Asterix category 021 - ADS-B Target Reports

category: 021

edition: 2.5

date: 2021-02-18

Preamble

Surveillance data exchange. ADS-B Target Reports.

Description of standard data items

I021/008 - Aircraft Operational Status

definition: Identification of the operational services available in the aircraft while airborne.

Group

I021/008/RA - TCAS Resolution Advisory Active

Element
bit size: 1
Values:

- **0:** TCAS II or ACAS RA not active
- **1:** TCAS RA active

I021/008/TC - Target Trajectory Change Report Capability

Element
bit size: 2
Values:

- **0:** No capability for Trajectory Change Reports
- **1:** Support for TC+0 reports only
- **2:** Support for multiple TC reports
- **3:** Reserved

I021/008/TS - Target State Report Capability

Element
bit size: 1
Values:

- **0:** No capability to support Target State Reports
- **1:** Capable of supporting target State Reports

I021/008/ARV - Air-Referenced Velocity Report Capability

Element
bit size: 1
Values:

- **0:** No capability to generate ARV-reports
- **1:** Capable of generate ARV-reports

I021/008/CDTIA - Cockpit Display of Traffic Information Airborne

Element
bit size: 1
Values:

- **0:** CDTI not operational
- **1:** CDTI operational

I021/008/NOTTCAS - TCAS System Status

Element
bit size: 1
Values:

0: TCAS operational
1: TCAS not operational

I021/008/SA - Single Antenna

Element
bit size: 1
Values:

0: Antenna Diversity
1: Single Antenna only

Note:

- Additional Aircraft Status Information is available in the Reserved Expansion Field of Category 021.

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).

I021/015 - Service Identification

definition: Identification of the service provided to one or more users.

Element
bit size: 8
Raw Content

Notes:

1. The service identification is allocated by the system.
2. The service identification is also available in item I023/015 [Ref. 3].

I021/016 - Service Management

definition: Identification of services offered by a ground station (identified by a SIC code).

Element
bit size: 8
Unsigned quantity
LSB = $1/2$ s ≈ 0.5 s
unit: ”s”

Notes:

1. This item contains the same information as item I023/101 in ASTERIX category 023 [Ref. 3]. Since not all service users receive category 023 data, this information has to be conveyed in category 021 as well.
2. If this item is due to be sent according to the encoding rule above, it shall be sent with the next target report

I021/020 - Emitter Category

definition: Characteristics of the originating ADS-B unit.

Element
bit size: 8
Values:

- **0:** No ADS-B Emitter Category Information
- **1:** Light aircraft <= 15500 lbs
- **2:** 15500 lbs < small aircraft <75000 lbs
- **3:** 75000 lbs < medium a/c < 300000 lbs
- **4:** High Vortex Large
- **5:** 300000 lbs <= 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:** Cluster obstacle
- **24:** Line obstacle

I021/040 - Target Report Descriptor

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

Extended

I021/040/ATP - Address Type

Element
bit size: 3
Values:

- **0:** 24-Bit ICAO address
- **1:** Duplicate 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: 25 ft
1: 100 ft
2: Unknown
3: Invalid

I021/040/RC - Range Check

Element
bit size: 1
Values:

0: Default
1: Range Check passed, CPR Validation pending

I021/040/RAB - Report Type

Element
bit size: 1
Values:

0: Report from target transponder
1: Report from field monitor (fixed transponder)

(FX) - extension bit

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/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/CL - Confidence Level

Element
bit size: 2
Values:

0: Report valid
1: Report suspect
2: No information
3: Reserved for future use

(FX) - extension bit

Spare bits: 1

I021/040/LLC - List Lookup Check

Element
bit size: 1
Values:

0: Default
1: List Lookup failed (see note)

I021/040/IPC - Independent Position Check

Element
bit size: 1
Values:

0: Default (see note)
1: Independent Position Check failed

I021/040/NOGO - No-go Bit Status

Element
bit size: 1
Values:

0: NOGO-bit not set
1: NOGO-bit set

I021/040/CPR - Compact Position Reporting

Element
bit size: 1
Values:

0: CPR Validation correct
1: CPR Validation failed

I021/040/LDPJ - Local Decoding Position Jump

Element
bit size: 1
Values:

0: LDPJ not detected
1: LDPJ detected

I021/040/RCF - Range Check

Element
bit size: 1
Values:

0: Default
1: Range Check failed

(FX) - extension bit

Notes:

1. Bit 3 indicates that the position reported by the target is within a credible range from the ground station. The range check is followed by the CPR validation to ensure that global and local position decoding both indicate valid position information. Bit 3=1 indicates that the range check was done, but the CPR validation is not yet completed. Once CPR validation is completed, Bit 3 will be reset to 0.

2. Bits 8/6 (ATP): values 0, 2 and 3 depend on the value of the Control Field (CF) in the Downlink Format 18 Message as defined in the ADS-B MOPS (EUROCAE ED-102/RTCA DO-260, Ref [11] Table 2-7).
   CF=0 denotes a 24-bit ICAO address and shall be encoded with ATP=0.
   CF=1 denotes "another kind of address for the transmitting ADS-B participant: a self assigned "anonymous" address, a ground vehicle address, or a surface obstruction address".
   Thus, from the downlinked information it is not possible to distinguish between a "Surface Vehicle Address – ATP=2" or an "Anonymous Address – ATP=3".
   Therefore how CF=1 in the received 1090 MHz Extended Squitter is encoded in ATP shall be described in the ICD of the ASTERIX system.
   It should be noted, however, that EUROCAE Document ED-129B (the "Technical Specification for a 1090MHz Extended Squitter ADS-B Ground System", Ref. [12]) requires ATP to be set to "3" if CF=1. Therefore it is recommended that a value of CF=1 received in the Extended Squitter should be encoded as ATP=3.
3. Except for Bit 5 (NOGO), the second extension signals the reasons for which the report has been indicated as suspect (indication Confidence Level (CL) in the first extension).
4. Bit 7, if set to 1, indicates that a lookup in a Black-list/White-list identified that the target may be suspect.
5. Bit 6, if set to 1, indicates that the position reported by the target was validated by an independent means and a discrepancy was detected. If no independent position check is implemented, the default value "0" is to be used.
6. Bit 5 represents the setting of the GO/NOGO-bit as defined in item I023/100 of Category 023 [Ref. 2].
7. Bit 2 indicates that the Range Check failed, i.e. the target is reported outside the credible range for the Ground Station. For operational users such a target will be suppressed. In services used for monitoring the Ground Station, the target will be transmitted with bit 2 indicating the fault condition.

I021/070 - Mode 3/A Code in Octal Representation

definition: Mode-3/A code converted into octal representation.

Group

Spare bits: 4

I021/070/MODE3A - Mode-3/A Reply in Octal Representation

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

I021/071 - Time of Applicability for Position

definition: Time of applicability 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"

Notes:

1. The time of applicability value is reset to zero at every midnight.
2. The time of applicability indicates the exact time at which the position transmitted in the target report is valid.

I021/072 - Time of Applicability for Velocity

definition: Time of applicability (measurement) of the reported velocity, 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”

Notes:

1. The time of the applicability value is reset to zero at every midnight.
2. The time of applicability indicates the exact time at which the velocity information transmitted in the target report is valid.
3. This item will not be available in some ADS-B technologies.

I021/073 - Time of Message Reception for Position

definition: Time of reception of the latest position squitter in the Ground Station, 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”

Note:

- The time of message reception value is reset to zero at every midnight.

I021/074 - Time of Message Reception of Position-High Precision

definition: Time at which the latest ADS-B position information was received by the ground station, expressed as fraction of the second of the UTC Time.

Group

I021/074/FSI - Full Second Indication

Element
bit size: 2
Values:

3: Reserved
2: TOMRp whole seconds = (I021/073) Whole seconds - 1
1: TOMRp whole seconds = (I021/073) Whole seconds + 1
0: TOMRp whole seconds = (I021/073) Whole seconds

I021/074/TOMRP - Fractional Part of the Time of Message Reception for Position in the Ground Station

Element
bit size: 30
Unsigned quantity
LSB = $1/2^30$ s ≈ $9.313225746154785625e-10$ s
unit: ”s”

I021/075 - Time of Message Reception for Velocity

definition: Time of reception of the latest velocity squitter in the Ground Station, 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”

Note:

- The time of message reception value is reset to zero at every midnight.

I021/076 - Time of Message Reception of Velocity-High Precision

definition: Time at which the latest ADS-B velocity information was received by the ground station, expressed as fraction of the second of the UTC Time.

Group

I021/076/FSI - Full Second Indication

Element
bit size: 2
Values:

3: Reserved
2: TOMRp whole seconds = (I021/075) Whole seconds - 1
1: TOMRp whole seconds = (I021/075) Whole seconds + 1
0: TOMRp whole seconds = (I021/075) Whole seconds

I021/076/TOMRP - Fractional Part of the Time of Message Reception for Position in the Ground Station

Element
bit size: 30
Unsigned quantity
LSB = $1/2^30$ s ≈ $9.313225746154785625e-10$ s
unit: ”s”

I021/077 - Time of ASTERIX Report Transmission

definition: Time of the transmission of the ASTERIX category 021 report 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”

Note:

- The time of ASTERIX report transmission value is reset to zero at every midnight.

I021/080 - Target Address

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

Element
bit size: 24
Raw Content

Note:

- The type of address encoded in Data Item I021/080 is transmitted in the ATP indication in the Primary Subfield of Data Item I021/040.

I021/090 - Quality Indicators

definition: ADS-B quality indicators transmitted by a/c according to MOPS version.
Extended

I021/090/NUCRNACV - Navigation Uncertainty Category for Velocity NUCr or the Navigation Accuracy Category for Velocity NACv

Element
bit size: 3
Raw Content

I021/090/NUCPNIC - Navigation Uncertainty Category for Position NUCp or Navigation Integrity Category NIC

Element
bit size: 4
Raw Content

Notes:

1. Apart from the “PIC” item, all items are defined as per the respective link technology protocol version (“MOPS version”, see I021/210).
2. The primary subfield is kept for backwards compatibility reasons. Version 2 NIC-values shall be mapped accordingly. This is required to ensure that downstream systems, which are not capable of interpreting extensions 2 and 3 (because they use an ASTERIX

(FX) - extension bit

I021/090/NICBARO - Navigation Integrity Category for Barometric Altitude

Element
bit size: 1
Raw Content

I021/090/SIL - Surveillance (version 1) or Source (version 2) Integrity Level

Element
bit size: 2
Raw Content

I021/090/NACP - Navigation Accuracy Category for Position

Element
bit size: 4
Raw Content

(FX) - extension bit

Spare bits: 2

I021/090/SILS - SIL-Supplement

Element
bit size: 1
Values:

0: Measured per flight-hour

1: Measured per sample

I021/090/SDA - Horizontal Position System Design Assurance Level (as Defined in Version 2)

Element
bit size: 2
Raw Content

I021/090/GVA - Geometric Altitude Accuracy

Element
bit size: 2
Raw Content

(FX) - extension bit

I021/090/PIC - Position Integrity Category

Element
bit size: 4
Raw Content

Spare bits: 3

(FX) - extension bit

Notes:

1. Apart from the “PIC” item, all items are defined as per the respective link technology protocol version (“MOPS version”, see I021/210).
2. The primary subfield is kept for backwards compatibility reasons. Version 2 NIC-values shall be mapped accordingly. This is required to ensure that downstream systems, which are not capable of interpreting extensions 2 and 3 (because they use an ASTERIX edition earlier than 2.0) still get the required information
3. “Version 1” or “Version 2” refers to the MOPS version as defined in data item I021/210, bits 6/4
4. “Version 2” refers to the MOPS version as defined in data item I021/210, bits 6/4
5. PIC=0 is defined for completeness only. In this case the third extension shall not be generated.
6. For ED102A/DO260B PIC values of 7 and 9, the NIC supplements for airborne messages (NIC supplements A/B) and surface messages (NIC supplements A/C) are listed. For ED102A/DO260B PIC=8, the NIC supplements A/B for airborne messages are listed. For DO260A PIC values of 7 and 8, the NIC supplement for airborne messages is shown in brackets. The aircraft air-ground status, and hence message type (airborne or surface), is derived from the GBS-bit in I021/040, 1 st extension.

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: Position in WGS-84 Co-ordinates.

Group

I021/130/LAT - Latitude

Element
bit size: 24
Signed quantity
LSB = $180/2^23$ ° ≈ $2.1457672119140625e-5$ °
unit: "°"
>= -90.0
<= 90.0

I021/130/LON - Longitude

Element
bit size: 24
Signed quantity
LSB = $180/2^23$ ° ≈ $2.1457672119140625e-5$ °
unit: "°"
>= -180.0
< 180.0

Notes:

- Positive longitude indicates East. Positive latitude indicates North.

I021/131 - High-Resolution Position in WGS-84 Co-ordinates

definition: Position in WGS-84 Co-ordinates in high resolution.

Group

I021/131/LAT - Latitude

Element
bit size: 32
Signed quantity
LSB = $180/2^30$ ° ≈ $1.676380634307861328125e-7$ °
unit: "°"
>= -90.0
<= 90.0

I021/131/LON - Longitude

Element
bit size: 32
Signed quantity
LSB = $180/2^30$ ° ≈ $1.676380634307861328125e-7$ °
unit: "°"
>= -180.0
< 180.0

Notes:

- Positive longitude indicates East. Positive latitude indicates North.

I021/132 - Message Amplitude

definition: Amplitude, in dBm, of ADS-B messages received by the ground station, coded in two's complement.

Element
bit size: 8
Signed quantity
LSB = 1 dBm ≈ 1.0 dBm
unit: ”dBm”

Note:

- The value gives the amplitude of the latest received squitter.

I021/140 - Geometric Height

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.
2. A value of ‘0111111111111111’ indicates that the aircraft transmits a “greater than” indication.

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 - Selected Altitude

definition: The Selected Altitude as provided by the avionics and corresponding either to the MCP/FCU Selected Altitude (the ATC cleared altitude entered by the flight crew into the avionics) or to the FMS Selected Altitude.

Group

I021/146/SAS - Source Availability

Element
bit size: 1
Values:

- **0:** No source information provided
- **1:** Source Information provided

I021/146/S - 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

Notes:

1. The Selected Altitude provided in this field is not necessarily the “Target Altitude” as defined by ICAO.
2. The value of “Source” (bits 15/14) indicating “unknown” or “Aircraft Altitude” is kept for backward compatibility as these indications are not provided by “version 2” systems as defined by data item I021/210, bits 6/4.
3. Vertical mode indications supporting the determination of the nature of the Selected Altitude are provided in the Reserved Expansion Field in the subfield NAV.

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 or unknown
1: Active

I021/148/AH - Altitude Hold Mode

Element
bit size: 1
Values:

0: Not active or unknown
1: Active

I021/148/AM - Approach Mode

Element
bit size: 1
Values:

0: Not active or unknown
1: Active

I021/148/ALT - Altitude

Element
bit size: 13
Signed quantity

LSB = 25 ft ≈ 25.0 ft
unit: ”ft”
>= −1300.0
< 100000.0

Notes:

- This item is kept for backward compatibility but shall not be used for “version 2” ADS-B systems (as defined by data item I021/210, bits 6/4) for which item 146 will be used to forward the MCP/FCU or the FMS selected altitude information. For “version 2” ADS-B systems, the vertical mode indications will be provided through the Reserved Expansion Field in the subfield NAV .

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.

Group

I021/151/RE - Range Exceeded Indicator

Element
bit size: 1
Values:
0: Value in defined range
1: Value exceeds defined range

I021/151/TAS - True Air Speed

Element
bit size: 15
Unsigned quantity
LSB = 1 kt ≈ 1.0 kt
unit: ”kt”

Notes:

- The RE-Bit, if set, indicates that the value to be transmitted is beyond the range defined for this specific data item and the applied technology. In this case the True Air Speed contains the maximum value that can be downloaded from the aircraft avionics and the RE-bit indicates that the actual value is greater than the value contained in the field.

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: "°"

Notes:

- True North Heading is defined in the Reserved Expansion Field in the subfield TNH.

I021/155 - Barometric Vertical Rate

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

Group

I021/155/RE - Range Exceeded Indicator

Element
bit size: 1
Values:

0: Value in defined range
1: Value exceeds defined range

I021/155/BVR - Barometric Vertical Rate

Element
bit size: 15
Signed quantity
LSB = $25/2^2$ ft/min ≈ 6.25 ft/min
unit: "ft/min"

Notes:

- The RE-Bit, if set, indicates that the value to be transmitted is beyond the range defined for this specific data item and the applied technology. In this case the Barometric Vertical Rate contains the maximum value that can be downloaded from the aircraft avionics and the RE-bit indicates that the actual value is greater than the value contained in the field.

I021/157 - Geometric Vertical Rate

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

Group

I021/157/RE - Range Exceeded Indicator

Element
bit size: 1
Values:

0: Value in defined range
1: Value exceeds defined range

I021/157/GVR - Geometric Vertical Rate

Element
bit size: 15
Signed quantity
LSB = $25/2^2$ ft/min ≈ 6.25 ft/min
unit: ”ft/min”

Notes:

- The RE-Bit, if set, indicates that the value to be transmitted is beyond the range defined for this specific data item and the applied technology. In this case the Geometric Vertical Rate contains the maximum value that can be downloaded from the aircraft avionics and the RE-bit indicates that the actual value is greater than the value contained in the field.

I021/160 - Airborne Ground Vector

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

Group

I021/160/RE - Range Exceeded Indicator

Element
bit size: 1
Values:
0: Value in defined range
1: Value exceeds defined range

I021/160/GS - Ground Speed Referenced to WGS-84

Element
bit size: 15
Unsigned quantity
LSB = $1/2^14$ NM/s ≈ $6.103515625e-5$ NM/s
unit: ”NM/s”
>= 0.0
< 2.0

I021/160/TA - Track Angle Clockwise Reference to True North

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

Notes:

1. The RE-Bit, if set, indicates that the value to be transmitted is beyond the range defined for this specific data item and the applied technology. In this case the Ground Speed contains the maximum value that can be downloaded from the aircraft avionics and the RE-bit indicates that the actual value is greater than the value contained in the field.
2. The Surface Ground Vector format is defined in the Reserved Expansion Field in the subfield SGV.

I021/161 - Track Number

definition: An integer value representing a unique reference to a track record within a particular track file.

Group

Spare bits: 4

I021/161/TRNUM - Track Number

Element
bit size: 12
Raw Content

I021/165 - Track Angle Rate

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

Group

Spare bits: 6

I021/165/TAR - Track Angle Rate

Element
bit size: 10
Signed quantity
LSB = $1/2^5$ °/s ≈ $3.125e-2$ °/s
unit: "°/s"
>= -16.0
<= 16.0

Notes:

1. A positive value represents a right turn, whereas a negative value represents a left turn.
2. Maximum value means Maximum value or above.
3. This item will not be transmitted for the technology 1090 MHz Extended Squitter.

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

Group

I021/200/ICF - Intent Change Flag (see Note)

Element
bit size: 1
Values:

0: No intent change active
1: Intent change flag raised

I021/200/LNAV - LNAV Mode

Element
bit size: 1
Values:

0: LNAV Mode engaged
1: LNAV Mode not engaged

I021/200/ME - Military Emergency

Element
bit size: 1
Values:

0: No military emergency
1: Military emergency

I021/200/PS - Priority Status

Element
bit size: 3
Values:

0: No emergency / not reported
1: General emergency
2: Lifeguard / medical emergency
3: Minimum fuel
4: No communications
5: Unlawful interference
6: DOWNED Aircraft

I021/200/SS - Surveillance Status

Element
bit size: 2
Values:

0: No condition reported
1: Permanent Alert (Emergency condition)
2: Temporary Alert (change in Mode 3/A Code other than emergency)
3: SPI set

Notes:

- Bit-8 (ICF), when set to “1” indicates that new information is available in the Mode S GICB registers 40, 41 or 42. As of MOPS Version 3 (see I021/210) as defined in Ref. [11] this flag is no longer used and shall be set to “0”.

I021/210 - MOPS Version

definition: Identification of the MOPS version used by a/c to supply ADS-B information.
Group

Spare bits: 1

I021/210/VNS - Version Not Supported

Element
bit size: 1
Values:

0: The MOPS Version is supported by the GS
1: The MOPS Version is not supported by the GS

I021/210/VN - Version Number

Element
bit size: 3
Values:

0: ED102/DO-260 [Ref. 7]
1: DO-260A [Ref. 8]
2: ED102A/DO-260B [Ref. 10]
3: ED-102B/DO-260C [Ref. 11]

I021/210/LTT - Link Technology Type

Element
bit size: 3
Values:

0: Other
1: UAT
2: 1090 ES
3: VDL 4
4: Not assigned
5: Not assigned
6: Not assigned
7: Not assigned

Notes:

- VN sub-field shall contain a value describing the MOPS used by each aircraft. The versions of other link technologies are assumed to be in line with the 1090 ES MOPS versions and the corresponding MASPS versions.
- Bit 7 (VNS) when set to 1 indicates that the aircraft transmits a MOPS Version indication that is not supported by the Ground Station. However, since MOPS versions are supposed to be backwards compatible, the GS has attempted to interpret the message and achieved a credible result. The fact that the MOPS version received is not supported by the GS is submitted as additional information to subsequent processing systems.
- In Bits 6/4 (VN) the possibility has been added to indicate an Extended Squitter received from a “Version 3” ADS-B System conforming to Ref. [11]. This edition of the Category 021 Specification has NOT been extended to process additional data contained in VERSION 3 Extended Squitters. Thus, systems in line with this specification cannot benefit from the changes applied. Adding Version 3 to the permitted Version Numbers only permits to utilise the Version 3 Extended Squitters by decoding the information that can be encoded in the version of this specification.

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.

I021/250 - Mode S MB Data

definition: Mode S Comm B data as extracted from the aircraft transponder.

Repetitive

Regular, 1 byte(s) REP field size.

Element
bit size: 64
BDS register with address

Notes:

1. For the transmission of BDS20, item 170 should be used.
2. For the transmission of BDS30, item 260 is used.

I021/260 - ACAS Resolution Advisory Report

definition: Currently active Resolution Advisory (RA), if any, generated by the ACAS associated with the transponder transmitting the RA message and threat identity data.

Group

I021/260/TYP - Message Type (= 28 for 1090 ES, Version 2)

Element
bit size: 5
Raw Content

I021/260/STYP - Message Sub-type (= 2 for 1090 ES, Version 2)

Element
bit size: 3
Raw Content

I021/260/ARA - Active Resolution Advisories

Element
bit size: 14
Raw Content

I021/260/RAC - RAC (RA Complement) Record

Element
bit size: 4
Raw Content

I021/260/RAT - RA Terminated

Element
bit size: 1
Raw Content

I021/260/MTE - Multiple Threat Encounter

Element
bit size: 1
Raw Content

I021/260/TTI - Threat Type Indicator

Element
bit size: 2
Raw Content

I021/260/TID - Threat Identity Data

Element
bit size: 26
Raw Content

Notes:

1. Version denotes the MOPS version as defined in I021/210, bits 6/4
2. This data items copies the value of BDS register 6,1 for message type 28, subtype 2
3. The “TYP” and “STYP” items are implementation (i.e. link technology) dependent.
4. Refer to ICAO Annex 10 SARPs for detailed explanations [Ref. 5]

I021/271 - Surface Capabilities and Characteristics

definition: Operational capabilities of the aircraft while on the ground.

Extended

Spare bits: 2

I021/271/POA - Position Offset Applied

Element
bit size: 1
Values:

0: Position transmitted is not ADS-B position reference point
1: Position transmitted is the ADS-B position reference point

I021/271/CDTIS - Cockpit Display of Traffic Information Surface

Element
bit size: 1
Values:

0: CDTI not operational
1: CDTI operational

I021/271/B2LOW - Class B2 Transmit Power Less Than 70 Watts

Element
bit size: 1
Values:

0: >= 70 Watts
1: < 70 Watts

I021/271/RAS - Receiving ATC Services

Element
bit size: 1
Values:

0: Aircraft not receiving ATC-services
1: Aircraft receiving ATC services

I021/271/IDENT - Setting of IDENT Switch

Element
bit size: 1
Values:

0: IDENT switch not active
1: IDENT switch active

(FX) - extension bit

I021/271/LW - Length and Width of the Aircraft

Element
bit size: 4
Raw Content

Spare bits: 3

(FX) - extension bit

Notes:

1. Version 2 (as defined in I021/210, bits 6/4) data technology protocols encode “No Data or Unknown” with value 0. In this case data item I021/271, first extension is not generated.
2. As of edition 2.2 the structure of this data item has been changed. Edition 2.2 is not backwards compatible with previous editions.

I021/295 - Data Ages

definition: Ages of the data provided.

Compound

I021/295/AOS - Aircraft Operational Status Age

description: Age of the information transmitted in item I021/008.

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TRD - Target Report Descriptor Age

description: Age of the Target Report Descriptor, item I021/040

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/M3A - Mode 3/A Age

description: Age of the Mode 3/A Code, item I021/070

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/QI - Quality Indicators Age

description: Age of the Quality Indicators, item I021/090

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TI1 - Trajectory Intent Age

description: Age of the Trajectory Intent information, item I021/110

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/MAM - Message Amplitude Age

description: Age of the message amplitude, item I021/132

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/GH - Geometric Height Age

description: Age of the Geometric Height, item 021/140

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/FL - Flight Level Age

description: Age of the Flight Level, item I021/145

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/ISA - Intermediate State Selected Altitude Age

description: Age of the Intermediate State Selected Altitude, item I021/146

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/FSA - Final State Selected Altitude Age

description: Age of the Final State Selected Altitude, item I021/148

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/AS - Air Speed Age

description: Age of the Air Speed, item I021/150

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TAS - True Air Speed Age

description: Age of the True Air Speed, item I021/151

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/MH - Magnetic Heading Age

description: Age of the Magnetic Heading, item I021/152

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/BVR - Barometric Vertical Rate Age

description: Age of the Barometric Vertical Rate, item I021/155

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/GVR - Geometric Vertical Rate Age

description: Age of the Geometric Vertical Rate, item I021/157

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/GV - Ground Vector Age

description: Age of the Ground Vector, item I021/160

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TAR - Track Angle Rate Age

description: Age of the Track Angle Rate, item I021/165

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TI2 - Target Identification Age

description: Age of the Target Identification, item I021/170

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/TS - Target Status Age

description: Age of the Target Status, item I021/200

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/MET - Met Information Age

description: Age of the Meteorological Information, item I021/220

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/ROA - Roll Angle Age

description: Age of the Roll Angle, item I021/230

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/ARA - ACAS Resolution Advisory Age

description: Age of the latest update of an active ACAS Resolution Advisory, item I021/260

Element
bit size: 8
Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

I021/295/SCC - Surface Capabilities and Characteristics Age

description: Age of the information on the surface capabilities and characteristics of the respective target, item I021/271

Element
bit size: 8

Unsigned quantity
LSB = $1/10$ s ≈ 0.1 s
unit: ”s”
<= 25.5

Notes:

- In all the subfields, the maximum value indicates “maximum value or above”.

I021/400 - Receiver ID

definition: Designator of Ground Station in Distributed System.

Element
bit size: 8
Raw Content

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: `I021/161` - Track Number
- 4: `I021/015` - Service Identification
- 5: `I021/071` - Time of Applicability for Position
- 6: `I021/130` - Position in WGS-84 Co-ordinates
- 7: `I021/131` - High-Resolution Position in WGS-84 Co-ordinates
- (FX) - Field extension indicator
- 8: `I021/072` - Time of Applicability for Velocity
- 9: `I021/150` - Air Speed
- 10: `I021/151` - True Airspeed
- 11: `I021/080` - Target Address
- 12: `I021/073` - Time of Message Reception for Position
- 13: `I021/074` - Time of Message Reception of Position-High Precision
- 14: `I021/075` - Time of Message Reception for Velocity
- (FX) - Field extension indicator
- 15: `I021/076` - Time of Message Reception of Velocity-High Precision
- 16: `I021/140` - Geometric Height
- 17: `I021/090` - Quality Indicators
- 18: `I021/210` - MOPS Version
- 19: `I021/070` - Mode 3/A Code in Octal Representation
- 20: `I021/230` - Roll Angle
- 21: `I021/145` - Flight Level
- (FX) - Field extension indicator
- 22: `I021/152` - Magnetic Heading
- 23: `I021/200` - Target Status
- 24: `I021/155` - Barometric Vertical Rate
- 25: `I021/157` - Geometric Vertical Rate

- 26: `I021/160` - Airborne Ground Vector
- 27: `I021/165` - Track Angle Rate
- 28: `I021/077` - Time of ASTERIX Report Transmission
- (FX) - Field extension indicator
- 29: `I021/170` - Target Identification
- 30: `I021/020` - Emitter Category
- 31: `I021/220` - Met Information
- 32: `I021/146` - Selected Altitude
- 33: `I021/148` - Final State Selected Altitude
- 34: `I021/110` - Trajectory Intent
- 35: `I021/016` - Service Management
- (FX) - Field extension indicator
- 36: `I021/008` - Aircraft Operational Status
- 37: `I021/271` - Surface Capabilities and Characteristics
- 38: `I021/132` - Message Amplitude
- 39: `I021/250` - Mode S MB Data
- 40: `I021/260` - ACAS Resolution Advisory Report
- 41: `I021/400` - Receiver ID
- 42: `I021/295` - Data Ages
- (FX) - Field extension indicator
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- 48: `I021/RE` - Reserved Expansion Field
- 49: `I021/SP` - Special Purpose Field
- (FX) - Field extension indicator