

# **cat021 expansion specification**

***Release 2018-03-08, 1.4***

## **ADS-B Target Reports Expansion**

**2018-03-08**



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## DESCRIPTION OF ASTERIX EXPANSION

Compound item (fspec=8 bits)

### **I021/BPS** - *Barometric Pressure Setting*

#### **I021/BPS/(spare)**

- 4 bits [ . . . . ]

#### **I021/BPS/BPS** - *Barometric Pressure Setting*

- 12 bits [ . . . . . . . . . . . . . . . . ]
- unsigned quantity
- scaling factor: 0.1
- fractional bits: 0
- unit: "hPa"
- LSB = 0.1 hPa
- value  $\geq 0$  hPa
- value  $\leq 409.5$  hPa

#### **remark** 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.

### **I021/SH** - *Selected Heading*

#### **I021/SH/(spare)**

- 4 bits [ . . . . ]

#### **I021/SH/HDR** - *Horizontal Reference Direction*

- 1 bit [ . ]
- values:
  - 0: True North
  - 1: Magnetic North

#### **I021/SH/STAT** - *Selected Heading Status*

- 1 bit [ . ]
- values:

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

**I021/SH/SH** - *Selected Heading*

- 10 bits [.....]
- unsigned quantity
- scaling factor: 45
- fractional bits: 6
- unit: “deg”
- $\text{LSB} = 45/2^6 \text{ deg} = 45/64 \text{ deg} \approx 0.703125 \text{ deg}$

**remark** 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).

**I021/NAV** - *Navigation Mode***I021/NAV/AP** - *Autopilot*

- 1 bit [.]
- values:
  - 0: Autopilot not engaged
  - 1: Autopilot engaged

**I021/NAV/VN** - *Vertical Navigation*

- 1 bit [.]
- values:
  - 0: Vertical Navigation not active
  - 1: Vertical Navigation active

**I021/NAV/AH** - *Altitude Hold*

- 1 bit [.]
- values:
  - 0: Altitude Hold not engaged
  - 1: Altitude Hold engaged

**I021/NAV/AM** - *Approach Mode*

- 1 bit [.]
- values:
  - 0: Approach Mode not active
  - 1: Approach Mode active

**I021/NAV/(spare)**

- 4 bits [....]

**remark** This data-item should only be transmitted if an ADS-B indication has been received that the mode bits have been “actively populated”.by the avionics (1090 ES version 2 (as defined in I021/210) BDS 6,2, subtype 1, bit 47: “Status of MCP / FCU Mode Bits”)

**I021/GAO** - *GPS Antenna Offset*



- 8 bits [ . . . . . ]
- raw value

**remark** The value of this field is copied from the respective bits 33-40 of version 2 (as defined in I021/210) of 1090 ES BDS register 6,5 (Aircraft Operational Status)

#### **I021/SGV** - *Surface Ground Vector*

Extended item with first part 16 bits long and optional 8 bits extends.

##### **I021/SGV/STP**

- 1 bit [ . ]
- values:
  - 0: Aircraft has not stopped
  - 1: Aircraft has stopped

##### **I021/SGV/HTS**

- 1 bit [ . ]
- values:
  - 0: Heading/Ground Track data is not valid
  - 1: Heading/Ground Track data is valid

##### **I021/SGV/HTT**

- 1 bit [ . ]
- values:
  - 0: Heading data provided
  - 1: Ground Track provided

##### **I021/SGV/HRD**

- 1 bit [ . ]
- values:
  - 0: True North
  - 1: Magnetic North

##### **I021/SGV/GSS** - *Ground Speed*

- 11 bits [ . . . . . ]
- unsigned quantity
- scaling factor: 1
- fractional bits: 3
- unit: "kts"
- $\text{LSB} = 1/2^3 \text{ kts} = 1/8 \text{ kts} \approx 0.125 \text{ kts}$

(FX)

- extension bit
  - 0: End of data item
  - 1: Extension into next extent

##### **I021/SGV/HGT** - *Heading/Ground Track Information*

- 7 bits [ . . . . . ]
- unsigned quantity

- scaling factor: 45
- fractional bits: 4
- unit: “deg”
- $\text{LSB} = 45/2^4 \text{ deg} = 45/16 \text{ deg} \approx 2.8125 \text{ deg}$

(FX)

- extension bit
  - 0: End of data item
  - 1: Extension into next extent

#### **I021/STA - Aircraft Status**

Extended item with first part 8 bits long and optional 8 bits extends.

##### **I021/STA/ES**

- 1 bit [.]
- values:
  - 0: Target is not 1090 ES IN capable
  - 1: Target is 1090 ES IN capable

##### **I021/STA/UAT**

- 1 bit [.]
- values:
  - 0: Target is not UAT IN capable
  - 1: Target is UAT IN capable

##### **I021/STA/(spare)**

- 5 bits [.....]

(FX)

- extension bit
  - 0: End of data item
  - 1: Extension into next extent

#### **I021/TNH - True North Heading**

- 16 bits [.....]
- unsigned quantity
- scaling factor: 360
- fractional bits: 16
- unit: “deg”
- $\text{LSB} = 360/2^{16} \text{ deg} = 360/65536 \text{ deg} \approx 0.0054931640625 \text{ deg}$

**remark** Magnetic Heading is defined in I021/152.

#### **I021/MES - Military Extended Squitter**

Compound item (FX)

##### **I021/MES/SUM - Mode 5 Summary**

##### **I021/MES/SUM/M5**

- 1 bit [.]
- values:

0: No Mode 5 interrogation

1: Mode 5 interrogation

**I021/MES/SUM/ID**

- 1 bit [.]

- values:

0: No authenticated Mode 5 ID reply/report

1: Authenticated Mode 5 ID reply/report

**I021/MES/SUM/DA**

- 1 bit [.]

- 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)

**I021/MES/SUM/M1**

- 1 bit [.]

- values:

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

1: Mode 1 code from Mode 5 reply/report

**I021/MES/SUM/M2**

- 1 bit [.]

- values:

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

1: Mode 2 code from Mode 5 reply/report

**I021/MES/SUM/M3**

- 1 bit [.]

- values:

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

1: Mode 3 code from Mode 5 reply/report

**I021/MES/SUM/MC**

- 1 bit [.]

- values:

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

1: Flightlevel from Mode 5 reply/report

**I021/MES/SUM/PO**

- 1 bit [.]

- values:

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

1: Position from Mode 5 report

**remark** 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 fulfill the authentication criteria the corresponding authentication bit shall be set.

**I021/MES/PNO** - *Mode 5 PIN / National Origin***I021/MES/PNO/(spare)**

- 2 bits [ . . ]

**I021/MES/PNO/PIN** - *PIN Code*

- 14 bits [ . . . . . ]
- raw value

**I021/MES/PNO/(spare)**

- 5 bits [ . . . . . ]

**I021/MES/PNO/NO** - *National Origin Code*

- 11 bits [ . . . . . ]
- raw value

**I021/MES/EM1** - *Extended Mode 1 Code in Octal Representation***I021/MES/EM1/V**

- 1 bit [ . ]
- values:
  - 0: Code validated
  - 1: Code not validated

**I021/MES/EM1/(spare)**

- 1 bit [ . ]

**I021/MES/EM1/L**

- 1 bit [ . ]
- values:
  - 0: Mode 1 code as derived from the report of the transponder
  - 1: Smoothed Mode 1 code as provided by a local tracker

**I021/MES/EM1/(spare)**

- 1 bit [ . ]

**I021/MES/EM1/EM1** - *Extended Mode 1 Code in Octal Representation*

- 12 bits [.....]
- Octal string (3-bits per digit)

**remark** 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.

**I021/MES/XP** - *X Pulse Presence***I021/MES/XP/(spare)**

- 2 bits [.]

**I021/MES/XP/XP** - *X-pulse from Mode 5 PIN Reply/report*

- 1 bit [.]
- values:

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

**I021/MES/XP/X5** - *X-pulse from Mode 5 Data Reply or Report*

- 1 bit [.]
- values:

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

**I021/MES/XP/XC** - *X-pulse from Mode C Reply*

- 1 bit [.]
- values:

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

**I021/MES/XP/X3** - *X-pulse from Mode 3/A Reply*

- 1 bit [.]
- values:

0: X-pulse set to zero or no Mode 3/A reply  
1: X-pulse set to one (present)

**I021/MES/XP/X2** - *X-pulse from Mode 2 Reply*

- 1 bit [.]
- values:

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

**I021/MES/XP/X1** - *X-pulse from Mode 1 Reply*

- 1 bit [.]
- values:
  - 0: X-pulse set to zero or no Mode 1 reply
  - 1: X-pulse set to one (present)

**remark** 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.

**I021/MES/FOM** - *Figure of Merit***I021/MES/FOM/(spare)**

- 3 bits [...]

**I021/MES/FOM/FOM** - *Figure of Merit*

- 5 bits [.....]
- raw value

**I021/MES/M2** - *Mode 2 Code in Octal Representation***I021/MES/M2/V**

- 1 bit [.]
- values:
  - 0: Code validated
  - 1: Code not validated

**I021/MES/M2/(spare)**

- 1 bit [.]

**I021/MES/M2/L**

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

**I021/MES/M2/(spare)**

- 1 bit [.]

**I021/MES/M2/MODE2** - *Mode 2 Code in Octal Representation*

- 12 bits [.....]
- Octal string (3-bits per digit)

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

**remark** 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).





## INDICES AND TABLES

- `genindex`
- `modindex`
- `search`