

# Asterix category 021 - ADS-B Target Reports

**category:** 021

**edition:** 0.25

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## Preamble

Surveillance data exchange. ADS-B Target Reports.

## Description of standard data items

### I021/010 - Data Source Identification

definition: Identification of the ADS-B station providing information.

Group

#### I021/010/SAC - System Area Code

Element

bit size: 8

Raw Content

#### I021/010/SIC - System Identification Code

Element

bit size: 8

Raw Content

#### Note:

- The up-to-date list of SACs is published on the EUROCONTROL ASTERIX Web Site (<http://www.eurocontrol.int/services/system-area-code-list>).

### I021/020 - Emitter Category

definition: Characteristics of the originating ADS-B unit.

Element

bit size: 8

Values:

- 1: Light aircraft  $\leq 7000$  kg
- 2: Reserved
- 3:  $7000 \text{ kg} < \text{Medium aircraft} < 136000 \text{ kg}$
- 4: Reserved
- 5:  $136000 \text{ kg} \leq \text{Heavy aircraft}$
- 6: Highly manoeuvrable (5g acceleration capability) and high speed ( $>400$  knots cruise)
- 7: Reserved
- 8: Reserved
- 9: Reserved
- 10: Rotocraft
- 11: Glider / sailplane
- 12: Lighter-than-air
- 13: Unmanned aerial vehicle
- 14: Space / transatmospheric vehicle
- 15: Ultralight / handglider / paraglider
- 16: Parachutist / skydiver

- 17: Reserved
- 18: Reserved
- 19: Reserved
- 20: Surface emergency vehicle
- 21: Surface service vehicle
- 22: Fixed ground or tethered obstruction
- 23: Reserved
- 24: Reserved

### **I021/030 - Time of Day**

definition: Time of applicability (measurement) of the reported position, in the form of elapsed time since last midnight, expressed as UTC.

Element

bit size: 24

Unsigned quantity

LSB =  $1/2^7$  s  $\approx 7.8125e-3$  s

unit: "s"

The time of the day value is reset to zero at every midnight.

### **I021/032 - Time of Day Accuracy**

definition: The maximum difference between the actual time of applicability of the reported position and the time reported in the Time of Day item (I021/030).

Element

bit size: 8

Unsigned quantity

LSB =  $1/2^8$  s  $\approx 3.90625e-3$  s

unit: "s"

### **I021/040 - Target Report Descriptor**

definition: Type and characteristics of the data as transmitted by a system.

Group

#### **I021/040/DCR - Differential Correction**

Element

bit size: 1

Values:

0: No differential correction (ADS-B)

1: Differential correction (ADS-B)

#### **I021/040/GBS - Ground Bit Setting**

Element

bit size: 1

Values:

0: Ground Bit not set

1: Ground Bit set

#### **I021/040/SIM - Simulated Target**

Element

bit size: 1

Values:

0: Actual target report

1: Simulated target report

### **I021/040/TST - Test Target**

Element

bit size: 1

Values:

**0:** Default

**1:** Test Target

### **I021/040/RAB - Report Type**

Element

bit size: 1

Values:

**0:** Report from target transponder

**1:** Report from field monitor (fixed transponder)

### **I021/040/SAA - Selected Altitude Available**

Element

bit size: 1

Values:

**0:** Equipment capable to provide Selected Altitude

**1:** Equipment not capable to provide Selected Altitude

### **I021/040/SPI - Special Position Identification**

Element

bit size: 1

Values:

**0:** Absence of SPI

**1:** Special Position Identification

Spare bits: 1

### **I021/040/ATP - Address Type**

Element

bit size: 3

Values:

**0:** Non unique address

**1:** 24-Bit ICAO address

**2:** Surface vehicle address

**3:** Anonymous address

**4:** Reserved for future use

**5:** Reserved for future use

**6:** Reserved for future use

**7:** Reserved for future use

### **I021/040/ARC - Altitude Reporting Capability**

Element

bit size: 2

Values:

**0:** Unknown

**1:** 25 ft

**2:** 100 ft

Spare bits: 3

### **I021/080 - Target Address**

definition: Target address (emitter identifier) assigned uniquely to each target.

Element

bit size: 24

Raw Content

## **I021/090 - Figure of Merit**

definition: ADS figure of merit (FOM) provided by the aircraft avionics.  
Group

### **I021/090/AC - ACAS Capabilities**

Element  
bit size: 2  
Values:  
    **0:** Unknown  
    **1:** ACAS not operational  
    **2:** ACAS operational  
    **3:** Invalid

### **I021/090/MN - Multiple Navigation Aids**

Element  
bit size: 2  
Values:  
    **0:** Unknown  
    **1:** Multiple Navigation not operational  
    **2:** Multiple Navigation operational  
    **3:** Invalid

### **I021/090/DC - Differential Correction**

Element  
bit size: 2  
Values:  
    **0:** Unknown  
    **1:** Differential Correction  
    **2:** NO Differential Correction  
    **3:** Invalid

Spare bits: 6

### **I021/090/PA - Position Accuracy**

Element  
bit size: 4  
Signed quantity  
LSB = 1  $\approx$  1.0  
unit: ""

**Note:** bits-4/1 (PA) code the "Navigational Uncertainty Categories - Position" as described in the ADS-B MASPS [Ref. 3]

## **I021/095 - Velocity Accuracy**

definition: Velocity uncertainty category of the least accurate velocity

Element  
bit size: 8  
Raw Content

**Note:** bits-8/1 code the "Navigational Uncertainty Categories - Velocity" as described in the ADS-B MASPS [Ref. 3]

## **I021/110 - Trajectory Intent**

definition: Reports indicating the 4D intended trajectory of the aircraft.  
Compound

## **I021/110/TIS - Trajectory Intent Status**

Extended

### **I021/110/TIS/NAV**

Element

bit size: 1

Values:

**0:** Trajectory Intent Data is available for this aircraft

**1:** Trajectory Intent Data is not available for this aircraft

### **I021/110/TIS/NVB**

Element

bit size: 1

Values:

**0:** Trajectory Intent Data is valid

**1:** Trajectory Intent Data is not valid

Spare bits: 5

(FX) - extension bit

## **I021/110/TID - Trajectory Intent Data**

Repetitive

Regular, 1 byte(s) REP field size.

Group

### **I021/110/TID/TCA**

Element

bit size: 1

Values:

**0:** TCP number available

**1:** TCP number not available

### **I021/110/TID/NC**

Element

bit size: 1

Values:

**0:** TCP compliance

**1:** TCP non-compliance

### **I021/110/TID/TCPN**

description: Trajectory Change Point number

Element

bit size: 6

Raw Content

### **I021/110/TID/ALT - Altitude in Two's Complement Form**

Element

bit size: 16

Signed quantity

LSB = 10 ft  $\approx$  10.0 ft

unit: "ft"

$\geq -1500.0$

$\leq 150000.0$

### **I021/110/TID/LAT - In WGS.84 in Two's Complement**

Element

bit size: 24

Signed quantity

LSB =  $180/2^{23}$  °  $\approx 2.1457672119140625e-5$  °

unit: "°"

$\geq -90.0$

$\leq 90.0$

### **I021/110/TID/LON - In WGS.84 in Two's Complement**

Element  
bit size: 24  
Signed quantity  
 $\text{LSB} = 180/2^{23} \text{ }^\circ \approx 2.1457672119140625e - 5 \text{ }^\circ$   
unit: "°"  
 $\geq -180.0$   
 $< 180.0$

### **I021/110/TID/PT - Point Type**

Element  
bit size: 4  
Values:  
**0:** Unknown  
**1:** Fly by waypoint (LT)  
**2:** Fly over waypoint (LT)  
**3:** Hold pattern (LT)  
**4:** Procedure hold (LT)  
**5:** Procedure turn (LT)  
**6:** RF leg (LT)  
**7:** Top of climb (VT)  
**8:** Top of descent (VT)  
**9:** Start of level (VT)  
**10:** Cross-over altitude (VT)  
**11:** Transition altitude (VT)

### **I021/110/TID/TD**

Element  
bit size: 2  
Values:  
**0:** N/A  
**1:** Turn right  
**2:** Turn left  
**3:** No turn

### **I021/110/TID/TRA**

description: Turn Radius Availability

Element  
bit size: 1  
Values:  
**0:** TTR not available  
**1:** TTR available

### **I021/110/TID/TOA**

Element  
bit size: 1  
Values:  
**0:** TOV available  
**1:** TOV not available

### **I021/110/TID/TOV - Time Over Point**

Element  
bit size: 24  
Unsigned quantity  
 $\text{LSB} = 1 \text{ s} \approx 1.0 \text{ s}$   
unit: "s"

### **I021/110/TID/TTR - TCP Turn Radius**

Element  
bit size: 16  
Unsigned quantity  
 $\text{LSB} = 1/100 \text{ NM} \approx 1.0e - 2 \text{ NM}$   
unit: "NM"

$\geq 0.0$   
 $\leq 655.35$

Notes:

1. NC is set to one when the aircraft will not fly the path described by the TCP data.
2. TCP numbers start from zero.
3. LT = Lateral Type
4. VT = Vertical Type
5. TOV gives the estimated time before reaching the point. It is defined as the absolute time from midnight.
6. TOV is meaningful only if TOA is set to 1.

### **I021/130 - Position in WGS-84 Co-ordinates**

definition: Calculated Position in WGS-84 Co-ordinates with a resolution of  $180/(2^{25})$  degrees.

Group

#### **I021/130/LAT - Latitude**

Element  
bit size: 32  
Signed quantity  
 $LSB = 180/2^{25} \text{ }^\circ \approx 5.36441802978515625e - 6 \text{ }^\circ$   
unit: "°"  
 $\geq -90.0$   
 $\leq 90.0$

#### **I021/130/LON - Longitude**

Element  
bit size: 32  
Signed quantity  
 $LSB = 180/2^{25} \text{ }^\circ \approx 5.36441802978515625e - 6 \text{ }^\circ$   
unit: "°"  
 $\geq -180.0$   
 $< 180.0$

Notes:

1. Positive longitude indicates East. Positive latitude indicates North.
2. The LSB provides a resolution at least better than 0.6m.

### **I021/140 - Geometric Altitude**

definition: Vertical distance between the target and the projection of its position on the earth's ellipsoid, as defined by WGS84, in two's complement form.

Element  
bit size: 16  
Signed quantity  
 $LSB = 25/2^2 \text{ ft} \approx 6.25 \text{ ft}$   
unit: "ft"  
 $\geq -1500.0$   
 $< 150000.0$

**Note:**

1. LSB is required to be less than 10 ft by ICAO.

### **I021/145 - Flight Level**

definition: Flight Level from barometric measurements, not QNH corrected, in two's complement form.

Element  
bit size: 16  
Signed quantity  
 $\text{LSB} = 1/2^2 \text{ FL} \approx 0.25 \text{ FL}$   
unit: "FL"  
 $\geq -15.0$   
 $< 1500.0$

### **I021/146 - Intermediate State Selected Altitude**

definition: The short-term vertical intent as described by either the FMS selected altitude, the Altitude Control Panel Selected Altitude, or the current aircraft altitude according to the aircraft's mode of flight.

Group

#### **I021/146/SAS - Source Availability**

Element  
bit size: 1  
Values:  
**0:** No source information provided  
**1:** Source Information provided

#### **I021/146/SRC - Source**

Element  
bit size: 2  
Values:  
**0:** Unknown  
**1:** Aircraft Altitude (Holding Altitude)  
**2:** MCP/FCU Selected Altitude  
**3:** FMS Selected Altitude

#### **I021/146/ALT - Altitude**

Element  
bit size: 13  
Signed quantity  
 $\text{LSB} = 25 \text{ ft} \approx 25.0 \text{ ft}$   
unit: "ft"  
 $\geq -1300.0$   
 $< 100000.0$

### **I021/148 - Final State Selected Altitude**

definition: The vertical intent value that corresponds with the ATC cleared altitude, as derived from the Altitude Control Panel (MCP/FCU).

Group

#### **I021/148/MV - Manage Vertical Mode**

Element  
bit size: 1  
Values:  
**0:** Not active  
**1:** Active

#### **I021/148/AH - Altitude Hold Mode**



Element  
bit size: 1  
Values:  
    **0**: Not active  
    **1**: Active

#### **I021/148/AM - Approach Mode**

Element  
bit size: 1  
Values:  
    **0**: Not active  
    **1**: Active

#### **I021/148/ALT - Altitude**

Element  
bit size: 13  
Signed quantity  
LSB = 25 ft  $\approx$  25.0 ft  
unit: "ft"  
 $\geq -1300.0$   
 $< 100000.0$

#### **I021/150 - Air Speed**

definition: Calculated Air Speed (Element of Air Vector).

Group

##### **I021/150/IM**

Element  
bit size: 1  
Values:  
    **0**: Air Speed = IAS, LSB (Bit-1) =  $2^{-14}$  NM/s  
    **1**: Air Speed = Mach, LSB (Bit-1) = 0.001

##### **I021/150/AS - Air Speed (IAS or Mach)**

Element  
bit size: 15  
Depending on: (150/IM)  
    **(0)**: Unsigned quantity  
        LSB =  $1/2^{14}$  NM/s  $\approx 6.103515625e-5$  NM/s  
        unit: "NM/s"  
    **(1)**: Unsigned quantity  
        LSB =  $1/1000$  Mach  $\approx 1.0e-3$  Mach  
        unit: "Mach"  
Default:  
    Raw Content

#### **I021/151 - True Airspeed**

definition: True Air Speed.

Element  
bit size: 16  
Unsigned quantity  
LSB = 1 kt  $\approx$  1.0 kt  
unit: "kt"

#### **I021/152 - Magnetic Heading**

definition: Magnetic Heading (Element of Air Vector).

Element

bit size: 16

Unsigned quantity

$LSB = 360/2^{16} \text{ }^\circ \approx 5.4931640625e - 3 \text{ }^\circ$

unit: "°"

#### **I021/155 - Barometric Vertical Rate**

definition: Barometric Vertical Rate, in two's complement form.

Element

bit size: 16

Signed quantity

$LSB = 25/2^2 \text{ ft/min} \approx 6.25 \text{ ft/min}$

unit: "ft/min"

#### **I021/157 - Geometric Vertical Rate**

definition: Geometric Vertical Rate, in two's complement form, with reference to WGS-84.

Element

bit size: 16

Signed quantity

$LSB = 25/2^2 \text{ ft/min} \approx 6.25 \text{ ft/min}$

unit: "ft/min"

#### **I021/160 - Ground Vector**

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

Group

##### **I021/160/GS - Ground Speed in Two's Complement Form Referenced to WGS84**

Element

bit size: 16

Signed quantity

$LSB = 1/2^{14} \text{ NM/s} \approx 6.103515625e - 5 \text{ NM/s}$

unit: "NM/s"

$\geq 0.0$

$< 2.0$

##### **I021/160/TA - Track Angle**

Element

bit size: 16

Unsigned quantity

$LSB = 360/2^{16} \text{ }^\circ \approx 5.4931640625e - 3 \text{ }^\circ$

unit: "°"

#### **I021/165 - Rate Of Turn**

definition: Rate of Turn, in two's complement form.

Extended

##### **I021/165/TI - Turn Indicator**

Element  
bit size: 2  
Values:  
    **0:** Not available  
    **1:** Left  
    **2:** Right  
    **3:** Straight

Spare bits: 5

(FX) - extension bit

#### **I021/165/ROT - Rate of Turn**

Element  
bit size: 7  
Signed quantity  
LSB =  $1/2^2$  °/s  $\approx 0.25$  °/s  
unit: "°/s"  
≤ 15.0

(FX) - extension bit

#### **Notes:**

1. A positive value represents a right turn, whereas a negative value represents a left turn.
2. Value 15 means 15 °/s or above.

#### **I021/170 - Target Identification**

definition: Target (aircraft or vehicle) identification in 8 characters, as reported by the target.

Element  
bit size: 48  
ICAO string (6-bits per char)

#### **I021/200 - Target Status**

definition: Status of the target

Element  
bit size: 8  
Values:  
    **0:** No emergency / not reported  
    **1:** General emergency  
    **2:** Lifeguard / medical  
    **3:** Minimum fuel  
    **4:** No communications  
    **5:** Unlawful interference

#### **I021/210 - Link Technology Indicator**

definition: Indication of which ADS link technology has been used to send the target report.

Group

Spare bits: 3

#### **I021/210/DTI - Cockpit Display of Traffic Information**

Element  
bit size: 1  
Values:

0: Unknown  
1: Aircraft equipped with CDTI

#### **I021/210/MDS - Mode-S Extended Squitter**

Element  
bit size: 1  
Values:  
0: Not used  
1: Used

#### **I021/210/UAT - UAT**

Element  
bit size: 1  
Values:  
0: Not used  
1: Used

#### **I021/210/VDL - VDL Mode 4**

Element  
bit size: 1  
Values:  
0: Not used  
1: Used

#### **I021/210/OTR - Other Technology**

Element  
bit size: 1  
Values:  
0: Not used  
1: Used

### **I021/220 - Met Information**

definition: Meteorological information.

Compound

#### **I021/220/WS - Wind Speed**

Element  
bit size: 16  
Unsigned quantity  
LSB = 1 kt  $\approx$  1.0 kt  
unit: "kt"  
 $\geq$  0.0  
 $\leq$  300.0

#### **I021/220/WD - Wind Direction**

Element  
bit size: 16  
Unsigned quantity  
LSB = 1 °  $\approx$  1.0 °  
unit: "°"  
 $\geq$  1.0  
 $\leq$  360.0

#### **I021/220/TMP - Temperature**

Element  
bit size: 16  
Signed quantity  
LSB =  $1/2^2$  °C  $\approx$  0.25 °C  
unit: "°C"  
 $\geq$  -100.0  
 $\leq$  100.0

### **I021/220/TRB - Turbulence**

Element  
bit size: 8  
Unsigned integer  
>= 0.0  
≤ 15.0

### **I021/230 - Roll Angle**

definition: The roll angle, in two's complement form, of an aircraft executing a turn.

Element  
bit size: 16  
Signed quantity  
 $LSB = 1/100^\circ \approx 1.0e-2^\circ$   
unit: "°"  
= −180.0  
≤ 180.0

#### **Notes:**

1. Negative Value indicates "Left Wing Down".
2. Resolution provided by the technology "1090 MHz Extended Squitter" is 1 degree.

### **I021/RE - Reserved Expansion Field**

definition: Expansion  
Explicit (ReservedExpansion)

### **I021/SP - Special Purpose Field**

definition: Special Purpose Field  
Explicit (SpecialPurpose)

## **User Application Profile**

- 1: I021/010 - Data Source Identification
- 2: I021/040 - Target Report Descriptor
- 3: I021/030 - Time of Day
- 4: I021/130 - Position in WGS-84 Co-ordinates
- 5: I021/080 - Target Address
- 6: I021/140 - Geometric Altitude
- 7: I021/090 - Figure of Merit
- (FX) - Field extension indicator
- 8: I021/210 - Link Technology Indicator
- 9: I021/230 - Roll Angle
- 10: I021/145 - Flight Level
- 11: I021/150 - Air Speed
- 12: I021/151 - True Airspeed
- 13: I021/152 - Magnetic Heading
- 14: I021/155 - Barometric Vertical Rate
- (FX) - Field extension indicator
- 15: I021/157 - Geometric Vertical Rate
- 16: I021/160 - Ground Vector
- 17: I021/165 - Rate Of Turn
- 18: I021/170 - Target Identification
- 19: I021/095 - Velocity Accuracy

- 20: I021/032 - Time of Day Accuracy
- 21: I021/200 - Target Status
- (FX) - Field extension indicator
- 22: I021/020 - Emitter Category
- 23: I021/220 - Met Information
- 24: I021/146 - Intermediate State Selected Altitude
- 25: I021/148 - Final State Selected Altitude
- 26: I021/110 - Trajectory Intent
- *Spare*
- *Spare*
- (FX) - Field extension indicator
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- 34: I021/RE - Reserved Expansion Field
- 35: I021/SP - Special Purpose Field
- (FX) - Field extension indicator