Asterix expansion 021 - ADS-B Target Reports Expansion

category: 021

edition: 1.5

date: 2021-12-22

FSPEC byte size: 1

Items

BPS - Barometric Pressure Setting

definition: Barometric Pressure Setting

Group

Spare bits: 4

BPS/BPS - Barometric Pressure Setting

Element
bit size: 12
Unsigned quantity
LSB = $1/10$ hPa ≈ 0.1 hPa
unit: ”hPa”
>= 0.0
<= 409.5

Notes:

- BPS is the barometric pressure setting of the aircraft minus 800 hPa
- A value of ”0” indicates that in the aircraft a value of 800 hPa or less has been selected.
- A value of ”409.5” indicates that in the aircraft a value of 1209.5 hPa or more has been selected.

SH - Selected Heading

definition: Selected Heading

Group

Spare bits: 4

SH/HDR - Horizontal Reference Direction

Element
bit size: 1
Values:

- **0:** True North
- **1:** Magnetic North

SH/STAT - Selected Heading Status

Element
bit size: 1
Values:

- **0:** Data is either unavailable or invalid
- **1:** Data is available and valid

SH/SH - Selected Heading

Element
bit size: 10
Unsigned quantity
LSB = $45/2^6$ ° ≈ 0.703125 °
unit: "°"

On many aircraft, the ADS-B Transmitting Subsystem receives Selected Heading from a Mode Control Panel / Flight Control Unit (MCP / FCU). Users of this data are cautioned that the Selected Heading value transmitted by the ADS-B Transmitting Subsystem does not necessarily reflect the true intention of the airplane during certain flight modes (e.g., during LNAV mode).

NAV - Navigation Mode

definition: Navigation Mode Settings

Group

NAV/AP - Autopilot

Element
bit size: 1
Values:

- **0:** Autopilot not engaged
- **1:** Autopilot engaged

NAV/VN - Vertical Navigation

Element
bit size: 1
Values:

- **0:** Vertical Navigation not active
- **1:** Vertical Navigation active

NAV/AH - Altitude Hold

Element
bit size: 1
Values:

- **0:** Altitude Hold not engaged
- **1:** Altitude Hold engaged

NAV/AM - Approach Mode

Element
bit size: 1
Values:

- **0:** Approach Mode not active
- **1:** Approach Mode active

NAV/MFM - Status of MCP/FCU Mode Bits

Group

NAV/MFM/EP - Element Populated Bit

Element
bit size: 1
Values:

- **0:** Element not populated
- **1:** Element populated

NAV/MFM/VAL - Value

Element
bit size: 1
Values:

- **0:** MCP/FCU Mode Bits not populated
- **1:** MCP/FCU Mode Bits populated

Spare bits: 2

NOTE: 1: The status of the LNAV indication is contained in Data Item I021/200, bit-7. Please also consider Note 2 to Data Item I021/200.

NOTE: 2: MFM (Status of MCP/FCU Mode Bits) is contained in the Target State and Status Message (Register 62 16, Format Type Code 29, Subtype Code 1) as defined in EUROCAE ED-102B/RTCA DO-260C Ref. [11] chapter 2.2.3.2.7.1.3.11. If set to “1”, MFM#VAL indicates that the bits for “AP”, “VN”, “AH”, “AM” (in I021/REF/NAV) and for LNAV (in I021/200) have been actively populated.

NOTE: 3: If MFM#VAL = 0, AP, VN, AH, and AM (in I021/REF/NAV) shall be set to 0 and LNAV (in I021/200) shall be set to 1.

GAO - GPS Antenna Offset

definition: GPS Antenna Offset

Element
bit size: 8
Raw Content

The value of this field is copied from the respective bits 33-40 of Register 65 16 of Version 2 and Version 3 ADS-B Systems (as defined in I021/210) (Aircraft Operational Status - Surface). The detailed definition is contained in EUROCAE Document ED-102()/RTCA DO-260() Ref. [11]. Bit-8 indicates the direction of the offset with a value of 0 indicating ‘left of centerline’ and a value of 1 indicating ‘right of centerline’.

SGV - Surface Ground Vector

definition: Ground Speed and Track Angle elements of the Surface Ground Vector.

Extended

SGV/STP

Element
bit size: 1
Values:

0: Aircraft has not stopped
1: Aircraft has stopped

SGV/HTS

Element
bit size: 1
Values:

0: Heading/Ground Track data is not valid
1: Heading/Ground Track data is valid

SGV/HTT

Element
bit size: 1
Values:

0: Heading data provided
1: Ground Track provided

SGV/HRD

Element
bit size: 1
Values:

0: True North
1: Magnetic North

SGV/GSS - Ground Speed

Element
bit size: 11
Unsigned quantity
LSB = $1/2^3$ kt ≈ 0.125 kt
unit: ”kt”

(FX) - extension bit

SGV/HGT - Heading/Ground Track Information

Element
bit size: 7
Unsigned quantity
LSB = $45/2^4$ ° ≈ 2.8125 °
unit: ”°”

(FX) - extension bit

STA - Aircraft Status

definition: This item contains flags to convey information on the status of a target.
Extended

STA/ES - ES IN Capability

Element
bit size: 1
Values:

- **0:** Target is not 1090 ES IN capable
- **1:** Target is 1090 ES IN capable

STA/UAT - UAT IN Capability

Element
bit size: 1
Values:

- **0:** Target is not UAT IN capable
- **1:** Target is UAT IN capable

STA/RCE - Reduced Capability Equipment

Group

STA/RCE/EP - Element Populated Bit

Element
bit size: 1
Values:

- **0:** Element not populated
- **1:** Element populated

STA/RCE/VAL - Value

Element
bit size: 2
Values:

- **0:** Not RCE
- **1:** TABS (see Note 2)
- **2:** Reserved for future use
- **3:** Other RCE

STA/RRL - Reply Rate Limiting

Group

STA/RRL/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/RRL/VAL - Value

Element
bit size: 1
Values:

0: Reply Rate Limiting is not active
1: Reply Rate Limiting is active

Notes:

1. The RCE information is taken from the Capability Class field in the “Aircraft Operational Status Message (Register 65 16)” as defined in EUROCAE ED-102B/RTCA DO-260C (Chapter A.1.4.10.3 in Ref.[11]).
2. TABS is the “Traffic Awareness Beacon System” as defined by ETSO-C199 / TSO-C199.
3. The RRL information is contained in the Operational Mode field in the Airborne Operational Status Message, (Register 65_16, Bit 29).

(FX) - extension bit

STA/PS3 - Priority Status for Version 3 ADS-B Systems

Group

STA/PS3/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/PS3/VAL - Value

Element
bit size: 3
Values:

0: No emergency / not reported
1: General emergency
2: UAS/RPAS - Lost link
3: Minimum fuel
4: No communications
5: Unlawful interference
6: Aircraft in Distress
7: Aircraft in Distress Manual Activation

STA/TPW - Transmit Power

Group

STA/TPW/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/TPW/VAL - Value

Element
bit size: 2
Values:

0: Unavailable, Unknown, or less than 70 W
1: 70 W
2: 125 W
3: 200 W

Notes:

1. For ADS-B Version 3 systems as defined in EUROCAE ED-102B/RTCA DO-260C (Ref. [11]) the values have been re-defined. PS3 shall be used exclusively for Version 3 ADS-B systems as defined in I021/210/VN.
2. For ADS-B systems with a version number below 3, the PS shall be encoded in Data Item I021/200/PS. However, since values have been re-defined in ADS-B Version 3, mapping is required to ensure that information is not lost. This mapping shall be done according to the following table: :

ADS-B Version 3 (PS3)	ADS-Version < 3 (I021/200 - PS)
0 (No Emergency/not reported)	0 (No Emergency/not reported)
1 (General emergency)	1 (General emergency)
2 (UAS/RPAS Lost Link)	4 (No communication)
3 (Minimum fuel)	3 (Minimum fuel)
4 (No communication)	4 (No communication)
5 (Unlawful interference)	5 (Unlawful interference)
6 (Aircraft in distress - automatic activation)	1 (General emergency)
7 (Aircraft in distress - manual activation)	1 (General emergency)

3. TPW#VAL is defined in EUROCAE ED-102B/DO-260C Ref. [11] “Aircraft Operational Status Message (Register 65 16)” Bits 17-18 and indicates the nearest minimum transmit power (in Watts) at the antenna port. The nearest minimum setting in this field would be rounded down from the actual design value. For example, if the avionics is designed to transmit at 100W out of the antenna port, the encoded value in this field would be for 70W (decimal 1).

(FX) - extension bit

STA/TSI - Transponder Side Indication

Group

STA/TSI/EP - Element Populated Bit

Element
bit size: 1
Values:

- **0:** Element not populated
- **1:** Element populated

STA/TSI/VAL - Value

Element
bit size: 2
Values:

- **0:** Unknown
- **1:** Transponder #1 (left/pilot side or single)
- **2:** Transponder #2 (right/co-pilot side)
- **3:** Transponder #3 (auxiliary or Backup)

STA/MUO - Manned / Unmanned Operation

Group

STA/MUO/EP - Element Populated Bit

Element
bit size: 1
Values:

- **0:** Element not populated
- **1:** Element populated

STA/MUO/VAL - Value

Element
bit size: 1
Values:

0: Manned Operation
1: Unmanned Operation

STA/RWC - Remain Well Clear Corrective Alert

Group

STA/RWC/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/RWC/VAL - Value

Element
bit size: 1
Values:

0: RWC Corrective Alert not active
1: RWC Corrective Alert active

Notes:

1. This information is taken from the “Extended Squitter Aircraft Status Message” Register 61 16 Bit 25 as defined in EUROCAE ED-102B/RTCA DO-260C Ref. [11]. It is available for Version 3 ADS-B Systems only (refer to I021/210/VN).
2. This information is taken from the Operational Mode field in the “Aircraft Operational Status Message (Register 65 16 Bit 40)” as defined in EUROCAE ED-102B/RTCA DO-260C (Chapter A.1.4.10.4 in Ref. [11]). This information is available for Version 3 ADS-B systems only (refer to I021/210/VN).

(FX) - extension bit

STA/DAA - Detectand Avoid Capabilities

Group

STA/DAA/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/DAA/VAL - Value

Element
bit size: 2
Values:

0: No RWC Capability
1: RWC/RA/OCM Capability
2: RWC/OCM Capability
3: Invalid ASTERIX Value

STA/DF17CA - Transponder Capability

Group

STA/DF17CA/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/DF17CA/VAL - Value

Element
bit size: 3
Raw Content

Notes:

1. This information is taken from the Capability Class field in the "Aircraft Operational Status Message (Register 65 16 Bits 23-24)" as defined in EUROCAE ED-102B/RTCA DO-260C (Chapter A.1.4.10.3 in Ref. [11]). This information is available for Version 3 ADS-B systems only (refer to I021/210/VN).
2. The meaning of the individual values in "DAA" are described in Chapter A.1.4.10.24 in EUROCAE ED-102B/RTCA DO-260C Ref.[11].
3. CA is transmitted in Downlink Format 17 messages. CA is defined in EUROCAE ED-73F [14] chapter 3.18.4.5 and in RTCA DO-181F [14] chapter 2.2.14.4.6 where further details on the meaning of this Element are provided. Category 021 provides this Element as a "store-and-forward" capability only.

(FX) - extension bit

STA/SVH - Sense Vertical & Horizontal

Group

STA/SVH/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/SVH/VAL - Value

Element
bit size: 2
Values:

0: Vertical Only
1: Horizontal Only
2: Blended
3: Vertical Only or Horizontal Only per intruder

STA/CATC - CAS Type & Capability

Group

STA/CATC/EP - Element Population Bit

Element
bit size: 1
Values:

0: Element not populated
1: Element populated

STA/CATC/VAL - Value

Element
bit size: 3
Values:

0: Active CAS (TCAS II) or no CAS
1: Active CAS (not TCAS II)
2: Active CAS (not TCAS II) with OCM transmit capability
3: Active CAS of Junior Status
4: Passive CAS with 1030TCAS Resolution Message receive capability
5: Passive CAS with only OCM receive capability
6: Reserved for future use

7: Reserved for future use

Notes:

1. SVH is part of the CCCB (Collision Avoidance Coordination Capability Bits) in the “Aircraft Operational Status Message” Register 65_16 Bits 33-39 as defined in EUROCAE ED-102B/RTCA DO-260C Ref. [11], Chapter 2.2.3.2.7.2.4.8.1. This information is available for Version 3 ADS-B systems only (refer to I021/210/VN).
2. CATC is part of the CCCB (Collision Avoidance Coordination Capability Bits) in the “Aircraft Operational Status Message” Register 65_16 Bits 33-39 as defined in EUROCAE ED-102B/RTCA DO-260C Ref. [11], Chapter 2.2.3.2.7.2.4.8.2. This information is available for Version 3 ADS-B systems only (refer to I021/210/VN).

(FX) - extension bit

STA/TAO - Transponder Antenna Offset

Group

STA/TAO/EP - Element Populated Bit

Element
bit size: 1
Values:

0: Element Not Populated
1: Element Populated

STA/TAO/VAL - Value

Element
bit size: 5
Values:

0: No data
1: 0 ≤ TAO ≤ 1
2: 1 < TAO ≤ 2
3: 2 < TAO ≤ 4
4: 4 < TAO ≤ 6
5: 6 < TAO ≤ 8
6: 8 < TAO ≤ 10
7: 10 < TAO ≤ 12
8: 12 < TAO ≤ 14
9: 14 < TAO ≤ 16
10: 16 < TAO ≤ 18
11: 18 < TAO ≤ 20
12: 20 < TAO ≤ 22
13: 22 < TAO ≤ 24
14: 24 < TAO ≤ 26
15: 26 < TAO ≤ 28
16: 28 < TAO ≤ 30
17: 30 < TAO ≤ 32
18: 32 < TAO ≤ 34
19: 34 < TAO ≤ 36
20: 36 < TAO ≤ 38
21: 38 < TAO ≤ 40
22: 40 < TAO ≤ 42
23: 42 < TAO ≤ 44
24: 44 < TAO ≤ 46
25: 46 < TAO ≤ 48
26: 48 < TAO ≤ 50
27: 50 < TAO ≤ 52
28: 52 < TAO ≤ 54
29: 54 < TAO ≤ 56
30: 56 < TAO ≤ 58

31: TAO > 58

Spare bits: 1

Notes:

1. TAO is a one-to-one copy of Message Bits 68 to 72 of the ”Aircraft Operational Status Message” (Register 65 16). The TAO is measured along the longitudinal axis of the aircraft from the forward end.

(FX) - extension bit

TNH - True North Heading

definition: True North Heading (Element of Air Vector).

Element
bit size: 16
Unsigned quantity
LSB = $360/2^16$ ° ≈ $5.4931640625e-3$ °
unit: ”°”

Magnetic Heading is defined in I021/152.

MES - Military Extended Squitter

definition: Contents of Extended Squitters transmitted by Military Aircraft
Compound

MES/SUM - Mode 5 Summary

Group

MES/SUM/M5

Element
bit size: 1
Values:

0: No Mode 5 interrogation
1: Mode 5 interrogation

MES/SUM/ID

Element
bit size: 1
Values:

0: No authenticated Mode 5 ID reply/report
1: Authenticated Mode 5 ID reply/report

MES/SUM/DA

Element
bit size: 1
Values:

0: No authenticated Mode 5 Data reply or Report
1: Authenticated Mode 5 Data reply or Report (i.e any valid Mode 5 reply type other than ID)

MES/SUM/M1

Element
bit size: 1
Values:

0: Mode 1 code not present or not from Mode 5 reply/report
1: Mode 1 code from Mode 5 reply/report

MES/SUM/M2

Element
bit size: 1
Values:

0: Mode 2 code not present or not from Mode 5 reply/report
1: Mode 2 code from Mode 5 reply/report

MES/SUM/M3

Element
bit size: 1
Values:

0: Mode 3 code not present or not from Mode 5 reply/report
1: Mode 3 code from Mode 5 reply/report

MES/SUM/MC

Element
bit size: 1
Values:

0: Flightlevel not present or not from Mode 5 reply/report
1: Flightlevel from Mode 5 reply/report

MES/SUM/PO

Element
bit size: 1
Values:

0: Position not from Mode 5 report (ADS-B report)
1: Position from Mode 5 report

Notes:

1. The flag M2 refers to the contents of Subfield #6 below, M3, MC refer to the contents of data items I021/070 and I021/145 respectively. The flag M1 refers to the contents of Subfield #3 below (Extended Mode 1 Code in Octal Representation).
2. If a Mode 5 reply/report is received with the Emergency bit set, then the Military Emergency bit (ME) in Data Item I021/200, Target Status, shall be set.
3. If a Mode 5 reply/report is received with the Identification of Position bit set, then the Special Position Identification bit (SPI) in Data Item I021/200, Target Status, shall be set.
4. If a Mode 5 report (ID or Data) is received and fullfill the autentication criteria the corresponding authentication bit shall be set.

MES/PNO - Mode 5 PIN / National Origin

Group

Spare bits: 2

MES/PNO/PIN - PIN Code

Element
bit size: 14
Raw Content

Spare bits: 5

MES/PNO/NO - National Origin Code

Element
bit size: 11
Raw Content

MES/EM1 - Extended Mode 1 Code in Octal Representation

Group

MES/EM1/V

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

Spare bits: 1

MES/EM1/L

Element
bit size: 1
Values:

0: Mode 1 code as derived from the report of the transponder
1: Smoothed Mode 1 code as provided by a local tracker

Spare bits: 1

MES/EM1/EM1 - Extended Mode 1 Code in Octal Representation

Element
bit size: 12
Octal string (3-bits per char)

Notes:

- Subfield #1 is present, the M1 bit in Subfield #1 indicates whether the Extended Mode 1 Code is from a Mode 5 reply or a Mode 1 reply. If Subfield #1 is not present, the Extended Mode 1 Code is from a Mode 1 reply.
- If Subfield #3 is not present the Mode 1 Code was not reported or all Code Bits were equal to 0.
- The valid bit is set if the Code was only reported once for that target.

MES/XP - X Pulse Presence

Group

Spare bits: 2

MES/XP/XP - X-pulse from Mode 5 PIN Reply/report

Element
bit size: 1
Values:

0: X-Pulse not present
1: X-pulse present

MES/XP/X5 - X-pulse from Mode 5 Data Reply or Report

Element
bit size: 1
Values:

0: X-pulse set to zero or no authenticated Data reply or Report received
1: X-pulse set to one (present)

MES/XP/XC - X-pulse from Mode C Reply

Element
bit size: 1
Values:

0: X-pulse set to zero or no Mode C reply
1: X-pulse set to one (present)

MES/XP/X3 - X-pulse from Mode 3/A Reply

Element
bit size: 1
Values:

0: X-pulse set to zero or no Mode 3/A reply

1: X-pulse set to one (present)

MES/XP/X2 - X-pulse from Mode 2 Reply

Element
bit size: 1
Values:

0: 0 X-pulse set to zero or no Mode 2 reply
1: X-pulse set to one (present)

MES/XP/X1 - X-pulse from Mode 1 Reply

Element
bit size: 1
Values:

0: X-pulse set to zero or no Mode 1 reply
1: X-pulse set to one (present)

Within Mode 5 reports, the X-Pulse can be set for the following cases:
1. In a combined Mode 1 and Mode 2 report: in this case the X5 bit and the X2 bit shall be set;
2. In a combined Mode 3 and Mode C report: in this case the X5 bit and the X3 bit shall be set;
3. In a Mode 5 PIN data report: in this case the X5 bit and the XP bit shall be set. The X1 bit and the XC bit are meaningless as in Mode 1 and Mode C replies/reports the X Pulse is not defined. They are kept for compatibility reasons.

MES/FOM - Figure of Merit

Group

Spare bits: 3
MES/FOM/FOM - Figure of Merit

Element
bit size: 5
Raw Content

MES/M2 - Mode 2 Code in Octal Representation

Group

MES/M2/V

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

Spare bits: 1
MES/M2/L

Element
bit size: 1
Values:

0: Mode-2 code as derived from the reply of the transponder
1: Smoothed Mode-2 code as provided by a local tracker

Spare bits: 1
MES/M2/MODE2 - Mode 2 Code in Octal Representation

Element
bit size: 12
Octal string (3-bits per char)

If Subfield 6 is not present the Mode 2 Code was no reported or all Code Bits were equal to 0.

Notes:

- The Reserved Expansion Field is optional. When used to transmit MES, it shall be sent when the targets are represented by Mode 5 Level 2 reports.
- The information contained in this data item is specific to 1090MHz Extended Squitter messages transmitted by military aircraft (Mode 5 Level 2 squitter).