODING | | RF MSG BIT | | | NOTES | | | | | |
|  | | | | | | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  | | |  | | | | | |
| 2 | Label 1st Digit (LSB) |  | 0 |  | | |  | | | | |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  | | |  |
| 4 | Label 2nd Digit | 1 |  | | |  |
| 5 | Label 2nd Digit (LSB) | 1 |  | | |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  | | |  | | | | |
| 7 | Label 3rd Digit | 0 |  | | |  | | | | |
| 8 | Label 3rd Digit (LSB) | 0 |  | | |  | | | | |
| 9 | Not Used by TCAS | 0 | | 41 | | [3] | | | |
| 10 | Not Used by TCAS | 0 | | 42 | |  | | | |
| 11 | Version Bit\_3 (MSB) | As Required | | 43 | | [11] | | | |
| 12 | Version Bit\_2 | As Required | | 44 | |  | | | |
| 13 | Version Bit\_1 | As Required | | 45 | |  | | | |
| 14 | Version Bit\_0 (LSB) | As Required | | 46 | |  | | | |
| 15 | Not Used by TCAS | 0 | | 47 | |  | | | |
| 16 | BIT 48 | As Required | | 48 | | [4] [5] | | | |
| 17 | Not Used by TCAS |  | 0 | 49 | [3] | | | |
| 18 | Not Used by TCAS | 0 | 50 |
| 19 | Not Used by TCAS | 0 | 51 |
| 20 | Not Used by TCAS | 0 | 52 |
| 21 | Not Used by TCAS | 0 | 53 |
| 22 | Not Used by TCAS | 0 | 54 |
| 23 | Not Used by TCAS | 0 | 55 |
| 24 | Not Used by TCAS | 0 | 56 |
| 25 | Segment Number Bit\_0 (LSB) | 1 | 1 |  |  | | | |
| 26 | Segment Number Bit\_1 | 0 |  |  | | | |
| 27 | Segment Number Bit\_2 | 0 |  |  | | | |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  | | | |
| 29 | Continuation Bit |  | 1 |  |  | | | |
| 30 | Request/Delivery Bit |  | 0 |  | [2] | | | |
| 31 | Pad |  | 0 |  | [2] | | | |
| 32 | Parity (Odd) |  |  |  |  | | | |

Table 14C-1c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Not Used by TCAS | 0 | 0 | 57 | [3] |
| 10 | Not Used by TCAS | 0 | 58 |
| 11 | Not Used by TCAS | 0 | 59 |
| 12 | Not Used by TCAS | 0 | 60 |
| 13 | Not Used by TCAS | 0 | 61 |
| 14 | Not Used by TCAS | 0 | 62 |
| 15 | Not Used by TCAS | 0 | 63 |
| 16 | Not Used by TCAS | 0 | 64 |
| 17 | Not Used by TCAS | 0 | 65 |
| 18 | Not Used by TCAS | 0 | 66 |
| 19 | Not Used by TCAS | 0 | 67 |
| 20 | Not Used by TCAS | 0 | 68 |
| 21 | BIT 69 | As Required | | 69 | [6] [9] |
| 22 | BIT 70 | As Required | | 70 | [7] [9] |
| 23 | BIT 71 | As Required | | 71 | [8] [9] |
| 24 | BIT 72 | As Required | | 72 | [8] [9] |
| 25 | Segment Number Bit\_0 (LSB) | 2 | 0 |  |  |
| 26 | Segment Number Bit\_1 | 1 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 0 |  | [10] |
| 30 | Request/Delivery Bit |  | 0 |  | [2] |
| 31 | Pad |  | 0 |  | [2] |
| 32 | Parity (Odd) |  |  |  |  |

Notes:

1. For the Data Link Capability Report, Segment 0, the GICB Register or Buffer Number is equivalent to the BDS Buffer Number. This may or may not be the case for other messages to be transferred via the TGD protocol.
2. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it. Status of the ACAS X/Transponder system is provided to the Transponder by the ACAS X via TXWORD2 (Label 274) and TXWORD3 (Label 275).
3. These bits are not used by ACAS X: therefore, ACAS X should ensure that these bits are set to zero. These bits will be set by other equipment (i.e., transponder) in accordance with RTCA DO-218A or DO-181E.
4. Bit 48, Coding:

Bit 48 should be set to one by an ACAS X operating at a sensitivity level in the range of 2 or 3. Bit 48 should be set to zero by a ACAS X operating at a sensitivity level of 1, or if ACAS X has detected a failure, or if the ACAS X is being powered down.

1. This RF Message bit will be set to zero by the transponder if it detects a failure of the ACAS X/Transponder interface.
2. Bit 69 Coding:

0 = No Hybrid Surveillance Capability

1 = Hybrid Surveillance Capable

1. Bit 70 Coding:

0 = TCAS/ACAS Xa generating Traffic Advisories (TA’s) only, or ACAS Xu in Surveillance-Only Mode

1 = TCAS/ACAS Xa generating Traffic and Resolution Advisories (TA’s and RA’s) or ACAS Xu generating RWC/CA alerting and guidance

1. Bit 71, 72 Coding:

|  |  |  |
| --- | --- | --- |
| VERSION CODING | | MEANING |
| **BIT 72** | **BIT 71** |
| 0 | 0 | RTCA DO-185 (6.04A) |
| 0 | 1 | RTCA DO-185A Compatible |
| 1 | 0 | RTCA DO-185B and ED-143 Compatible |
| 1 | 1 | Newer Version – set for ACAS Xa and ACAS Xu or other newer version and further defined by bits 43-46. |

1. These RF Message bits will be set to zero by the transponder if it detects a failure of the ACAS X/Transponder interface.
2. The Continuation Bit in Segment may be set to zero since there are no further Data Link Capability Report data bits that are set by TCAS that would need to be transferred to the transponder in subsequent segments. If the Continuation Bit in Segment 2 is set to 1, then the Data Link Capability Report transfer should proceed in accordance with the TGD protocol.
3. Bit 43-46 Version Coding:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VERSION CODING | | | | MEANING |
| **BIT 43** | **BIT 44** | **BIT 45** | **BIT 46** |
| 0 | 0 | 0 | 0 | previous version |
| 0 | 0 | 0 | 1 | ACAS Xa version 1 |
| 0 | 0 | 1 | 0 | ACAS Xu version 1 |
| 0 | 0 | 1 | 1 | 0011 – 1111 = reserved |

ATTACHMENT 14D TCAS TO TRANSPONDER (TX) REQUEST FOR GICB DATA   
RTCA DO-385/386 COMPATIBLE EQUIPMENT

Table 14D-1 – LABEL 270

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| BIT FUNCTION CODING NOTES |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) [1] |
| 10 GICB1 [1] |
| 11 GICB1 [1] |
| 12 GICB1 (LSB) [1] |
| 13 GICB2 (MSB) [1] |
| 14 GICB2 [1] |
| 15 GICB2 [1] |
| 16 GICB2 (LSB) [1] |
| 17 Pad or Don’t Care |
| 18 Pad or Don’t Care |
| 19 Pad or Don’t Care |
| 20 Pad or Don’t Care |
| 21 Pad or Don’t Care |
| 22 Pad or Don’t Care |
| 23 Pad or Don’t Care |
| 24 Pad or Don’t Care |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 0 [2] |
| 30 Request/Delivery Bit 1 [3] [4] |
| 31 Pad 0 [4] |
| 32 Parity (Odd) |

Notes: ACAS X uses label 270 to request GICB data from the transponder. The register that is desired is specified in bits 9 through 16.

1. These fields should be set to the number of the Transponder GICB Register or Buffer that contains the data desired by ACAS X. Bit 9 is the MSB and Bit 16 is the LSB of the binary coding. GICB1 is used to represent the MS HEX character and GICB2 represent the LS HEX character for HEX representation.
2. The Continuation Bit should be set to zero.
3. The Request/Delivery Bit should be set to one.
4. The SSM field is not required for the XGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the ACAS X should not be sending it. Status of the ACAS X/Transponder system is provided to the Transponder by the ACAS X via TXWORD2 (Label 274) and TXWORD3 (Label 275).

ATTACHMENT 14E TCAS TO TRANSPONDER (TX) ACAS X UNIT AND SOFTWARE PART NUMBER FOR RTCA DO-385/386 COMPATIBLE EQUIPMENT

Attachment 14E-1 – Using Unit Part Number Coding Using Part Number Coding   
(Sample Part Number = 123-456-789-147)

Table 14E-1a – Label 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | GICB 1 (MSB) | E | 1 |  | [1] |
| 10 | GICB 1 | 1 |  |
| 11 | GICB 1 | 1 |  |
| 12 | GICB 1 (LSB) | 0 |  |
| 13 | GICB 2 (MSB) | 5 | 0 |  | [1] |
| 14 | GICB 2 | 1 |  |
| 15 | GICB 2 | 0 |  |
| 16 | GICB 2 (LSB) | 1 |  |
| 17 | ACAS Unit Part Number Status |  | 0 or 1 | 33 | [2] |
| 18 | Format Type (MSB) | 0 | 0 | 34 | [3] |
| 19 | Format Type (LSB) | 0 | 35 |
| 20 | Part Number Digit 1 (MSB) | 1 | 0 | 36 |  |
| 21 | Part Number Digit 1 | 0 | 37 |  |
| 22 | Part Number Digit 1 | 0 | 38 |  |
| 23 | Part Number Digit 1 (LSB) | 1 | 39 |  |
| 24 | Part Number Digit 2 (MSB) | 2 | 0 | 40 |  |
| 25 | Segment Number Bit\_0 (LSB) | 0 | 0 |  |  |
| 26 | Segment Number Bit\_1 | 0 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-1b – LABEL 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Part Number Digit 2 | 2 | 1 | 41 |  |
| 10 | Part Number Digit 2 | 0 | 42 |  |
| 11 | Part Number Digit 2 (LSB) | 0 | 43 |  |
| 12 | Part Number Digit 3 (MSB) | 3 | 0 | 44 |  |
| 13 | Part Number Digit 3 | 0 | 45 |  |
| 14 | Part Number Digit 3 | 1 | 46 |  |
| 15 | Part Number Digit 3 (LSB) | 1 | 47 |  |
| 16 | Part Number Digit 4 (MSB) | 4 | 0 | 48 |  |
| 17 | Part Number Digit 4 | 1 | 49 |  |
| 18 | Part Number Digit 4 | 0 | 50 |  |
| 19 | Part Number Digit 4 (LSB) | 0 | 51 |  |
| 20 | Part Number Digit 5 (MSB) | 5 | 0 | 52 |  |
| 21 | Part Number Digit 5 | 1 | 53 |  |
| 22 | Part Number Digit 5 | 0 | 54 |  |
| 23 | Part Number Digit 5 (LSB) | 1 | 55 |  |
| 24 | Part Number Digit 6 (MSB) | 6 | 0 | 56 |  |
| 25 | Segment Number Bit\_0 (LSB) | 1 | 1 |  |  |
| 26 | Segment Number Bit\_1 | 0 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-1c – Label 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Part Number Digit 6 | 6 | 1 | 57 |  |
| 10 | Part Number Digit 6 | 1 | 58 |  |
| 11 | Part Number Digit 6 (LSB) | 0 | 59 |  |
| 12 | Part Number Digit 7 (MSB) | 7 | 0 | 60 |  |
| 13 | Part Number Digit 7 | 1 | 61 |  |
| 14 | Part Number Digit 7 | 1 | 62 |  |
| 15 | Part Number Digit 7 (LSB) | 1 | 63 |  |
| 16 | Part Number Digit 8 (MSB) | 8 | 1 | 64 |  |
| 17 | Part Number Digit 8 | 0 | 65 |  |
| 18 | Part Number Digit 8 | 0 | 66 |  |
| 19 | Part Number Digit 8 (LSB) | 0 | 67 |  |
| 20 | Part Number Digit 9 (MSB) | 9 | 1 | 68 |  |
| 21 | Part Number Digit 9 | 0 | 69 |  |
| 22 | Part Number Digit 9 | 0 | 70 |  |
| 23 | Part Number Digit 9 (LSB) | 1 | 71 |  |
| 24 | Part Number Digit 10 (MSB) | 1 | 0 | 72 |  |
| 25 | Segment Number Bit\_0 (LSB) | 2 | 0 |  |  |
| 26 | Segment Number Bit\_1 | 1 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-1d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Part Number Digit 10 | 1 | 0 | 73 |  |
| 10 | Part Number Digit 10 | 0 | 74 |  |
| 11 | Part Number Digit 10 (LSB) | 1 | 75 |  |
| 12 | Part Number Digit 11 (MSB) | 4 | 0 | 76 |  |
| 13 | Part Number Digit 11 | 1 | 77 |  |
| 14 | Part Number Digit 11 | 0 | 78 |  |
| 15 | Part Number Digit 11 (LSB) | 0 | 79 |  |
| 16 | Part Number Digit 12 (MSB) | 7 | 0 | 80 |  |
| 17 | Part Number Digit 12 | 1 | 81 |  |
| 18 | Part Number Digit 12 | 1 | 82 |  |
| 19 | Part Number Digit 12 (LSB) | 1 | 83 |  |
| 20 | Reserved | 0 | 0 | 84 |  |
| 21 | Reserved | 0 | 85 |  |
| 22 | Reserved | 0 | 86 |  |
| 23 | Reserved | 0 | 87 |  |
| 24 | Reserved | 0 | 88 |  |
| 25 | Segment Number Bit\_0 (LSB) | 3 | 1 |  |  |
| 26 | Segment Number Bit\_1 | 1 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 0 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Attachment 14E-2 – Using Unit Character Coding Using Character Coding   
(Sample Character Coding = AB-CDE-FGH)

Table 14E-2a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | GICB 1 (MSB) | E | 1 |  | [1] |
| 10 | GICB 1 | 1 |  |
| 11 | GICB 1 | 1 |  |
| 12 | GICB 1 (LSB) | 0 |  |
| 13 | GICB 2 (MSB) | 5 | 0 |  | [1] |
| 14 | GICB 2 | 1 |  |
| 15 | GICB 2 | 0 |  |
| 16 | GICB 2 (LSB) | 1 |  |
| 17 | ACAS Unit Part Number Status |  | 0 or 1 | 33 | [2] |
| 18 | Format Type (MSB) | 1 | 0 | 34 | [3] |
| 19 | Format Type (LSB) | 1 | 35 |
| 20 | Character 1 (MSB) | A | 0 | 36 |  |
| 21 | Character 1 | 0 | 37 |  |
| 22 | Character 1 | 0 | 38 |  |
| 23 | Character 1 | 0 | 39 |  |
| 24 | Character 1 | 0 | 40 |  |
| 25 | Segment Number Bit\_0 (LSB) | 0 | 0 |  |  |
| 26 | Segment Number Bit\_1 | 0 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-2b – Label 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Character 1 (LSB) | A | 1 | 41 |  |
| 10 | Character 2 (MSB) | B | 0 | 42 |  |
| 11 | Character 2 | 0 | 43 |  |
| 12 | Character 2 | 0 | 44 |  |
| 13 | Character 2 | 0 | 45 |  |
| 14 | Character 2 | 1 | 46 |  |
| 15 | Character 2 (LSB) | 0 | 47 |  |
| 16 | Character 3 (MSB) | C | 0 | 48 |  |
| 17 | Character 3 | 0 | 49 |  |
| 18 | Character 3 | 0 | 50 |  |
| 19 | Character 3 | 0 | 51 |  |
| 20 | Character 3 | 1 | 52 |  |
| 21 | Character 3 (LSB) | 1 | 53 |  |
| 22 | Character 4 (MSB) | D | 0 | 54 |  |
| 23 | Character 4 | 0 | 55 |  |
| 24 | Character 4 | 0 | 56 |  |
| 25 | Segment Number Bit\_0 (LSB) | 1 | 1 |  |  |
| 26 | Segment Number Bit\_1 | 0 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-2c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Character 4 | D | 1 | 57 |  |
| 10 | Character 4 | 0 | 58 |  |
| 11 | Character 4 (LSB) | 0 | 59 |  |
| 12 | Character 5 (MSB) | E | 0 | 60 |  |
| 13 | Character 5 | 0 | 61 |  |
| 14 | Character 5 | 0 | 62 |  |
| 15 | Character 5 | 1 | 63 |  |
| 16 | Character 5 | 0 | 64 |  |
| 17 | Character 5 (LSB) | 1 | 65 |  |
| 18 | Character 6 (MSB) | F | 0 | 66 |  |
| 19 | Character 6 | 0 | 67 |  |
| 20 | Character 6 | 0 | 68 |  |
| 21 | Character 6 | 1 | 69 |  |
| 22 | Character 6 | 1 | 70 |  |
| 23 | Character 6 (LSB) | 0 | 71 |  |
| 24 | Character 7 (MSB) | G | 0 | 72 |  |
| 25 | Segment Number Bit\_0 (LSB) | 2 | 0 |  |  |
| 26 | Segment Number Bit\_1 | 1 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 1 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Table 14E-2d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BIT** | **FUNCTION** | **CODING** | | **RF MSG BIT** | **NOTES** |
|  | | | | | |
| 1 | Label 1st Digit (MSB) | 2 | 1 |  |  |
| 2 | Label 1st Digit (LSB) | 0 |  |  |
| 3 | Label 2nd Digit (MSB) | 7 | 1 |  |  |
| 4 | Label 2nd Digit | 1 |  |  |
| 5 | Label 2nd Digit (LSB) | 1 |  |  |
| 6 | Label 3rd Digit (MSB) | 0 | 0 |  |  |
| 7 | Label 3rd Digit | 0 |  |  |
| 8 | Label 3rd Digit (LSB) | 0 |  |  |
| 9 | Character 7 | G | 0 | 73 |  |
| 10 | Character 7 | 0 | 74 |  |
| 11 | Character 7 | 1 | 75 |  |
| 12 | Character 7 | 1 | 76 |  |
| 13 | Character 7 (LSB) | 1 | 77 |  |
| 14 | Character 8 (MSB) | H | 0 | 78 |  |
| 15 | Character 8 | 0 | 79 |  |
| 16 | Character 8 | 1 | 80 |  |
| 17 | Character 8 | 0 | 81 |  |
| 18 | Character 8 | 0 | 82 |  |
| 19 | Character 8 (LSB) | 0 | 83 |  |
| 20 | Reserved | 0 | 0 | 84 |  |
| 21 | Reserved | 0 | 85 |  |
| 22 | Reserved | 0 | 86 |  |
| 23 | Reserved | 0 | 87 |  |
| 24 | Reserved | 0 | 88 |  |
| 25 | Segment Number Bit\_0 (LSB) | 3 | 1 |  |  |
| 26 | Segment Number Bit\_1 | 1 |  |  |
| 27 | Segment Number Bit\_2 | 0 |  |  |
| 28 | Segment Number Bit\_3 (MSB) | 0 |  |  |
| 29 | Continuation Bit |  | 0 |  |  |
| 30 | Request/Delivery Bit |  | 0 |  | [4] |
| 31 | Pad |  | 0 |  | [4] |
| 32 | Parity (Odd) |  |  |  |  |

Attachment 14E-3 – Using Software Part Number Coding Using Part Number Coding   
(Sample Part Number = 123-456-789-147)

Encoding of the 270 Words for transfer of the Software Part Number using Part Number Coding proceeds exactly as for transfer of the Unit Part Number using Part Number Coding as defined in Attachment 14E-1 with the following exception:

The GICB1\_\_GICB2 encoding in Segment 0 shall be set to E6 hex (1110 0110 binary).

Attachment 14E-4 – Using Software Character Coding Using Character Coding   
(Sample Character Coding = AB-CDE-FGH)

Encoding of the 270 Words for transfer of the Software Part Number using Character Coding proceeds exactly as for transfer of the Unit Part Number using Character Coding as defined in Attachment 14E-2 with the following exception:

The GICB1\_\_GICB2 encoding in Segment 0 shall be set to E6 hex (1110 0110 binary).

The following notes apply equivalently to Attachments 14E-1 through 14E-4.

Notes:

1. For the ACAS X Unit Part Number, Segment 0, the GICB Register or Buffer Number is equivalent to the BDS register in which the data should be stored in the transponder.
2. ACAS X Unit Part Number Status: 0 = INVALID, 1 = VALID
3. Format Type Coding:

|  |  |  |
| --- | --- | --- |
| FORMAT TYPE CODING | | MEANING |
| **BIT 2** | **BIT 3** |
| 0 | 0 | Part Number (P/N) Coding |
| 0 | 1 | Character Coding |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. When available it is recommended to use the part number.
2. P/N Digits are BCD encoded. Digit 1 is the first left digit of the part number.
3. If the part number is not available, the first 8 characters of the commercial name can be used with the format type 01.
4. If format type 01 is used, the coding of character 1 to 8 shall be as defined in Table 3-7 of Chapter 3, ICAO Annex 10, Volume IV. Character 1 is the first left character of the ACAS unit type.
5. For operational reasons, some military installations may not implement this format.
   * + 1. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it.

ATTACHMENT 14F TCAS TO TRANSPONDER (TX) OPERATIONAL COORDINATION MESSAGE RTCA DO-385/386 COMPATIBLE EQUIPMENT

Table 14F-1a – LABEL 270 – SEGMENT 0

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) 3 0 [1] |
| 10 GICB1 0 [1] |
| 11 GICB1 1 [1] |
| 12 GICB1 (LSB) 1 [1] |
| 13 GICB2 (MSB) As Required [1], [2] |
| 14 GICB2 As Required [1], [2] |
| 15 GICB2 As Required [1], [2] |
| 16 GICB2 (LSB) As Required [1], [2] |
| 17 BDS1 (MSB) 3 0 33 [1], [3] |
| 18 BDS1 0 34 [1], [3] |
| 19 BDS1 1 35 [1], [3] |
| 20 BDS1 (LSB) 1 36 [1], [3] |
| 21 BDS2 (MSB) As Required 37 [1], [2], [3] |
| 22 BDS2 As Required 38 [1], [2], [3] |
| 23 BDS2 As Required 39 [1], [2], [3] |
| 24 BDS2 (LSB) As Required 40 [1], [2], [3] |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [12] |
| 31 Pad 0 [12] |
| 32 Parity (Odd) |

Table 14F-1b – LABEL 270 – SEGMENT 1

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 Not assigned 0 |
| 10 MTB As Required 42 [3], [4] |
| 11 CVC (MSB) As Required 43 [3], [5] |
| 12 CVC (LSB) As Required 44 [3], [5] |
| 13 VRC (MSB) As Required 45 [3], [6] |
| 14 VRC (LSB) As Required 46 [3], [6] |
| 15 CHC (MSB) As Required 47 [3], [7] |
| 16 CHC As Required 48 [3], [7] |
| 17 CHC (LSB) As Required 49 [3], [7] |
| 18 HRC (MSB) As Required 50 [3], [8] |
| 19 HRC As Required 51 [3], [8] |
| 20 HRC (LSB) As Required 52 [3], [8] |
| 21 HSB (MSB) As Required 53 [3], [9] |
| 22 HSB As Required 54 [3], [9] |
| 23 HSB As Required 55 [3], [9] |
| 24 HSB As Required 56 [3], [9] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 1 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [12] |
| 31 Pad 0 [12] |
| 32 Parity (Odd) |

Table 14F-1c – LABEL 270 – SEGMENT 2

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 HSB (LSB) As Required 57 [3], [9] |
| 10 VSB (MSB) As Required 58 [3], [10] |
| 11 VSB As Required 59 [3], [10] |
| 12 VSB As Required 60 [3], [10] |
| 13 VSB (LSB) As Required 61 [3], [10] |
| 14 Not assigned 0 |
| 15 Not assigned 0 |
| 16 Not assigned 0 |
| 17 TAA Bit\_24 (MSB) As Required 65 [3], [11] |
| 18 TAA Bit\_23 As Required 66 [3], [11] |
| 19 TAA Bit\_22 As Required 67 [3], [11] |
| 20 TAA Bit\_21 As Required 68 [3], [11] |
| 21 TAA Bit\_20 As Required 69 [3], [11] |
| 22 TAA Bit\_19 As Required 70 [3], [11] |
| 23 TAA Bit\_18 As Required 71 [3], [11] |
| 24 TAA Bit\_17 As Required 72 [3], [11] |
| 25 Segment Number Bit\_0 (LSB) |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 2 0 |
| 29 Continuation Bit 1 |
| 30 Request/Delivery Bit 0 [12] |
| 31 Pad 0 [12] |
| 32 Parity (Odd) |

Table 14F-1d – LABEL 270 – SEGMENT 3

TCAS TO TRANSPONDER (TX)  
TX Coordination #1 Out Bus  
TX Coordination #2 Out Bus

|  |
| --- |
| **BIT FUNCTION CODING RF MSG BIT NOTES** |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 TAA Bit\_16 As Required 73 [3], [11] |
| 10 TAA Bit\_15 As Required 74 [3], [11] |
| 11 TAA Bit\_14 As Required 75 [3], [11] |
| 12 TAA Bit\_13 As Required 76 [3], [11] |
| 13 TAA Bit\_12 As Required 77 [3], [11] |
| 14 TAA Bit\_11 As Required 78 [3], [11] |
| 15 TAA Bit\_10 As Required 79 [3], [11] |
| 16 TAA Bit\_9 As Required 80 [3], [11] |
| 17 TAA Bit\_8 As Required 81 [3], [11] |
| 18 TAA Bit\_7 As Required 82 [3], [11] |
| 19 TAA Bit\_6 As Required 83 [3], [11] |
| 20 TAA Bit\_5 As Required 84 [3], [11] |
| 21 TAA Bit\_4 As Required 85 [3], [11] |
| 22 TAA Bit\_3 As Required 86 [3], [11] |
| 23 TAA Bit\_2 As Required 87 [3], [11] |
| 24 TAA Bit\_1 (LSB) As Required 88 [3], [11] |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 3 0 |
| 29 Continuation Bit 0 |
| 30 Request/Delivery Bit 0 [12] |
| 31 Pad 0 [12] |
| 32 Parity (Odd) |

Notes:

1. For the Operational Coordination Message, Segment 0, the GICB Register Number is equivalent to the BDS Buffer Number. This may or may not be the case for other messages to be transferred via the TGD protocol..
2. In a given processing cycle, ACAS Xu may send up to five OCMs to be stored in transponder registers 3316 through 3716. The ACAS X will set the GICB Register Number and BDS Buffer Number appropriately.
3. These bits are sent by own transponder in the ADS-B Operational Coordination Message.
4. The Multiple Threat Bit (MTB) indicates a multiple threat.
5. The Cancel Vertical Resolution Advisory Complement (CVC) indicates the vertical RAC for the CA equipped threat aircraft to cancel.
6. The Vertical Resolution Advisory Complement (VRC) indicates the vertical RA complement (Do Not Pass Above or Do Not Pass Below) to the CA equipped threat aircraft.
7. The Cancel Horizontal Resolution Advisory Complement (CHC) indicates the horizontal RAC for the CA equipped threat aircraft to cancel.
8. The Horizontal Resolution Advisory Complement (HRC) indicates the horizontal RA complement (Do Not Turn Left or Do Not Turn Right) to the CA equipped threat aircraft.
9. The Horizontal Sense Bits (HSB) is a parity coding field used to protect the CHC and HRC fields.
10. The Vertical Sense Bits (VSB) is a parity coding field used to protect the CVC and VRC fields.
11. The Threat Identity Aircraft Address (TAA) contains the ICAO 24-bit Address of the threat aircraft that is the intended recipient of the OCM.
12. The SSM field is not required for the TGD protocol since it is assumed that the data being sent to the Transponder is valid; otherwise, the TCAS should not be sending it.

ATTACHMENT 14G TRANSPONDER TO TCAS (XT) XGD PROTOCOL RTCA DO-385/386 COMPATIBLE EQUIPMENT

Table 14G-1a – LABEL 270 – SEGMENT 0

TRANSPONDER TO TCAS (XT)  
XT Coordination #1 In Bus  
XT Coordination #2 In Bus

|  |
| --- |
| BIT FUNCTION CODING NOTES |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB1 (MSB) [1] |
| 10 GICB1 [1] |
| 11 GICB1 [1] |
| 12 GICB1 (LSB) [1] |
| 13 GICB2 (MSB) [1] |
| 14 GICB2 [1] |
| 15 GICB2 [1] |
| 16 GICB2 (LSB) [1] |
| 17 GICB Data Bit #1 (MSB) [2] |
| 18 GICB Data Bit #2 |
| 19 GICB Data Bit #3 |
| 20 GICB Data Bit #4 |
| 21 GICB Data Bit #5 |
| 22 GICB Data Bit #6 |
| 23 GICB Data Bit #7 |
| 24 GICB Data Bit #8 |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 0 0 |
| 29 Continuation Bit 1 [3] |
| 30 Request/Delivery Bit 0 [4] [5] |
| 31 Pad 0 [5] |
| 32 Parity (Odd) |

Table 14G-1b – LABEL 270 – SEGMENT 1

TRANSPONDER TO TCAS (XT)  
XT Coordination #1 In Bus  
XT Coordination #2 In Bus

|  |
| --- |
| BIT FUNCTION CODING NOTES |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB Data Bit #9 |
| 10 GICB Data Bit #10 |
| 11 GICB Data Bit #11 |
| 12 GICB Data Bit #12 |
| 13 GICB Data Bit #13 |
| 14 GICB Data Bit #14 |
| 15 GICB Data Bit #15 |
| 16 GICB Data Bit #16 |
| 17 GICB Data Bit #17 |
| 18 GICB Data Bit #18 |
| 19 GICB Data Bit #19 |
| 20 GICB Data Bit #20 |
| 21 GICB Data Bit #21 |
| 22 GICB Data Bit #22 |
| 23 GICB Data Bit #23 |
| 24 GICB Data Bit #24 |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 0 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 1 0 |
| 29 Continuation Bit 1 [3] |
| 30 Request/Delivery Bit 0 [4] [5] |
| 31 Pad 0 [5] |
| 32 Parity (Odd) |

Table 14G-1c – LABEL 270 – SEGMENT 2

TRANSPONDER TO TCAS (XT)   
XT Coordination #1 In Bus  
XT Coordination #2 In Bus

|  |
| --- |
| BIT FUNCTION CODING NOTES |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB Data Bit #25 |
| 10 GICB Data Bit #26 |
| 11 GICB Data Bit #27 |
| 12 GICB Data Bit #28 |
| 13 GICB Data Bit #29 |
| 14 GICB Data Bit #30 |
| 15 GICB Data Bit #31 |
| 16 GICB Data Bit #32 |
| 17 GICB Data Bit #33 |
| 18 GICB Data Bit #34 |
| 19 GICB Data Bit #35 |
| 20 GICB Data Bit #36 |
| 21 GICB Data Bit #37 |
| 22 GICB Data Bit #38 |
| 23 GICB Data Bit #39 |
| 24 GICB Data Bit #40 |
| 25 Segment Number Bit\_0 (LSB) 0 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 2 0 |
| 29 Continuation Bit 1 [3] |
| 30 Request/Delivery Bit 0 [4] [5] |
| 31 Pad 0 [5] |
| 32 Parity (Odd) |

Table 14G-1d – LABEL 270 – SEGMENT 3

TRANSPONDER TO TCAS (XT)  
XT Coordination #1 In Bus  
XT Coordination #2 In Bus

|  |
| --- |
| BIT FUNCTION CODING NOTES |
|  |
| 1 Label 1st Digit (MSB) 2 1 |
| 2 Label 1st Digit (LSB) 0 |
| 3 Label 2nd Digit (MSB) 7 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 1 |
| 6 Label 3rd Digit (MSB) 0 0 |
| 7 Label 3rd Digit 0 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 GICB Data Bit #41 |
| 10 GICB Data Bit #42 |
| 11 GICB Data Bit #43 |
| 12 GICB Data Bit #44 |
| 13 GICB Data Bit #45 |
| 14 GICB Data Bit #46 |
| 15 GICB Data Bit #47 |
| 16 GICB Data Bit #48 |
| 17 GICB Data Bit #49 |
| 18 GICB Data Bit #50 |
| 19 GICB Data Bit #51 |
| 20 GICB Data Bit #52 |
| 21 GICB Data Bit #53 |
| 22 GICB Data Bit #54 |
| 23 GICB Data Bit #55 |
| 24 GICB Data Bit #56 (LSB) |
| 25 Segment Number Bit\_0 (LSB) 1 |
| 26 Segment Number Bit\_1 1 |
| 27 Segment Number Bit\_2 0 |
| 28 Segment Number Bit\_3 (MSB) 3 0 |
| 29 Continuation Bit 0 [6] |
| 30 Request/Delivery Bit 0 [4] [5] |
| 31 Pad 0 [5] |
| 32 Parity (Odd) |

Notes:

1. These fields should be set to the number of the Transponder GICB Register or Buffer containing the data that is being transferred to the ACAS X.
2. Contents of the GICB buffer are transferred MSB first (bit 1 of the GICB).
3. The Continuation Bit should be set to one.
4. The Request/Delivery Bit should be set to zero.
5. The SSM field is not required for the XGD protocol since it is assumed that the data being sent to the ACAS X is valid; otherwise, the Transponder should not be sending it. Status of the ACAS X/Transponder system is provided to the ACAS X by the Transponder via all other standard ARINC 429 words, except Control Words, that are sent to the ACAS X (see ATTACHMENT 11).
6. The Continuation Bit should be set to zero.

ATTACHMENT 15A DISPLAY TRAFFIC INFORMATION FILE (DTIF) FORMAT

This attachment defines the Display Traffic Information File (DTIF) structure. The following table lists the goals and requirements for the DTIF format. A brief description is included on how these goals are satisfied.

|  |  |
| --- | --- |
| **Goals/Requirement** | **Compliance** |
| Provide a mechanism to display ICAO Flight ID on intruders, which are displayed by TCAS. | This is provided in the DTIF. |
| Provide a mechanism to display ranges greater than 128 nmi. (up to 512 nmi). | This is provided by the DTIF. |
| Provide a mechanism to display relative altitudes outside of ± 12700 ft (up to ± 51200 ft). | This is provided in the DTIF (see definition of labels). |
| Provide a mechanism to furnish the display with more than 32 traffic items (up to 127). | This is provided in the DTIF (see definition of labels). |
| Minimize change: Addition of the Display Traffic Information File requires no change to the standard TCAS intruder file. | The DTIF does not require any changes to the current TCAS intruder file structure. |
| Backward Compatibility: The Display Traffic Information File Format should be backward compatible with existing displays so that only the desired display in an aircraft would need to have its software updated. For example, a dedicated TCAS display could be updated, but the existing TA/VSIs would not require a change. | The DTIF is backward compatible with existing displays. The labels used in the transmission protocol (currently defined as 366 and 367) are currently not defined by ARINC 735 display interface and therefore are ignored by existing displays. |
| Flexibility: The file structure should allow for future growth (as other ADS-B applications are defined). However, future changes should be compatible with existing displays. | The file structure is variable length. The “traffic packets” are variable length. The length of each packet is defined in the packet header word. The file structure allows each traffic packet to contain different data types. |
| Minimizes Impact To Bus Bandwidth:The DTIF packs the data in more densely than the standard TCAS intruder file and avoids repetition of data (i.e., intruder number). Data types can be omitted from packets as needed to reduce bus overhead and increase data transmission rates. | The DTIF uses bit packing and does not repeat redundant information (such as traffic number) in every label. |
| Integrity: The file structure should support equivalent integrity to the standard TCAS intruder file structure. | The file structure supports equivalent file validity checking.  a. If any word of the DTIF has bad parity, then it should not be counted by the receiving device. The receiving device should discard the file for a mismatch in word count.  b. Likewise, if a word is dropped from the DTIF then the receiving device should discard the file for a mismatch in word count.  c. The start and end of file are assigned labels different from the file content labels so that a file content label cannot be misinterpreted as the start or end of a file. |

ATTACHMENT 15B DISPLAY TRAFFIC INFORMATION FILE (DTIF) STRUCTURE   
TCAS TO DISPLAY

Display Traffic Information File (DTIF) [1] [2] [4] [13]

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Label 367 (DTIF Start of Transmission Control Word) [3] | | | | | | |
|  | Label 366 (DTIF Header) [3] [5] | | | | |  |
|  |  | Label 366 (DTIF Packet Header)- Packet #1[6] [7] [8] [10] [12] | | |  |  |
|  |  |  | Data Type 0000 [9] [10]  Label 366 (DTIF Data Word – Type 0: Traffic Flight ID) - Traffic # h, Flight ID Word (Char #1, #2 and #3) |  |  |  |
|  |  |  | Label 366 (DTIF Data Word – Type 0: Traffic Flight ID) - Traffic # h, Flight ID Word (Char #4, #5 and #6) |  |  |  |
|  |  |  | Label 366 (DTIF Data Word – Type 0: Traffic Flight ID) - Traffic # h, Flight ID Word (Char #7 and #8) |  |  |  |
|  |  |  | Data Type 0001[9] [10]  Label 366 (DTIF Data Word – Type 1: Traffic Range, Altitude and Bearing) – Traffic # h. |  |  |  |
|  |  |  | Label 366 (DTIF Data Word – Type 1: Traffic Range, Altitude and Bearing) – Traffic # h. |  |  |  |
|  |  |  | **:**  **:**  Data Type x [9]  Label 366 Data Word – Traffic # h, Data Type x |  |  |  |
|  |  |  | | |  |  |
|  |  |  | | |  |  |
|  |  | Label 366 (DTIF Packet Header) - Packet #2[6] [7] [8] [10] | | |  |  |
|  |  |  | Data Type 0001[9] [10]  Label 366 (DTIF Data Word – Type 1: Traffic Range, Altitude and Bearing) - Traffic # i. |  |  |  |
|  |  |  | Label 366 (DTIF Data Word – Type 1: Traffic Range, Altitude and Bearing) – Traffic # i. |  |  |  |
|  |  | **:**  **:** | | |  |  |
|  |  | **:** | | |  |  |
|  |  | Label 366 (DTIF Packet Header) – Packet #n[6] [7] [8] [10] | | |  |  |
|  |  |  | Data Type XXXX [9] [10]  Label 366 (Traffic File Data Word – Type x) – Traffic # n. |  |  |  |
|  |  |  | Label 366 (Traffic File Data Word – Type x) – Traffic # n. |  |  |  |
|  |  |  | | |  |  |
|  |  | | | | |  |
| Label 367 (DTIF End of Transmission Control Word) [3] | | | | | | |

TCAS transmits two different traffic information files. The standard TCAS intruder file defined in ATTACHMENT 6 and the Display Traffic Information File (DTIF) defined in Attachments 15A through 15P. It is expected that when appropriately strapped, the TCAS should transmit both files. Any given display should only process one of them. Displays designed against ATTACHMENT 6 should use that file. Displays that implement some form of CDTI (i.e., display of Flight ID) should use the DTIF. The DTIF provides a consolidated file that incorporates the data content of the TCAS Intruder file plus data content to support ADS-B, TIS-B and other traffic types. Therefore, the CDTI capable displays are only required to read the DTIF for complete display information. Both files are transmitted to insure backward compatibility with a cockpit that has two different traffic displays, where only one has been updated to accept the DTIF.

Regardless of the traffic display file format, the traffic records are prioritized in decreasing order of importance within the file. The data for the highest priority traffic is transmitted first and the data for the lowest priority traffic is last. A number is assigned to each traffic entry that remains associated with that traffic for the life of its track. This number facilitates identification of the data associated with each traffic entry in consecutively transmitted traffic display files so that the display unit can smooth the position of the traffic between updates. The number in no way indicates the importance or priority for display of traffic, display priority is indicated solely by the order of the traffic within the traffic display file.

The DTIF is transmitted at a one Hertz nominal rate. The DTIF may be interrupted between labels by non-periodic and periodic data transfer requirements, between the TCAS and displays, without causing a failure of the interface. Upon completion of the interrupting data transfer, the interface should resume transmission of the file, keeping the integrity of the file structure intact.

The interleaving of other words with this DTIF structure is permitted.

Notes:

1. The DTIF should be activated (transmitted) by connecting the Display Traffic Information File pin (RMP-5E) to the Program Pin Common (RBP-7K) OR by setting the Display Traffic Information File bit, of Label 013, to the appropriate state. Refer to ARINC 735A, Attachment 3B and Attachment 6C.
2. When enabled, the time between the Start of Transmission (STX) and End of Transmission (ETX) framing labels should be no greater than 1 second.
3. When enabled, the STX and ETX labels and the DTIF Header should always be transmitted – even when no traffic is present.
4. The maximum word count in the DTIF is 2289 – including the STX, ETX, and File Heading labels.
5. The DTIF is limited to 127 traffic packets.
6. The number of data types in any given packet is limited to 16.
7. Data types should not be duplicated in any given packet.
8. The data types’ order in any packet is variable.
9. The number of labels in a given data type must be received in the correct order (see definition of labels).
10. Traffic numbers must stay the same for each target for its entire duration.
11. The number of words in a data type may be variable. This is communicated via the data type continuation bit.
12. The number of labels specified in the DTIF Packet Header includes the header label itself.
13. The Display Traffic Information File (DTIF) should contain only one traffic information packet per intruder (airborne or ground).

Table 20B-1 – DTIF Output Logic

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| External Selection | | | Traffic Computer Output  Label 013 | | | DTIF Output – System Response | |
| MCDU/  Control Head ADS-B Selection | DTIF Program Pin MP-5E | Transponder Input Label 013 Bit 15 setting | Bit 15 = DTIF | Bit 17 = ADS\_B Off | Signal Type | DTIF Packet Header | Label Numbers |
| ADS-B On | Open | 1  Transmit DTIF | 1  Transmit DTIF | 0 = On | All Types DTIF Data | TCAS, ADS-B, TIS-B, ADS-R, Multi-source, as appropriate | 130-132, 272, 366, 367 |
| ADS-B Off | Open | 1  Transmit DTIF | 1  Transmit DTIF | 1 = Off | All Types DTIF Data for TCAS participants only (TCAS or Multi-source) | Multi-source becomes TCAS. ADS-B, ADS-R, and TIS-B traffic set to invalid, TCAS remains TCAS. | 130-132, 272, 366, 367 |
| ADS-B On | Strapped | 1  Transmit DTIF | 1  Transmit DTIF | 0 = On | All Types DTIF Data | TCAS, ADS-B, TIS-B, ADS-R, Multi-source, as appropriate | 130-132, 272, 366, 367 |
| ADS-B Off | Strapped | 1  Transmit DTIF | 1  Transmit DTIF | 1 = Off | All Types DTIF Data for TCAS participants only (TCAS or Multi-source) | Multi-source becomes TCAS. ADS-B, ADS-R, and TIS-B traffic set to invalid, TCAS remains TCAS. | 130-132, 272, 366, 367 |
| Don’t care | Open | 0  No DTIF | 0  No DTIF Transmitted | 1 = Off | TCAS Data Only (Range, Bearing); incl 130-132. | DTIF not transmitted. | 130-132 |
| ADS-B On | Strapped | 0  No DTIF | 1  Transmit DTIF | 0 = On | All Types DTIF Data | TCAS, ADS-B, TIS-B, ADS-R, Multi-source, as appropriate | 130-132, 272, 366, 367 |
| ADS-B Off | Strapped | 0  No DTIF | 1  Transmit  DTIF | 1 = Off | All Types DTIF Data for TCAS participants only (TCAS or Multi-source) | Multi-source becomes TCAS. ADS-B, ADS-R, and TIS-B traffic set to invalid, TCAS remains TCAS. | 130-132, 272, 366, 367 |

ATTACHMENT 15C DISPLAY TRAFFIC INFORMATION FILE (DTIF) DATA TYPE WORD STRUCTURE

The following is an example of the typical DTIF Data Type word structure:

First Word in Data Type –

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **32** | **31** | **30-13** | **12-9** | **8-1** |
| Parity | Data Type  Continuation Bit  [4] | Data  [3] | Data Type  [2] | Label 366  [1] |

Subsequent Words in Data Type –

|  |  |  |  |
| --- | --- | --- | --- |
| **32** | **31** | **30-9** | **8-1** |
| Parity | Data Type  Continuation Bit  [4] | Data  [3] | Label 366  [1] |

Notes:

1. This field contains the octal label number. With the exception of the STX and ETX framing words, all words in the traffic file should be numbered 366.
2. For the first word in any data type, this field contains the type of data that the word represents. For subsequent words in the data type, this field can be used as part of the data field. All data types are listed in the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BITS** | | | | | **MEANING** |
| **12** | **11** | | **10** | **9** |
| 0 | 0 | 0 | | 0 | Label 366 (DTIF Data Word – Type 0: Traffic Flight ID) |
| 0 | 0 | 0 | | 1 | Label 366 (DTIF Data Word – Type 1: Traffic Range, Relative Altitude, and Bearing) |
| 0 | 0 | 1 | | 0 | Label 366 (DTIF Data Word – Type 2: Traffic Position  (Latitude and Longitude) and Relative Altitude (Version 0) or Vertical Speed (Version 1) |
| 0 | 0 | 1 | | 1 | Label 366 (DTIF Data Word – Type 3: Traffic Ground Speed, Track  Angle, and Closure Rate) |
| 0 | 1 | 0 | | 0 | Label 366 (DTIF Data Word – Type 4: Traffic Quality Information by Grouping) |
| 0 | 1 | 0 | | 1 | Label 366 (DTIF Data Word – Type 5: Intruder Information Length/Width Word) |
| 0 | 1 | 1 | | 0 | Label 366 (DTIF Data Word – Type 6: User Defined) |
| 0 | 1 | 1 | | 1 | Label 366 (DTIF Data Word – Type 7: Traffic Time of Applicability (UTC)) |
| 1  1  1  1  1  1  1  1 | 0  0  0  0  1  1  1  1 | 0  0  1  1  0  0  1  1 | | 0  1  0  1  0  1  0  1 | Not Defined  Not Defined  Not Defined  Not Defined  Not Defined  Not Defined  Not Defined  Not Defined |

COMMENTARY

Display manufacturers should allow for additional unknown data types to be added in the future. And, no assumptions of data type ordering should be made.

1. This field contains the data information. For multiple word data types, this field comprises bits 13-30 for the first word and bits 9-30 for subsequent words.
2. This field contains the Data Type Continuation Bit. The Data Type Continuation Bit should be set to ZERO -- indicating that this data type has not terminated. The Data Type Continuation Bit should be set to ONE -- indicating that this data type has terminated.

ATTACHMENT 15D DISPLAY TRAFFIC INFORMATION FILE (DTIF) START OF FILE PROTOCOL – STX

**LABEL 367**

**BIT FUNCTION CODING NOTES**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 7 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 1

9 Number of Words in DTIF - 1 [1] [2]

10 Number of Words in DTIF - 2

11 Number of Words in DTIF - 4

12 Number of Words in DTIF - 8

13 Number of Words in DTIF - 16

14 Number of Words in DTIF - 32

15 Number of Words in DTIF - 64

16 Number of Words in DTIF - 128

17 Number of Words in DTIF - 256

18 Number of Words in DTIF - 512

19 Number of Words in DTIF - 1024

20 Number of Words in DTIF - 2048

21 Pad 0

22 Pad 0

23 Pad 0

24 All Traffic/Threat Traffic [3]

25 ISO #5 Character STX (0/2) (LSB) 0

26 ISO #5 Character STX (0/2) 1

27 ISO #5 Character STX (0/2) 0

28 ISO #5 Character STX (0/2) 0

29 ISO #5 Character STX (0/2) 0

30 ISO #5 Character STX (0/2) 0

31 ISO #5 Character STX (0/2) (MSB) 0

32 Parity (Odd)

Notes:

1. This field contains the total number of ARINC 429 words, including the STX/ETX control words and the Display Traffic Information File Header, in the Display Traffic Information File.
2. The number of words in the Display Traffic Information File can range from minimum of 3 words (STX, file header and ETX) to a maximum of 2289 words.
3. This bit is filled according to the connection of the program pin   
   RBP-7F. If RBP-7F is open, bit 24 should be set to 1 and all traffic should be displayed on ND. If RBP-7F is connected to program pin common (RBP-7K), then bit 24 should be set to 0 and traffic should be displayed on ND only if a TA or RA is active.

|  |  |
| --- | --- |
| **All traffic/Threat traffic BIT 24** | **MEANING** |
| 0 | Display traffic only if a TA/RWC or RA is active |
| 1 | Display traffic |

ATTACHMENT 15E DISPLAY TRAFFIC INFORMATION FILE (DTIF) END OF FILE   
PROTOCOL – ETX

**LABEL 367**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 7 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 1

9 Number of Words in DTIF - 1 [1] [2]

10 Number of Words in DTIF - 2

11 Number of Words in DTIF - 4

12 Number of Words in DTIF - 8

13 Number of Words in DTIF - 16

14 Number of Words in DTIF - 32

15 Number of Words in DTIF - 64

16 Number of Words in DTIF - 128

17 Number of Words in DTIF - 256

18 Number of Words in DTIF - 512

19 Number of Words in DTIF - 1024

20 Number of Words in DTIF - 2048

21 Pad 0

22 Pad 0

23 Pad 0

24 Pad 0

25 ISO #5 Character ETX (0/3) (LSB) 1

26 ISO #5 Character ETX (0/3) 1

27 ISO #5 Character ETX (0/3) 0

28 ISO #5 Character ETX (0/3) 0

29 ISO #5 Character ETX (0/3) 0

30 ISO #5 Character ETX (0/3) 0

31 ISO #5 Character ETX (0/3) (MSB) 0

32 Parity (Odd)

Notes:

1. This field contains the total number of ARINC 429 words, including the STX/ETX control words and the Display Traffic Information File Header, in the Display Traffic Information File.
2. The number of words in the Display Traffic Information File can range from minimum of three words (STX, file header, and ETX) to a maximum of 2289 words.

ATTACHMENT 15F DISPLAY TRAFFIC INFORMATION FILE (DTIF) HEADER

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Number of Traffic Packets in DTIF File 1 [1]

10 Number of Traffic Packets in DTIF File 2

11 Number of Traffic Packets in DTIF File 4

12 Number of Traffic Packets in DTIF File 8

13 Number of Traffic Packets in DTIF File 16

14 Number of Traffic Packets in DTIF File 32

15 Number of Traffic Packets in DTIF File 64

16 DTIF Version Number LSB [3]

17 DTIF Version Number

18 DTIF Version Number MSB

19 Pad 0

20 Reserved for Manufacturer Use 0

21 Reserved for Manufacturer Use 0

22 Reserved for Manufacturer Use 0

23 Pad 0

24 Display limit – Number of targets 1 [2]

25 Display limit – Number of targets 2

26 Display limit – Number of targets 4

27 Display limit – Number of targets 8

28 Display limit – Number of targets 16

29 Display limit – Number of targets 32

30 Display limit – Number of targets 64

31 Pad 0

32 Parity (Odd)

Notes:

1. The maximum number of traffic packets in any Display Traffic Information File is limited to 127.
2. The display limit indicates to the display the maximum number of targets that shall be displayed at the same time on the CDTI.
3. The DTIF version number is used to allow multiple meanings of DTIF Type 2 data. It was recognized that the reporting of relative altitude was repeated across both Type 1 and Type 2 DTIF data. Therefore, with the introduction of DTIF Version 1, DTIF Type 2 data would now include vertical speed data in the place of the relative altitude data. The setting of DTIF version number is then:

000 = Version 0

001 = Version 1

ATTACHMENT 15G DISPLAY TRAFFIC INFORMATION FILE (DTIF) PACKET HEADER

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Traffic Number – 1 [1]

10 Traffic Number – 2

11 Traffic Number – 4

12 Traffic Number – 8

13 Traffic Number – 16

14 Traffic Number – 32

15 Traffic Number – 64

16 Number of Labels in Packet – 1 [2]

17 Number of Labels in Packet – 2

18 Number of Labels in Packet – 4

19 Number of Labels in Packet – 8

20 Number of Labels in Packet – 16

21 Reserved for Manufacturer Use

22 Reserved for Manufacturer Use

23 Display Matrix[4]

24 Display Matrix

25 Display Matrix

26 Display Matrix

27 Source Data Type [5]

28 Source Data Type

29 Source Data Type

30 Air/Ground Status [3]

31 Spare

32 Parity (Odd)

Notes:

1. The traffic numbers can range from 0 to 127.
2. The maximum number of labels per packet is limited to 18. The number of labels count includes the label with the Display Traffic Information File Packet Header and all labels that contain File Data Words.
3. 0 = Traffic is Airborne.

1 = Traffic is On Ground.

1. Display Matrix coding:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BITS** | | | | **MEANING** |
| **26** | **25** | **24** | **23** |
| 0 | 0 | 0 | 0 | Non Threat Traffic |
| 0 | 0 | 0 | 1 | Traffic Advisory |
| 0 | 0 | 1 | 0 | Resolution Advisory |
| 0 | 0 | 1 | 1 | Proximate Traffic |
| 0 | 1 | 0 | 0 | Reserved |
| 0 | 1 | 0 | 1 | Reserved |
| 0 | 1 | 1 | 0 | Reserved |
| 0 | 1 | 1 | 1 | Reserved |
| 1 | 0 | 0 | 0 | Reserved (Military) |
| 1 | 0 | 0 | 1 | Reserved (Military) |
| 1 | 0 | 1 | 0 | Reserved (Military) |
| 1 | 0 | 1 | 1 | Reserved (Military) |
| 1 | 1 | 0 | 0 | Reserved (Military) |
| 1 | 1 | 0 | 1 | Reserved (Military) |
| 1 | 1 | 1 | 0 | Reserved (Military) |
| 1 | 1 | 1 | 1 | Reserved (Military) |

For aircraft whose Source Data Type indicates TCAS, the meaning of Non Threat, Traffic Advisory, Resolution Advisory, and Proximate Traffic are defined in RTCA DO-185B.

1. Source Data coding:

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **29** | **28** | **27** |
| 0 | 0 | 0 | Invalid |
| 0 | 0 | 1 | TCAS |
| 0 | 1 | 0 | ADS-B |
| 0 | 1 | 1 | ADS-R |
| 1 | 0 | 0 | TIS-B |
| 1 | 0 | 1 | Reserved |
| 1 | 1 | 0 | Reserved |
| 1 | 1 | 1 | Multi-source Traffic Data |

This field indicates the source of the traffic data.

ATTACHMENT 15H-1 DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 0 FLIGHT ID WORD (CHAR #1, #2, #3)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Data Type (LSB) 0 0 [1]

10 Data Type 0

11 Data Type 0

12 Data Type (MSB) 0

13 Character #1 (LSB) [2]

14 Character #1

15 Character #1

16 Character #1

17 Character #1

18 Character #1 (MSB)

19 Character #2 (LSB) [2]

20 Character #2

21 Character #2

22 Character #2

23 Character #2

24 Character #2 (MSB)

25 Character #3 (LSB) [2]

26 Character #3

27 Character #3

28 Character #3

29 Character #3

30 Character #3 (MSB)

31 Data Type Continuation Bit 0 [3]

32 Parity (Odd)

ATTACHMENT 15H-2 DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 0 FLIGHT ID WORD (CHAR #4, #5, #6)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Character #4 (LSB) [2]

10 Character #4

11 Character #4

12 Character #4

13 Character #4

14 Character #4 (MSB)

15 Character #5 (LSB) [2]

16 Character #5

17 Character #5

18 Character #5

19 Character #5

20 Character #5 (MSB)

21 Character #6 (LSB) [2]

22 Character #6

23 Character #6

24 Character #6

25 Character #6

26 Character #6 (MSB)

27 Pad 0

28 Pad 0

29 Pad 0

30 Pad 0

31 Data Type Continuation Bit 0 [3]

32 Parity (Odd)

ATTACHMENT 15H-3 DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 0 FLIGHT ID WORD (CHAR #7, #8)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Character #7 (LSB) [2]

10 Character #7

11 Character #7

12 Character #7

13 Character #7

14 Character #7 (MSB)

15 Character #8 (LSB) [2]

16 Character #8

17 Character #8

18 Character #8

19 Character #8

20 Character #8 (MSB)

21 Type Code (LSB) [5]

22 Type Code

23 Type Code (MSB)

24 Pad 0

25 Aircraft Category (LSB) [6]

26 Aircraft Category

27 Aircraft Category (MSB)

28 ADS-B Version Number (LSB) [7]

29 ADS-B Version Number

30 ADS-B Version Number (MSB)

31 Data Type Continuation Bit 1 [4]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C).
2. Encoded as a 6-bit subset as specified in RTCA DO – 181F Section 2.2.19.1.13.
3. The Data Type Continuation Bit should be set to 0 -- indicating that this data type has not terminated.
4. The Data Type Continuation Bit should be set to ONE -- indicating that this data type has terminated.
5. Encode the Type Code as per the following table   
   (Reference: RTCA DO-260B/C, 2.2.3.2.5.2).

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **23** | **22** | **21** |
| 0 | 0 | 0 | Aircraft Category Set A |
| 0 | 0 | 1 | Aircraft Category Set B |
| 0 | 1 | 0 | Aircraft Category Set C |
| 0 | 1 | 1 | Aircraft Category Set D |
| 1 | 0 | 0 | Reserved for future use |
| 1 | 0 | 1 | Reserved for future use |
| 1 | 1 | 0 | Reserved for future use |
| 1 | 1 | 1 | Reserved for future use |
| Note: Category Set D is undefined in DO-260C. | | | |

Encode Aircraft Category according to RTCA DO-260B, Table 2-19 or RTCA DO-260C Table 2-16.

|  |  |  |  |
| --- | --- | --- | --- |
| AIRCRAFT CATEGORY SET ENCODING | | | |
| BIT | 27 | 26 | 25 |
| “ME” BIT | 6 | 7 | 8 |

1. If any one of the data parameters is available (e.g., Flt ID, Type Code, or Aircraft Category), then Type 0 will still be transmitted in its entirety (i.e., all three data words will be transmitted). If none of the data parameters is available, then NO Type 0 words will be transmitted. If the traffic is TCAS only, then Type 0 words will not be transmitted.
2. ADS-B Version Number encoding:

|  |  |  |  |
| --- | --- | --- | --- |
| **BITS** | | | **MEANING** |
| **30** | **29** | **28** |
| 0 | 0 | 0 | Conformant to DO-260/ED-102 |
| 0 | 0 | 1 | Conformant to DO-260A |
| 0 | 1 | 0 | Conformant to DO-260B/ED-102A |
| 0 | 1 | 1 | Conformant to DO-260C/ED-102B |
| 1 | 0 | 0 | Reserved for future use |
| 1 | 0 | 1 | Reserved for future use |
| 1 | 1 | 0 | Reserved for future use |
| 1 | 1 | 1 | Reserved for future use |

ATTACHMENT 15I DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 1 TRAFFIC RANGE, ALTITUDE, AND BEARING WORD

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Data Type (LSB) 1 1 [1]

10 Data Type 0

11 Data Type 0

12 Data Type (MSB) 0

13 Traffic Vert Sense [2] [3]

14 Traffic Vert Sense

15 Coarse/Fine Range [6]

16 Traffic Range 1/16 NM **/** 1/512 NM [7]

17 Traffic Range 1/8 NM **/** 1/256 NM

18 Traffic Range 1/4 NM **/** 1/128 NM

19 Traffic Range 1/2 NM **/** 1/64 NM

20 Traffic Range 1 NM **/** 1/32 NM

21 Traffic Range 2 NM **/** 1/16 NM

22 Traffic Range 4 NM **/** 1/8 NM

23 Traffic Range 8 NM **/** 1/4 NM

24 Traffic Range 16 NM **/** 1/2 NM

25 Traffic Range 32 NM **/** 1 NM

26 Traffic Range 64 NM **/** 2 NM

27 Traffic Range 128 NM **/** 4 NM

28 Traffic Range 256 NM **/** 8 NM

29 Traffic Range Invalidity [8]

30 Relative Altitude Status [4]

31 Data Type Continuation Bit [5]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit 3 1

2 Label 1st Digit 1

3 Label 2nd Digit 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit 0

6 Label 3rd Digit 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit 0

9 Relative Altitude 100 FT.

10 Relative Altitude 200

11 Relative Altitude 400

12 Relative Altitude 800

13 Relative Altitude 1600

14 Relative Altitude 3200

15 Relative Altitude 6400

16 Relative Altitude 12800

17 Relative Altitude 25600

18 Relative Altitude Sign

19 Traffic Bearing 0.175781 DEG.

20 Traffic Bearing 0.351563

21 Traffic Bearing 0.703125

22 Traffic Bearing 1.40625

23 Traffic Bearing 2.8125

24 Traffic Bearing 5.625

25 Traffic Bearing 11.25

26 Traffic Bearing 22.5

27 Traffic Bearing 45

28 Traffic Bearing 90

29 Traffic Bearing Sign

30 Bearing Status [4]

31 Data Type Continuation Bit [5]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C).
2. Bits 13-15 of the first Extended Range, Altitude, and Bearing Data Type word were previously defined in ARINC 735A as Display Matrix. This has been superseded by moving the Display Matrix field to the Data Packet Header word.
3. Sense of Traffic’s Vertical Rate

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| 14 | 13 |
| 0 | 0 | No Vertical Rate (Level Flight) |
| 0 | 1 | Climbing |
| 1 | 0 | Descending |
| 1 | 1 | No Data |

1. Relative Altitude Status and Bearing Status:
2. 1 = Valid
3. 0 = Invalid
4. The Data Type Continuation Bit:
5. 0 = indicates that this data type has not terminated.
6. 1 = indicates that this data type has terminated.
7. The Coarse/Fine Range
8. 0 = Coarse Range Settings (1/16 NM to 256 NM).
9. 1 = Fine Range S ettings (1/512 NM to 2 NM).
10. The Traffic Computer should compute and transmit horizontal range to the displays when intruder altitude information is available and valid, and should transmit slant range when intruder altitude information is not available or is invalid.
11. Traffic Range Invalidity:
12. 0 = Valid
13. 1 = Invalid

ATTACHMENT 15J DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 2 VERSION 0 TRAFFIC LATITUDE, LONGITUDE, AND RELATIVE ALTITUDE

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 2 0 [1]

10 Data Type 1

11 Data Type 0

12 Data Type (MSB) 0

13 Latitude -- 1.0728836 x 10-5 DEG.

14 Latitude -- 2.1457672 x 10-5

15 Latitude -- 4.2915344 x 10-5

16 Latitude -- 8.5830688 x 10-5

17 Latitude -- 1.7166138 x 10-4

18 Latitude -- 3.4332275 x 10-4

19 Latitude -- 6.8664551 x 10-4

20 Latitude -- 0.00137329

21 Latitude -- 0.00274658

22 Latitude -- 0.00549316

23 Latitude -- 0.0109863

24 Latitude -- 0.0219726

25 Latitude -- 0.0439453

26 Latitude -- 0.0878906

27 Latitude -- 0.175781

28 Latitude -- 0.351563

29 Latitude -- 0.703125

30 Latitude -- 1.40625

31 Data Type Continuation Bit [2]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Latitude -- 2.8125

10 Latitude -- 5.625

11 Latitude -- 11.25

12 Latitude -- 22.5

13 Latitude -- 45

14 Latitude -- Sign [6]

15 Longitude -- 1.0728836 x 10-5 DEG

16 Longitude -- 2.1457672 x 10-5

17 Longitude -- 4.2915344 x 10-5

18 Longitude -- 8.5830688 x 10-5

19 Longitude -- 1.7166138 x 10-4

20 Longitude -- 3.4332275 x 10-4

21 Longitude -- 6.8664551 x 10-4

22 Longitude -- 0.00137329

23 Longitude -- 0.00274658

24 Longitude -- 0.00549316

25 Longitude -- 0.0109863

26 Longitude -- 0.0219726

27 Longitude -- 0.0439453

28 Longitude -- 0.0878906

29 Longitude -- 0.175781

30 Longitude -- 0.351563

31 Data Type Continuation Bit [2]

32 Parity (Odd)

**LABEL 366**

|  |
| --- |
| **BIT FUNCTION CODING NOTE** |
| 1 Label 1st Digit (MSB) 3 1 |
| 2 Label 1st Digit (LSB) 1 |
| 3 Label 2nd Digit (MSB) 6 1 |
| 4 Label 2nd Digit 1 |
| 5 Label 2nd Digit (LSB) 0 |
| 6 Label 3rd Digit (MSB) 6 1 |
| 7 Label 3rd Digit 1 |
| 8 Label 3rd Digit (LSB) 0 |
| 9 Longitude 0.703125 |
| 10 Longitude 1.40625 |
| 11 Longitude 2.8125 |
| 12 Longitude 5.625 |
| 13 Longitude 11.25 |
| 14 Longitude 22.5 |
| 15 Longitude 45 |
| 16 Longitude 90 |
| 17 Longitude Sign [7] |
| 18 Relative Altitude 100 FT. [5] |
| 19 Relative Altitude 200 |
| 20 Relative Altitude 400 |
| 21 Relative Altitude 800 |
| 22 Relative Altitude 1600 |
| 23 Relative Altitude 3200 |
| 24 Relative Altitude 6400 |
| 25 Relative Altitude 12800 |
| 26 Relative Altitude 25600 |
| 27 Relative Altitude Sign [8] |
| 28 Traffic Vertical Sense (LSB) [3] |
| 29 Traffic Vertical Sense (MSB) |
| 30 Relative Altitude Status [4] |
| 31 Data Type Continuation Bit 1 [2] |
| 32 Parity (Odd) |

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C).
2. The Data Type Continuation Bit:
3. 0 = indicates that this data type has not terminated.
4. 1 = indicates that this data type has terminated.
5. Sense of Traffic’s Vertical Rate

|  |  |  |
| --- | --- | --- |
| **BITS** | | **MEANING** |
| 30 | 29 |
| 0 | 0 | No Vertical Rate (Level Flight) |
| 0 | 1 | Climbing |
| 1 | 0 | Descending |
| 1 | 1 | No Data |

1. Parameter Status:
2. 1 = Valid
3. 0 = Invalid
4. The use of relative altitude in this word is dependent on the setting of Version 0 in Label 366, DTIF Header. Version 1 is shown in Attachment 15K. The setting of latitude and longitude remains the same for either version 0 and 1.
5. Latitude Sign:
6. 0 = Positive (North)
7. 1 = Negative (South)
8. Longitude Sign
9. 0 = Positive (East)
10. 1 = Negative (West)
11. Relative Altitude Sign:
12. 0 = Positive
13. 1 = Negative

ATTACHMENT 15K DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 2 VERSION 1 TRAFFIC LATITUDE, LONGITUDE, AND VERTICAL SPEED

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 2 0 [1]

10 Data Type 1

11 Data Type 0

12 Data Type (MSB) 0

13 Latitude -- 1.0728836 x 10-5 DEG.

14 Latitude -- 2.1457672 x 10-5

15 Latitude -- 4.2915344 x 10-5

16 Latitude -- 8.5830688 x 10-5

17 Latitude -- 1.7166138 x 10-4

18 Latitude -- 3.4332275 x 10-4

19 Latitude -- 6.8664551 x 10-4

20 Latitude -- 0.00137329

21 Latitude -- 0.00274658

22 Latitude -- 0.00549316

23 Latitude -- 0.0109863

24 Latitude -- 0.0219726

25 Latitude -- 0.0439453

26 Latitude -- 0.0878906

27 Latitude -- 0.175781

28 Latitude -- 0.351563

29 Latitude -- 0.703125

30 Latitude -- 1.40625

31 Data Type Continuation Bit [2]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Latitude -- 2.8125

10 Latitude -- 5.625

11 Latitude -- 11.25

12 Latitude -- 22.5

13 Latitude -- 45

14 Latitude -- Sign [6]

15 Longitude -- 1.0728836 x 10-5 DEG

16 Longitude -- 2.1457672 x 10-5

17 Longitude -- 4.2915344 x 10-5

18 Longitude -- 8.5830688 x 10-5

19 Longitude -- 1.7166138 x 10-4

20 Longitude -- 3.4332275 x 10-4

21 Longitude -- 6.8664551 x 10-4

22 Longitude -- 0.00137329

23 Longitude -- 0.00274658

24 Longitude -- 0.00549316

25 Longitude -- 0.0109863

26 Longitude -- 0.0219726

27 Longitude -- 0.0439453

28 Longitude -- 0.0878906

29 Longitude -- 0.175781

30 Longitude -- 0.351563

31 Data Type Continuation Bit [2]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Longitude 0.703125

10 Longitude 1.40625

11 Longitude 2.8125

12 Longitude 5.625

13 Longitude 11.25

14 Longitude 22.5

15 Longitude 45

16 Longitude 90

17 Longitude Sign [7]

18 Vertical Speed 16 FT/MIN [4] [3]

19 Vertical Speed 32

20 Vertical Speed 64

21 Vertical Speed 128

22 Vertical Speed 256

23 Vertical Speed 512

24 Vertical Speed 1024

25 Vertical Speed 2048

26 Vertical Speed 4096

27 Vertical Speed 8192

28 Vertical Speed 16384

29 Vertical Speed Sign [8]

30 Vertical Speed Status [5]

31 Data Type Continuation Bit 1 [2]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C).
2. The Data Type Continuation Bit:
3. 0 = indicates that this data type has not terminated.
4. 1 = indicates that this data type has terminated.
5. Vertical Speed resolution of 16 ft/min set based on resolution of Baro Altitude Rate, Label 212 normally provided via BDS 0.9 (per ARINC 718A).
6. The use of vertical speed in this word is dependent on the setting of Version 1 in Label 366, DTIF Header. Version 0 is shown in Attachment 15J. The setting of latitude and longitude remains the same for either Version 0 or Version 1.
7. Vertical Speed Status:
8. 1 = Valid
9. 0 = Invalid
10. Latitude Sign:
11. 0 = Positive (North)
12. 1 = Negative (South)
13. Longitude Sign:
14. 0 = Positive (East)
15. 1 = Negative (West)
16. Vertical Speed Sign
17. 0 = Positive (Climbing)
18. 1 = Negative (Descending)

ATTACHMENT 15L DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 3 TRAFFIC GROUND SPEED, TRACK ANGLE, AND CLOSURE RATE

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 3 1 [1]

10 Data Type 1

11 Data Type 0

12 Data Type (MSB) 0

13 Pad 0

14 Pad 0

15 Magnetic/True Heading Indication [6]

16 Ground Speed 1 KNOT

17 Ground Speed 2

18 Ground Speed 4

19 Ground Speed 8

20 Ground Speed 16

21 Ground Speed 32

22 Ground Speed 64

23 Ground Speed 128

24 Ground Speed 256

25 Ground Speed 512

26 Ground Speed 1024

27 Ground Speed 2048

28 Pad

29 Ground Speed Status [4]

30 Track Angle Status [5]

31 Data Type Continuation Bit [2]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING DESCRIPTION NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Heading/Track Angle 1.40625 DEG. [8]

10 Heading/Track Angle 2.8125

11 Heading/Track Angle 5.625

12 Heading/Track Angle 11.25

13 Heading/Track Angle 22.5

14 Heading/Track Angle 45.0

15 Heading/Track Angle 90.0

16 Heading/Track Angle Sign [9]

17 Closure Rate 0.5 KNOT

18 Closure Rate 1

19 Closure Rate 2 Signed Two’s Complement

20 Closure Rate 4 (Degrees)

21 Closure Rate 8

22 Closure Rate 16

23 Closure Rate 32

24 Closure Rate 64

25 Closure Rate 128

26 Closure Rate 256

27 Closure Rate 512

28 Closure Rate 1024

29 Closure Rate Sign [3]

30 Closure Rate Status [7]

31 Data Type Continuation Bit [2]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C)
2. The Data Type Continuation Bit:
3. 0 = indicates that this data type has not terminated
4. 1 = indicates that this data type has terminated
5. Closure Rate Sign Bit:
6. 0 = Departing from Own Ship
7. 1 = Closing on Own Ship
8. Ground Speed Status Bit:
9. 1 = Valid
10. 0 = Invalid
11. Track Angle Status Bit:
12. 1 = Valid
13. 0 = Invalid
14. Magnetic/True Heading Indication Bit:
15. 1 = Magnetic Heading
16. 0 = True Heading
17. Closure Rate Status Bit:
18. 1 = Valid
19. 0 = Invalid
20. Data value contains Track Angle when target Air/Ground status indicates In Air.
21. Data value contains Heading Angle when target Air/Ground status indicates On Ground.

See DTIF Packet Header (Attachment 15G) for Air/Ground Status.

1. Heading/Track Angle Sign

|  |  |
| --- | --- |
| **BIT16** | **MEANING** |
| 0 | Positive |
| 1 | Negative |

1. Per ARINC 429, the angular range 0 through 359.XXX degrees is encoded as 0 through ±179.XXX degrees, with the value of the most significant bit being one half of a semicircle (90°). Angles between 180° to 360° will be determined by taking the two’s complement of the fractional binary series for the result of subtracting each value from 360. Thus, the code for 181° is the two’s complement of the code for 179°. Throughout the negative semicircle, which includes 180°, the sign bit contains the negative sign.
2. The following examples illustrate the encoding of angles. As the examples show, angles can be considered to be signed two’s complement values over the range of   
   (-180,180) or they can be considered to be unsigned values over the range (0, 360). Both paradigms result in the same encoding. For instance, Example 2 shows that the encoding for -84.375 degrees using the two’s complement paradigm is identical to the encoding of 275.625 degrees using the full circle paradigm.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BIT | | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |
| **Weighting – two’s complement paradigm** | | **Sign** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
| **Weighting – 0-360 full circle paradigm** | | **180** | **90** | **45** | **22.5** | **11.25** | **5.625** | **2.8125** | **1.40625** | **0.703125** | **0.351563** | **0.175781** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Example 1 | 95.625 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 2 | -84.375 (275.625) | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Example 3 | -95.625 (264.375) | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

ATTACHMENT 15M DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 4 INTRUDER INFORMATION QUALITY

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 4 0 [1]

10 Data Type 0

11 Data Type 1

12 Data Type (MSB) 0

13 AIRB Quality Level LSB [2] [3]

14 AIRB Quality Level MSB

15 SURF Quality Level LSB [2] [4]

16 SURF Quality Level MSB

17 Interval Management Quality Level LSB [2] [5]

18 Interval Management Quality Level MSB

19 ITP Quality Level LSB [2] [6]

20 ITP Quality Level MSB

21 TSAA Quality Level LSB [2] [7]

22 TSAA Quality Level MSB

23 Reserved for future application’s quality level [2]

24 Reserved for future application’s quality level

25 VSA Quality Level LSB [2] [8]

26 VSA Quality Level MSB

27 ACAS Xo DNA Quality Level LSB [2] [9]

28 ACAS Xo DNA Quality Level MSB

29 ACAS Xo CSPO-3000 Quality Level LSB [2] [10]

30 ACAS Xo CSPO-3000 Quality Level MSB

31 Data Type Continuation Bit [11]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Reserved for future application’s quality level [2]

10 Reserved for future application’s quality level

11 Reserved for future application’s quality level

12 Reserved for future application’s quality level

13 Reserved for future application’s quality level

14 Reserved for future application’s quality level

15 Reserved for future application’s quality level

16 Reserved for future application’s quality level

17 Reserved for future application’s quality level

18 Reserved for future application’s quality level

19 Reserved for future application’s quality level

20 Reserved for future application’s quality level

21 Reserved for future application’s quality level

22 Reserved for future application’s quality level

23 Reserved for future application’s quality level

24 Reserved for future application’s quality level

25 Reserved for future application’s quality level

26 Reserved for future application’s quality level

27 Reserved for future application’s quality level

28 Reserved for future application’s quality level

29 Reserved for future application’s quality level

30 Reserved for future application’s quality level

31 Data Type Continuation Bit [11]

32 Parity (Odd)

Notes

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C)
2. The quality level groupings are based on applications having the same or similar quality criteria as is present in RTCA DO-317B, MOPS for Aircraft Surveillance Applications (ASA) System. In RTCA DO-317B, Table 2-2, minimum quality levels including Horizontal Position Uncertainty, Horizontal Velocity Uncertainty, Vertical Position Uncertainty, and Vertical Velocity Uncertainty are established for each application. If a new application is added into RTCA DO-317B or other specification, the reserved bits would then be used for the new application.
3. Bits 14, 13: Airborne (AIRB) Quality Level

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 14 | 13 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |

1. Bits 16, 15: Surface (SURF) Quality Level

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 16 | 15 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |

1. Bits 18, 17: Interval Management Quality Level

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 18 | 17 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |

1. Bits 20, 19: Quality Level for In Trail Procedure

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 20 | 19 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |

1. Bits 22, 21: Quality Level for TSAA:

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 22 | 21 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |

1. Bit 26, 25: Quality Level for VSA

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 26 | 25 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Reserved |
| 1 | 0 | Degraded Performance Accuracy |
| 1 | 1 | Good Performance Accuracy |
|  |  |  |
|  |  |  |

1. Bit 28, 27: Quality Level for ACAS Xo DNA

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 28 | 27 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Valid |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. Bit 30, 29: Quality Level for ACAS Xo CSPO-3000

|  |  |  |
| --- | --- | --- |
| Bits | | Meaning |
| 30 | 29 |
| 0 | 0 | Invalid (Do Not Display) |
| 0 | 1 | Valid |
| 1 | 0 | Reserved |
| 1 | 1 | Reserved |

1. The Data Type Continuation Bit:
2. 0 = indicates that this data type has not terminated
3. 1 = indicates that this data type has terminated

ATTACHMENT 15N DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 5 INTRUDER INFORMATION LENGTH/WIDTH WORD

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 5 1 [1]

10 Data Type 0

11 Data Type 1

12 Data Type (MSB) 0

13 Position Offset Applied [2]

14 Width Code [3]

15 Length Code (LSB) [3]

16 Length Code [3]

17 Length Code (MSB) [3]

18 Length/Width Status [4]

19 PAD

20 PAD

21 PAD

22 PAD

23 PAD

24 PAD

25 PAD

26 PAD

27 PAD

28 PAD

29 PAD

30 PAD

31 Data Type Continuation Bit 1 [5]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure section.
2. 0 = the position transmitted in the surface position message is not known to be referenced to the ADS-B Position Reference Point of the A/V. Thus, the aircraft depiction is typically extended beyond the length/width size.
3. 1 = The position transmitted in the surface position message is known to be referenced to the ADS-B Position Reference Point of the A/V. Thus, the aircraft depiction typically matches the length/width size.
4. AV Length and Width codes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **A/V – L/W Code (Decimal)** | **Length Code** | | | **Width Code** | **Upper-Bound Length and Width for Each Length/Width Code** | |
| Bit 13 | Bit 12 | Bit 11 | Bit  10 | Length  (meters) | Width  (meters) |
| 0 | 0 | 0 | 0 | 0 | No Data or Unknown | |
| 1 | 0 | 0 | 0 | 1 | 15 | 23 |
| 2 | 0 | 0 | 1 | 0 | 25 | 28.5 |
| 3 | 1 | 34 |
| 4 | 0 | 1 | 0 | 0 | 35 | 33 |
| 5 | 1 | 38 |
| 6 | 0 | 1 | 1 | 0 | 45 | 39.5 |
| 7 | 1 | 45 |
| 8 | 1 | 0 | 0 | 0 | 55 | 45 |
| 9 | 1 | 52 |
| 10 | 1 | 0 | 1 | 0 | 65 | 59.5 |
| 11 | 1 | 67 |
| 12 | 1 | 1 | 0 | 0 | 75 | 72.5 |
| 13 | 1 | 80 |
| 14 | 1 | 1 | 1 | 0 | 85 | 80 |
| 15 | 1 | 90 |

1. The above table is constructed based on RTCA DO-260B,   
   Table 2-74. The sizes defined are simultaneous maximums; thus, in order to meet a given length, a width may be overstated or vice-versa.
2. If the Aircraft or Vehicle is longer than 85 meters, or wider than 90 meters, then decimal Aircraft/Vehicle Length/Width Code 15 is used.
3. Length/Width Status:
4. 1 = Valid
5. 0 = Invalid
6. 0 = Indicates that this data type has not been terminated.
7. 1 = Indicates that this data type has been terminated.

ATTACHMENT 15P DISPLAY TRAFFIC INFORMATION FILE (DTIF) TYPE 7 TIME OF APPLICABILITY (UTC AND UTC FINE)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Data Type (LSB) 7 1 [1]

10 Data Type 1

11 Data Type 1

12 Data Type (MSB) 0

13 Seconds 1 LSB

14 Seconds 2

15 Seconds 4

16 Seconds 8

17 Seconds 16

18 Seconds 32 MSB

19 Minutes 1 LSB

20 Minutes 2

21 Minutes 4

22 Minutes 8

23 Minutes 16

24 Minutes 32 MSB

25 Hours 1 LSB

26 Hours 2

27 Hours 4

28 Hours 8

29 Hours 16 MSB

30 Pad

31 Data Type Continuation Bit 0 [2]

32 Parity (Odd)

**LABEL 366**

**BIT FUNCTION CODING NOTE**

1 Label 1st Digit (MSB) 3 1

2 Label 1st Digit (LSB) 1

3 Label 2nd Digit (MSB) 6 1

4 Label 2nd Digit 1

5 Label 2nd Digit (LSB) 0

6 Label 3rd Digit (MSB) 6 1

7 Label 3rd Digit 1

8 Label 3rd Digit (LSB) 0

9 Pad

10 Pad

11 Pad

12 Pad

13 Pad

14 Pad

15 Pad

16 Seconds 0.00012207 LSB

17 Seconds 0.000244141

18 Seconds 0.000488281

19 Seconds 0.000976563

20 Seconds 0.001953125

21 Seconds 0.00390625

22 Seconds 0.0078125

23 Seconds 0.015625

24 Seconds 0.03125

25 Seconds 0.0625

26 Seconds 0.125

27 Seconds 0.25

28 Seconds 0.5 MSB

29 Time of Applicability Invalidity [3]

30 Pad

31 Data Type Continuation Bit 1 [2]

32 Parity (Odd)

Notes:

1. Data Type – see definition in DTIF Data Type Word Structure (Attachment 15C)
2. Data Type Continuation Bit:
3. 0 = indicates that this data type has not terminated.
4. 1 = indicates that this data type has terminated.
5. Time of Applicability Invalidity:
6. 0 = Valid,
7. 1 = Invalid
8. Acronym List

ACAS Airborne Collision Avoidance System

ACK Acknowledge

ACM Airborne Conflict Management

ADC Air Data Computer

ADS-B Automatic Dependent Surveillance – Broadcast

ADS-R Automatic Dependent Surveillance – Re-Broadcast

AGD ADS-B Guidance Display

AIF Application Information File

AIRB Airborne

AOTO ADS-B Only TA Only

APM Airplane Personality Module

ARA Active Resolution Advisories

ASA Aircraft Surveillance Applications

ASAS Aircraft Surveillance Applications System

ASIA Approach Spacing for Instrument Approaches

ASPA Airborne Spacing Application

ASSA Airport Surface Situational Awareness

ASSAP Airborne Surveillance and Separation Assurance Processing

ATA Air Traffic Association

ATAR Air To Air Radar

ATC Air Traffic Control

ATCRBS Air Traffic Control Radar Beacon System

ATE Automatic Test Equipment

ATSA Airborne or Enhanced Traffic Situational Awareness

ATSA-AIRB Enhanced Traffic Situational Awareness During Flight Operation

ATSA-ITP Enhanced Traffic Situational Awareness Oceanic In-Trail Procedure

ATSA-SURF Enhanced Traffic Situational Awareness on the Airport Surface

ATSA-VSA Enhanced Visual Separation on Approach

A/V Aircraft/Vehicle

BCD Binary Coded Data

BDS Binary Data Storage

BNR Binary (Two’s Complement Binary Notation)

BITE Built-In Test Equipment

CAS Collision Avoidance System

CAPT Captain

CAVS CDTI Assisted Visual Separation

CD Conflict Detection

CDTI Cockpit Display with Traffic Information

CFDIU Centralized Fault Display Interface Unit

CFDS Centralized Fault Display System

CMC Central Maintenance Computer

CRT Cathode Ray Tube

CSPO-3000 Closely Spaced Parallell Operations down to 3000 feet runway separtion

DAA Detect And Avoid

DF Downlink Format

DITS Digital Information Transfer System

DME Distance Measuring Equipment

DNA Designated No Alerts

DTIF Display Traffic Information File

EFIS Electronic Flight Instrument System

ELM Extended Length Message

EMI Electromagnetic Interference

EOT End of Transmission

ETX End of File Protocol

EV Acq Enhanced Visual Acquisition

EV App Enhanced Visual Approach

FAA Federal Aviation Administration

FAROA Final Approach and Runway Occupancy Awareness

FCC Federal Communications Commission

FIDS Fault Isolation and Detection System

FIM Flight Interval Management

FMC Flight Management Computer

FMS Flight Management System

F/O First Officer

GICB Ground Initiated Comm-B

GNLU GNSS Navigation and Landing Unit

GNSS Global Navigation Satellite System

GNU GNSS Navigation Unit

GPS Global Positioning System

GS Ground Speed

HMI Human Machine Interface

HS High-Speed

ICSPA Independent Closely Spaced Parallel Approach

IIS Interrogator Identifier Subfield

INS Inertial Navigation System

IRS Inertial Reference System

ITP In Trial Procedure

IVSI Instantaneous Vertical Speed Indicator

LBP Left Bottom Plug/Insert

LMP Left Middle Plug/Insert

LRU Line Replaceable Unit

LSB Least Significant Bit

LS HEX Least Significant Nibble Hex

LTP Left Top Plug/Insert

L/W Length/Width

M&S Merging and Spacing

Mach Mach Number Speed

MB Message Comm-B

MCDU Multi-Purpose Control and Display Unit

ME Message

MMR Multi-Mode Receiver

MODE S Mode Select (Radar Beacon System)

MOPS Minimum Operational Performance Standards

MSB Most Significant Bit

MS HEX Most Significant Nibble Hex

MTE Multiple Threat Encounter

MV Message Comm-V

NACV Navigation Accuracy Category Velocity

NACK or NAK No Acknowledgement

NAR Non Altitude Reporting

NCD No Computed Data

ND Navigation Display

NIC Navigation Integraty Category

NM Nautical Mile

Nmi Nautical Mile

NUL Null Character

PANS OPS Procedures for Air Navigation Services – Aircraft Operations

PFD Primary Flight Display

PROX Proximate Traffic

PSIA Pounds per Square Inch Absolute

RA Resolution Advisory

FAI Resolution Advisory Indicator

RAC Resolution Advisory Complement

RAD Resolution Advisory Display

RBP Right Bottom Plug/Insert

RC Containment Radius

RF Radio Frequency

RI Reply Information

RMP Right Middle Plug/Insert

RMS Root Mean Square

RTP Right Top Plug/Insert

RTS Request To Send

RWC Remain Well Clear

S&M Sequencing and Merging

SDA System Design Assurance

SDI Source Destination Identifier

SIL Source Integrity Level

SL Sensitivity Level

SLC Sensitivity Level Control

SRU Shop Replaceable Unit

SS/CS Source Select/Configuration Strap

SSM Sign-Status Matrix

STBY Stand By

STX Start of Transmission, Start of File Protocol

SURF Surface

TA Traffic Advisory

TACAN Tactical Air Navigation

TCAS Traffic Alert and Collision Avoidance System

TGD TCAS to Transponder Protocol

TID Threat Identity Data

TIDA Threat Identity Data Altitude

TIDB Threat Identity Data Bearing

TIDR Threat Identity Data Range

TIF Transponder Interface Function

TIS-B Traffic Information Service – Broadcast

TNC Threaded Neill Concelman (connector)

TSAA Traffic Situational Awareness with Alerts

TSO Technical Standard Order

TTF Traffic To Follow

TTI Threat Type Indicator

TX TCAS to Transponder ARINC 429 data bus

UAT Universal Access Transceiver

UF Uplink Format

UTC Coordinated Universal Time

VI Version Indicator

VSA Visual Separation on Approach

VSI Vertical Speed Indicator

VSWR Voltage Standing Wave Ratio

WXR Weather Radar

XGD Transponder to TCAS Protocol

XPDR Transponder

XT Transponder to TCAS ARINC 429 data bus

1. Label 270, Resolution Advisory Word, Reporting Combinations

TCAS Display Bus Outputs

The following is a general description of the ACAS X status information available to the ACAS X displays. It does not attempt to define the resulting display of this information. It is only meant to clarify the definition of what is available on the display buses.

The ARINC 429 low-speed buses contain Labels 270, 350, and 377, used to determine the status of the TCAS system. ACAS Xu systems also include labels 170, 171, 172 and 271.

The ARINC 429 high-speed buses contain the following:

Label 013 – Mode S Control Panel Data

Label 016 – Mode S Control Panel Data - passed through from the Mode S Control Panel unchanged. It can be used to determine the manually selected or actual mode which TCAS is in, respectively. This label will cease to be transmitted on the ACAS X display output buses when it is not received from the Mode S transponder.

Label 170 – Vertical RWC Guidance Data for ACAS Xu

Labels 171 and 172 – Horizontal RWC Guidance Data for ACAS Xu

Label 203 – Pressure Altitude – passed through from the active Mode S transponder unchanged. This label will cease to be transmitted on the TCAS display output buses when it is not received from the Mode S transponder.

Label 270 – Resolution Advisory Data – used to determine the ACAS X fail status.

Label 271 – Horizontal Resolution Advisory Data – used to determine the ACAS Xu fail status

Label 274 – Actual ACAS X Mode – used to determine the manually selected or actual mode which ACAS X is in, respectively.

Label 320 – Magnetic Heading – optional label passed from an ARINC 429 input source. This label will be transmitted with the SSM set to NCD if the input source is absent. When the ACAS X traffic computer has failed, the SSM will report Fail Warn in Label 320.

Label 350 – Fault Summary Word – used to determine the ACAS X fail status.

Labels 357, 130, 131, 132 – Intruder File Data

Labels 367, 366 – Display Traffic Intruder File (DTIF, see Attachment 15)

Label 377 – Unit Identification

Display Status

Label 270 SSM = NCD Only Mode

Standby

TCAS System Fail (Not Including TCAS Unit)

SSM = FAIL TCAS Unit Failure

SSM = TEST TCAS System Functional Test

Label 350 SSM always Normal

Bit 12 = 1 Top Antenna

Bit 13 = 1 Bottom Antenna

Bit 14 = 1 Radio Altimeter

Bit 15 = 1

Bit 16 = 1 Mode S Transponder

Bit 17 = 1

Bit 18 = 1 Attitude Input [1]

Bit 19 = 1 Heading Input [1]

Bit 20 = 1 TCAS System Fail (General)

Bit 21 = 1 FMS input bus status [1]

Bit 22 = 1 ASAS system status [1]

Bit 23 = 1 TA Display 1 [1]

Bit 24 = 1 TA Display 2 [1]

Bit 25 = 1 RA Display 1, 2 [1]

and Bit 26 = 1

Bit 27 = 1 CFDS Input [1]

Note: Does not cause ACAS X System Failure Bit 20 to be set.

The above Label 350 bit 20 logic assumes that the ACAS X System Failure bit is not set when all of the following conditions exist:

Working ACAS X Unit

* Good top and bottom antennas
* The selected Mode S transponder is working
* At least one good working Radio Altimeter
* At least one good working RA/VSI display

All other information available included in Label 350 is for maintenance purposes only.

ACAS X Mode Determination

Manually Selected Mode from Mode S Control Panel Label 016

1. SL = 0 Manually Selected Mode = Auto
2. SL = 1 Manually Selected Mode = Standby
3. SL = 2 Manually Selected Mode = TA Only
4. SL = 3 to 7 Manually Selected Mode = SL 3 to 7

Note: Manually Selected Mode does not always indicate the actual Mode that TCAS is in. For ACAS X SL values of 4 to 7 are not used.

Actual ACAS X Mode Label 274

RI = 0 or SL = 1 Actual ACAS X Mode = Standby

RI = 2 Actual ACAS X Mode = TA Only or Surveillance Only (SL can equal 2)

RI = 3 Actual ACAS X Mode = TA/RA or RWC/CA (SL can equal 3)

--------------------------------------------------------------------------------------------

Methods of Entering TA/Surveillance Only Mode

* Manually selected from Mode S Control Panel
* Advisory Inhibit Discrete Nos. 2, 3, and 4
* Altitude Threshold
* Possible future degraded operational modes

Table 1 – TCAS Failure and Mode Annunciations (ATA Standard)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **TCAS SYSTEM TEST ACTIVATED** | **DEDICATED RA/IVSI DISPLAY** | | **TRAFFIC** | **TA/RA/IVSI DISPLAY** | |  |  |
| T  E  S  T  M  O  D  E  S |  | TCAS | IVSI | DISPLAY | TCAS | IVSI | PFD | NOTES |
| LAMP TEST | TCAS (A) |  | TCAS TEST (I) | TEST (I) |  | TCAS TEST (I) |  |
|  | TCAS (A) |  | TCAS FAIL (A)[8] |  |  |  | [9] |
| TCAS STANDBY | RA OFF (I) |  | TCAS OFF (I) | TCAS OFF (I) |  | TCAS OFF (I) | [5] |
| TA ONLY | RA OFF (I) |  | TA ONLY (I) | TA ONLY (I) |  | TA ONLY (I) | [5] |
| TA/RA |  |  |  |  |  |  |  |
| ABOVE ALTITUDE SELECTED |  |  | ABOVE (I) [11] | ABOVE (I) [11] |  |  |  |
| BELOW ALTITUDE SELECTED |  |  | BELOW (I) [11] | BELOW (I) [11] |  |  |  |
| NORMAL SELECTED |  |  |  |  |  |  |  |
| SELECTED XPDR IN STANDBY | RA OFF (I) |  | TCAS OFF (I) | TCAS OFF (I) |  | TCAS OFF (I) |  |
| ALTITUDE REPORTING OFF | RA OFF (I) |  | TCAS OFF (I) | TCAS OFF (I) |  | TCAS OFF (I) |  |
| F  A  I  L  U  R  E  S | TCAS FAILURE  - POWER OFF  - TCAS COMPUTER FAILURE  - SELECTED XPDR FAILURE  - CONTROL PANEL FAILURE  - TOP OR BOTTOM ANTENNA FAILURE | TCAS (A) |  | TCAS OFF (A) | TCAS FAIL (A) |  | TCAS FAIL (A) |  |
| TRAFFIC DISPLAY FAILURE |  |  | TO FAIL (A) [1] | TO FAIL (A) [1] |  |  |  |
| SINGLE RA/IVSI INDICATOR FAILURE | TCAS (A) [1] | IVSI (A) [1] |  | RA FAIL (A) [1] | IVSI (A) [1] [3] |  | [6] |
| LOSS OF RA FUNCTION ONE SIDE | TCAS (A) [1] |  |  | RA FAIL (A) [1] |  | TCAS FAIL (A) [1] | [4] [6] |
| LOSS OF RA FUNCTION BOTH SIDES | TCAS (A) |  | TCAS FAIL (A) | TCAS FAIL (A) |  | TCAS FAIL (A) | [2] |
| LOSS OF IVSI FUNCTION ONE SIDE | TCAS (A) [1] | IVSI (A) [1] |  | RA FAIL (A) [1] | IVSI (A) [1] [3] | [10] | [4] [6] [7] |
| LOSS OF IVSI FUNCTION BOTH SIDES | TCAS (A) | IVSI (A) | TCAS FAIL (A) | TCAS FAIL (A) | IVSI (A) [3] | TCAS FAIL (A) | [2] [7] |
| LOSS OF IVSI FUNCTION ONE SIDE AND LOSS OF RA FUNCTION OTHER SIDE | TCAS (A) | IVSI (A) [1] | TCAS FAIL (A) | TCAS FAIL (A) | IVSI (A) [1] [3] | TCAS FAIL (A) | [2] [7] |

Note: Instruments capable of displaying traffic may annunciate degraded operational status in addition to the minimum reports shown here.

ANNUNCIATION TYPE: I = Information (Level 0)

Notes:

1. Affected side(s) only
2. TCAS computer annunciated system failure. However, selection of TA only mode restored system to TA only operation.
3. IVSI needle blanked
4. The affected TA/RA/IVSI should continue to display traffic, if possible.
5. TCAS computer placed into this mode by any of the following means: pilot selected, ATC selected, priority/discrete selected, CAS logic selected, or aircraft on ground (program pin option)
6. Fly operating RA display side
7. IVSI failures require RA fail to be annunciated. However, pneumatic RA/IVSI indicators may be incapable of detecting/annunciating failure of IVSI function.
8. Appears as a result of TCAS detecting RA display fail during lamp test.
9. The lamp/display test may cause IVSI functions to be inoperative during portions of this test.
10. Failure annunciation consistent with manufacturer’s other failure annunciation on the PFD.
11. Optional