Proposed TCAS Hybrid Surviellance Status bit for ARINC 735B

Revision 1

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Introduction:

To prevent any hidden failures of TCAS hybrid surveillance functionality, AC 20-151B and TSO-119d requires either a failure annunciation in the flight deck when hybrid surveillance has failed or a method for providing a scheduled maintenance task to verify that hybrid surveillance is functional (Ref. AC-20-151B sections 2-18 j., 2-21 b.; and TSO-119d section 5 k.).

This paper proposes to add a “TCAS Hybrid Surveillance Status” bit 11 on Label 352 (new Label) that may be used as a failure annunciation in the flight deck.

GPS #1, GPS #2, and IRS #1 input bus status bits were also added to assist the maintenance crew with troubleshooting. These inputs are needed to support hybrid surveillance passive tracking. These input sources were already defined in ARINC 735B-S1 to support ADS-B/ASAS functionality (Ref. Attachement 1E-1 Digital Input Signal Diagram).

Other misc. changes:

1. The other input sources (e.g. FMC #1, ADC #1) in Attachement 1E-1 were added to Label 351. These inputs may also be used to support ADS-B/ASAS functionality.
2. A statement was added to Note 1 of Label 350 to clarify that the status bits should be set to ‘0 = Normal’ when they don’t apply for a given system configuration.

Proposed ARINC 735B Changes:

Add the following proposed changes (see redlines below) to the existing Label 350 TCAS Summary Fault Word 1 and add Label 352 TCAS Summary Fault Word 2.PART 6Y-1

ARINC 429 CONTROL WORD – TRANSPONDER TO TCAS, TCAS TO 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 TCAS Computer Unit | 0 = Normal, 1 = Failure | [1] |
| 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 | [1] |
| 15 Radio Alt Input Bus 2 | 0 = Normal, 1 = Inactive | [1] |
| 16 ATC/Mode S Transponder #1 | 0 = Active or Standby  1 = Inactive or Fail | [1], [4] |
| 17 ATC/Mode S Transponder #2 | 0 = Active or Standby  1 = Inactive or Fail | [1], [4] |
| 18 Attitude Input Bus | 0 = Normal, 1 = Inactive | [3] |
| 19 Magnetic Heading Input Bus | 0 = Normal, 1 = Inactive | [3] |
| 20 TCAS System Status | 0 = Normal, 1 = Failure | [2] |
| 21 Flight Performance Bus Status | 0 = Normal, 1 = Inactive | [1] |
| 22 ASAS System status | 0 = Normal, 1 = Failure | [1] |
| 23 TA 1 Display System Status | 0 = Normal, 1 = Failure | [3] |
| 24 TA 2 Display System Status | 0 = Normal, 1 = Failure | [3] |
| 25 RA 1 Display System Status | 0 = Normal, 1 = Failure | [1] |
| 26 RA 2 Display System Status | 0 = Normal, 1 = Failure | [1] |
| 27 CFDIU Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 28 BITE Test Inhibit | 0 = Enable, 1 = Inhibit | [3] |
| 29 Command Word Acknowledge | 0 = NAK, 1 = ACK | [3] |
| 30 SSM |  | [5] |
| 31 SSM |  | [5] |
| 32 Parity | (Odd) |  |
|  | | |

Notes:

1. The status of these bits determines the status of the overall TCAS Systems as defined in Section 3.5.2.5. These bits should always indicate the status of the respective inputs, regardless of the TCAS Systems Status or TCAS mode of operation.

2. Section 3.5.2.5 defines the TCAS computer logic for this discrete bit.

3. This information is provided for maintenance purposes only. The definition of this word contained in ARINC 604 should have precedence over the definition contained herein.

4. Refer to Section 6.0 of Attachment 12.

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 6Y-2

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

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 | [1], [2] |
| 12 GPS #1 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 13 GPS #2 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 14 IRS #1 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 15 FMC #1 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 16 ADC #1 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 17 FCC Controller Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 18 MCDU #1 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 19 MCDU #2 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 20 MCDU #3 Input Bus | 0 = Normal, 1 = Inactive | [1] |
| 21 Spare |  |  |
| 22 Spare |  |  |
| 23 Spare |  |  |
| 24 Spare |  |  |
| 25 Spare |  |  |
| 26 Spare |  |  |
| 27 Spare |  |  |
| 28 Spare |  |  |
| 29 Spare |  |  |
| 30 SSM |  | [3] |
| 31 SSM |  | [3] |
| 32 Parity | (Odd) |  |
|  | | |

Notes:

1. The status of these bits determines the status of the overall TCAS Systems as defined in Section 3.5.2.5. These bits should always indicate the status of the respective inputs, regardless of the TCAS Systems Status or TCAS mode of operation.

2. 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 TCAS hybrid surveillance functionality is not installed within the Traffic Computer, then the status should be set to ‘0’ (Normal).

3. 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.