Asterix category 021 - ADS-B Target Reports

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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 <= 7000 kg
2: Reserved
3: 7000 kg < Medium aircraft < 136000 kg
4: Reserved
5: 136000 kg <= 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 ≈ $7.8125e-3$ 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 ≈ $3.90625e-3$ 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 operartional
- **3:** Invalid

I021/090/MN - Multiple Navigation Aids

Element
bit size: 2
Values:

- **0:** Unknown
- **1:** Multiple Navigation not operational
- **2:** Multiple Navigation operartional
- **3:** Invalid

I021/090/DC - Differencial Correction

Element
bit size: 2
Values:

- **0:** Unknown
- **1:** Differencial Correction
- **2:** NO Differencial Correction
- **3:** Invalid

Spare bits: 6

I021/090/PA - Position Accuracy

Element
bit size: 4
Signed quantity
LSB = 1 ≈ 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 ≈ 10.0 ft
unit: ”ft”
>= -1500.0
<= 150000.0

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

Element
bit size: 24
Signed quantity
LSB = $180/2^{2}3$ ° ≈ $2.1457672119140625e-5$ °
unit: ”°”
>= -90.0
<= 90.0

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

Element
bit size: 24
Signed quantity
LSB = $180/2^{2}3$ ° ≈ $2.1457672119140625e-5$ °
unit: ”°”
>= -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
LSB = 1 s ≈ 1.0 s
unit: ”s”

I021/110/TID/TTR - TCP Turn Radius

Element
bit size: 16
Unsigned quantity
LSB = $1/100$ NM ≈ $1.0e-2$ NM
unit: ”NM”

>= 0.0
<= 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 = $180/2^25$ ° ≈ $5.36441802978515625e-6$ °
unit: ”°”
>= -90.0
<= 90.0

I021/130/LON - Longitude

Element
bit size: 32
Signed quantity
LSB = $180/2^25$ ° ≈ $5.36441802978515625e-6$ °
unit: ”°”
>= -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: Minimum height from a plane tangent to the earth’s ellipsoid, defined by WGS-84, in two’s complement form.

Element
bit size: 16
Signed quantity
LSB = $25/2^2$ ft ≈ 6.25 ft
unit: ”ft”
>= -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
LSB = $1/2^2$ FL ≈ 0.25 FL
unit: ”FL”
>= −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
LSB = 25 ft ≈ 25.0 ft
unit: ”ft”
>= −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 ≈ 25.0 ft
unit: ”ft”
>= -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 ≈ $6.103515625e-5$ NM/s
unit: ”NM/s”

(1): Unsigned quantity
LSB = $1/1000$ Mach ≈ $1.0e-3$ Mach
unit: ”Mach”

Default:

Raw Content

I021/151 - True Airspeed

definition: True Air Speed.

Element
bit size: 16
Unsigned quantity
LSB = 1 kt ≈ 1.0 kt
unit: ”kt”

I021/152 - Magnetic Heading

definition: Magnetic Heading (Element of Air Vector).

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

I021/155 - Barometric Vertical Rate

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

Element
bit size: 16
Signed quantity
LSB = $25/2^2$ ft/min ≈ 6.25 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 = $25/2^2$ ft/min ≈ 6.25 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 = $1/2^14$ NM/s ≈ $6.103515625e-5$ NM/s
unit: ”NM/s”
>= 0.0
< 2.0

I021/160/TA - Track Angle

Element
bit size: 16
Unsigned quantity
LSB = $360/2^16$ ° ≈ $5.4931640625e-3$ °
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 ≈ 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 equiped 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 ≈ 1.0 kt
unit: ”kt”
>= 0.0
<= 300.0

I021/220/WD - Wind Direction

Element
bit size: 16
Unsigned quantity
LSB = 1 ° ≈ 1.0 °
unit: ”°”
>= 1.0
<= 360.0

I021/220/TMP - Temperature

Element
bit size: 16
Signed quantity
LSB = $1/2^2$ °C ≈ 0.25 °C
unit: "°C"
>= -100.0
<= 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 = $1/100$ ° ≈ $1.0e-2$ °
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