Asterix category 001 - Transmission of Monoradar Data Target Reports

category: 001

edition: 1.3

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Preamble

Surveillance data exchange.

Description of standard data items

I001/010 - Data Source Identifier

definition: Identification of the radar station from which the data are received.

Group

I001/010/SAC - System Area Code

Element
bit size: 8
Raw Content

I001/010/SIC - System Identification Code

Element
bit size: 8
Raw Content

Note: The defined SACs are on the EUROCONTROL ASTERIX website (www.eurocontrol.int/asterix)

I001/020 - Target Report Descriptor

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

Extended

I001/020/TYP

Element
bit size: 1
Values:

- **0:** Plot
- **1:** Track

I001/020/SIM

Element
bit size: 1
Values:

- **0:** Actual plot or track
- **1:** Simulated plot or track

I001/020/SSRPSR - Radar Detection in Last Antenna Scan

Element
bit size: 2
Values:

- **0:** No detection
- **1:** Sole primary detection

2: Sole secondary detection
3: Combined primary and secondary detection

I001/020/ANT

Element
bit size: 1
Values:

0: Target report from antenna 1
1: Target report from antenna 2

I001/020/SPI

Element
bit size: 1
Values:

0: Default
1: Special Position Identification

I001/020/RAB

Element
bit size: 1
Values:

0: Default
1: Plot or track from a fixed transponder

(FX) - extension bit

I001/020/TST

Element
bit size: 1
Values:

0: Default
1: Test target indicator

I001/020/DS1DS2 - Radar Detection in Last Antenna Scan

Element
bit size: 2
Values:

0: Default
1: Unlawful interference (code 7500)
2: Radio-communication failure (code 7600)
3: Emergency (code 7700)

I001/020/ME

Element
bit size: 1
Values:

0: Default
1: Military emergency

I001/020/MI

Element
bit size: 1
Values:

0: Default
1: Military identification

Spare bits: 2
(FX) - extension bit

Note:

- Bit-7 (SIM) is used to identify a simulated target report as produced by a traffic simulator.

I001/030 - Warning/Error Conditions

definition: Warning/error conditions detected by a radar station for the target report involved.

Repetitive

With FX extension bit.

Element

bit size: 7

Values:

- **0:** No warning nor error condition
- **1:** Garbled reply
- **2:** Reflection
- **3:** Sidelobe reply
- **4:** Split plot
- **5:** Second time around reply
- **6:** Angels
- **7:** Terrestrial vehicles
- **64:** Possible wrong code in Mode-3/A
- **65:** Possible wrong altitude information, transmitted when the Code C credibility check fails together with the Mode-C code in binary notation
- **66:** Possible phantom MSSR plot
- **80:** Fixed PSR plot
- **81:** Slow PSR plot
- **82:** Low quality PSR plot

Notes:

1. Warning/error condition values 0-63 are reserved for common standard use, whereas the values 64-127 are application dependent.

I001/040 - Measured Position in Polar Co-ordinates

definition: Measured position of an aircraft in local polar co-ordinates.

Group

I001/040/RHO

Element
bit size: 16
Unsigned quantity
LSB = $1/2^7$ NM ≈ $7.8125e-3$ NM
unit: ”NM”
<= 512.0

I001/040/THETA

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

Note:

- When expressed in 16 bits, signed or unsigned azimuths have the same value.

I001/042 - Calculated Position in Cartesian Co-ordinates

definition: Calculated position of an aircraft in Cartesian co-ordinates.

Group

I001/042/X - X-Component

Element
bit size: 16
Signed quantity
LSB = $1/2^6$ NM ≈ $1.5625e-2$ NM
unit: "NM"
>= -512.0
<= 512.0

I001/042/Y - Y-Component

Element
bit size: 16
Signed quantity
LSB = $1/2^6$ NM ≈ $1.5625e-2$ NM
unit: "NM"
>= -512.0
<= 512.0

Notes:

1. LSB is calculated as 2^{-6+f}.
2. A default quantisation unit of 1/64 NM is obtained for a value of f = 0.
3. Negative values are expressed in 2's complement form, bit-32 and bit-16 shall be set to 0 for positive values and 1 for negative values.

I001/050 - Mode-2 Code in Octal Representation

definition: Reply to Mode-2 interrogation.

Group

I001/050/V

Element
bit size: 1
Values:

- **0:** Code validated
- **1:** Code not validated

I001/050/G

Element
bit size: 1
Values:

- **0:** Default
- **1:** Garbled code

I001/050/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

I001/050/MODE2 - Mode-2 Code in Octal Representation

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

Notes:

1. Smoothed Mode-2 data (bit-14 set to one) is used when the plot contains no Mode-2 code or the Mode-2 codes of the plot and track are different.
2. Bits-16/15 have no meaning in the case of a smoothed Mode-2 and are set to 0 for a calculated track.

I001/060 - Mode-2 Code Confidence Indicator

definition: Confidence level for each bit of a Mode-2 reply as provided by a monopulse SSR station.

Group

Spare bits: 4

I001/060/QA4

Element
bit size: 1
Values:

0: High quality pulse A4
1: Low quality pulse A4

I001/060/QA2

Element
bit size: 1
Values:

0: High quality pulse A2
1: Low quality pulse A2

I001/060/QA1

Element
bit size: 1
Values:

0: High quality pulse A1
1: Low quality pulse A1

I001/060/QB4

Element
bit size: 1
Values:

0: High quality pulse B4
1: Low quality pulse B4

I001/060/QB2

Element
bit size: 1
Values:

0: High quality pulse B2
1: Low quality pulse B2

I001/060/QB1

Element
bit size: 1
Values:

0: High quality pulse B1
1: Low quality pulse B1

I001/060/QC4

Element
bit size: 1
Values:

0: High quality pulse C4
1: Low quality pulse C4

I001/060/QC2

Element
bit size: 1
Values:

0: High quality pulse C2
1: Low quality pulse C2

I001/060/QC1

Element
bit size: 1
Values:

0: High quality pulse C1
1: Low quality pulse C1

I001/060/QD4

Element
bit size: 1
Values:

0: High quality pulse D4
1: Low quality pulse D4

I001/060/QD2

Element
bit size: 1
Values:

0: High quality pulse D2
1: Low quality pulse D2

I001/060/QD1

Element
bit size: 1
Values:

0: High quality pulse D1
1: Low quality pulse D1

Note:

- This Data Item is only transmitted if at least one pulse is of low quality.

I001/070 - Mode-3/A Code in Octal Representation

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

Group

I001/070/V

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

I001/070/G

Element
bit size: 1
Values:

0: Default
1: Garbled code

I001/070/L

Element
bit size: 1
Values:

0: Mode-3/A code derived from the reply of the transponder
1: Smoothed Mode-3/A code as provided by a local tracker

Spare bits: 1

I001/070/MODE3A - Mode-3/A Reply in Octal Representation

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

Notes:

1. The detector signals a garbled code (bit-15 set to one) when at least two replies are overlapping.
2. Smoothed Mode-3/A data (bit-14 set to a one) are used in the case of the absence of Mode-3/A code information in the plot, or in the case of a difference between the plot and track Mode-3/A code information.
3. Bits-16/15 have no meaning in the case of a smoothed Mode-3/A and are set to 0 for a calculated track.

I001/080 - Mode-3/A Code Confidence Indicator

definition: Confidence level for each bit of a Mode-3/A reply as provided by a monopulse SSR station.

Group

Spare bits: 4

I001/080/QA4

Element
bit size: 1
Values:

0: High quality pulse A4
1: Low quality pulse A4

I001/080/QA2

Element
bit size: 1
Values:

0: High quality pulse A2
1: Low quality pulse A2

I001/080/QA1

Element
bit size: 1
Values:

0: High quality pulse A1
1: Low quality pulse A1

I001/080/QB4

Element
bit size: 1
Values:

0: High quality pulse B4
1: Low quality pulse B4

I001/080/QB2

Element
bit size: 1
Values:

0: High quality pulse B2
1: Low quality pulse B2

I001/080/QB1

Element
bit size: 1
Values:

0: High quality pulse B1
1: Low quality pulse B1

I001/080/QC4

Element
bit size: 1
Values:

0: High quality pulse C4
1: Low quality pulse C4

I001/080/QC2

Element
bit size: 1
Values:

0: High quality pulse C2
1: Low quality pulse C2

I001/080/QC1

Element
bit size: 1
Values:

0: High quality pulse C1
1: Low quality pulse C1

I001/080/QD4

Element
bit size: 1
Values:

0: High quality pulse D4
1: Low quality pulse D4

I001/080/QD2

Element
bit size: 1
Values:

0: High quality pulse D2
1: Low quality pulse D2

I001/080/QD1

Element
bit size: 1
Values:

0: High quality pulse D1
1: Low quality pulse D1

I001/090 - Mode-C Code in Binary Representation

definition: Mode-C height converted into binary representation.
Group

I001/090/V

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

I001/090/G

Element
bit size: 1
Values:

0: Default
1: Garbled code

I001/090/HGT - Mode-C HEIGHT

Element
bit size: 14
Signed quantity
LSB = $1/2^2$ FL ≈ 0.25 FL
unit: "FL"

Notes:

1. The detector signals a garbled code when at least two replies are overlapping.
2. The maximum height which can be represented is 204 775 ft. Practically the maximum valid value is 126 750 ft (refer to ICAO Annex 10).
3. Negative values are expressed in 2's complement form, bit-14 is set to 0 for positive values and 1 for negative values.

I001/100 - Mode-C Code and Code Confidence Indicator

definition: Mode-C height in Gray notation as received from the transponder together with the confidence level for each reply bit as provided by a monopulse SSR station.

Group

I001/100/V

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

I001/100/G

Element
bit size: 1
Values:

0: Default
1: Garbled code

Spare bits: 2

I001/100/MODEC - Mode-C Reply in Gray Notation

Element
bit size: 12
Raw Content

Spare bits: 4

I001/100/QC1

Element
bit size: 1
Values:

0: High quality pulse C1
1: Low quality pulse C1

I001/100/QA1

Element
bit size: 1
Values:

0: High quality pulse A1
1: Low quality pulse A1

I001/100/QC2

Element
bit size: 1
Values:

0: High quality pulse C2
1: Low quality pulse C2

I001/100/QA2

Element
bit size: 1
Values:

0: High quality pulse A2
1: Low quality pulse A2

I001/100/QC4

Element
bit size: 1
Values:

0: High quality pulse C4
1: Low quality pulse C4

I001/100/QA4

Element
bit size: 1
Values:

0: High quality pulse A4
1: Low quality pulse A4

I001/100/QB1

Element
bit size: 1
Values:

0: High quality pulse B1
1: Low quality pulse B1

I001/100/QD1

Element
bit size: 1
Values:

0: High quality pulse D1
1: Low quality pulse D1

I001/100/QB2

Element
bit size: 1
Values:

0: High quality pulse B2
1: Low quality pulse B2

I001/100/QD2

Element
bit size: 1
Values:

0: High quality pulse D2
1: Low quality pulse D2

I001/100/QB4

Element
bit size: 1
Values:

0: High quality pulse B4
1: Low quality pulse B4

I001/100/QD4

Element
bit size: 1
Values:

0: High quality pulse D4
1: Low quality pulse D4

Notes:

1. This Data Item is only transmitted if at least one pulse is of low quality.
2. The detector signals a garbled code when at least two replies are overlapping.

I001/120 - Measured Radial Doppler Speed

definition: Radial component of the ground speed as measured by means of Doppler filter banks in radar signal processors.

Element
bit size: 8
Signed quantity
LSB = $1/2^8$ NM/s ≈ $3.90625e-3$ NM/s
unit: ”NM/s”

Notes:

1. LSB is calculated as 2^{-14+f}.
2. A default quantisation unit of 14.0625 kt and a maximum of +/- 1 800 kt is obtained for a value of f = 6.
3. Negative values are expressed in 2's complement form, bit-8 is set to 0 for positive values and 1 for negative values.

I001/130 - Radar Plot Characteristics

definition: Additional information on the quality of the target report.

Repetitive

With FX extension bit.

Element
bit size: 7
Raw Content

Notes:

- The actual meaning of the bits is application dependent.”
- This Data Item may contain parameters such as plot runlength (primary and secondary), difference between primary and secondary derived azimuth, pulse amplitude, etc.

I001/131 - Received Power

definition: Measurement of the received power.

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

Notes:

1. POWER is the measured value of the power received on the sum pattern for a plot.
2. Negative values are expressed in 2's complement form, bit-8 is set to 0 for positive values and 1 for negative values.

I001/141 - Truncated Time of Day

definition: Absolute time stamping expressed as Coordinated Universal Time (UTC) time.

Element
bit size: 16
Unsigned quantity
LSB = $1/2^7$ s ≈ $7.8125e-3$ s
unit: ”s”

Notes:

1. The exchange of this Data Item allows the easy derivation of the correct UTC time value, provided that the clocks at the data source and sink(s) are less than 512 seconds out of synchronisation. Special care has to be taken at the transition of an ”all ones” value to an ”all zeros” value (every 512 seconds).
2. The time of day value is reset to 0 each day at midnight.
3. For time management in radar transmission applications, refer to Part 1, paragraph 5.4 [Ref. 2].

I001/150 - Presence of X-Pulse

definition: Presence of the X-Pulse for the various modes applied in the interrogation interlace pattern.

Group

I001/150/XA

Element
bit size: 1
Values:

0: Default
1: X-pulse received in Mode-3/A reply

Spare bits: 1

I001/150/XC

Element
bit size: 1
Values:

0: Default

1: X-pulse received in Mode-C reply

Spare bits: 2

I001/150/X2

Element
bit size: 1
Values:

0: Default
1: X-pulse received in Mode-2 reply

Spare bits: 2

Note:

- This Data Item is transmitted only if at least one X-pulse has been received in a Mode-A, Mode-2 or Mode-C reply.

I001/161 - Track Plot Number

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

Element
bit size: 16
Raw Content

Note:

- The differentiation between track and plot number is either implicit or is made via the Target Report Descriptor (Data Item I001/020).

I001/170 - Track Status

definition: Status of track derived either from primary and/or secondary radar information.

Extended

I001/170/CON

Element
bit size: 1
Values:

0: Confirmed Track
1: Track in initialisation phase

I001/170/RAD

Element
bit size: 1
Values:

0: Primary track
1: SSR/Combined track

I001/170/MAN

Element
bit size: 1
Values:

0: Default
1: Aircraft manoeuvring

I001/170/DOU

Element
bit size: 1
Values:

0: Default
1: Doubtful plot to track association

I001/170/RDPC - Radar Data Processing Chain

Element
bit size: 1
Values:

0: RDP Chain 1
1: RDP Chain 2

Spare bits: 1

I001/170/GHO

Element
bit size: 1
Values:

0: Default
1: Ghost track

(FX) - extension bit

I001/170/TRE

Element
bit size: 1
Values:

0: Default
1: Last report for a track

Spare bits: 6

(FX) - extension bit

Notes:

1. Bit-2 (GHO) is used to signal that the track is suspected to have been generated by a fake target.
2. Bit-4 (RDPC) is used to signal the discontinuity of the track numbers.

I001/200 - Calculated Track Velocity in Polar Co-ordinates

definition: Calculated track velocity expressed in polar co-ordinates.

Group

I001/200/GSP - Calculated Groundspeed

Element
bit size: 16
Unsigned quantity
LSB = $1/2^14$ NM/s $\approx 6.103515625e-5$ NM/s
unit: ”NM/s”

I001/200/HDG - Calculated Heading

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

I001/210 - Track Quality

definition: Relative track quality.

Repetitive

With FX extension bit.

Element
bit size: 7
Raw Content

Note:

- Actual bit signification is application dependent.

I001/SP - Special Purpose Field

definition: Special Purpose Field

Explicit (SpecialPurpose)

User Application Profile

This category has multiple UAPs.

UAP selection is based on the value of: `020/TYP`

- `0`
  plot
- `1`
  track

plot

- 1: `I001/010` - Data Source Identifier
- 2: `I001/020` - Target Report Descriptor
- 3: `I001/040` - Measured Position in Polar Co-ordinates
- 4: `I001/070` - Mode-3/A Code in Octal Representation
- 5: `I001/090` - Mode-C Code in Binary Representation
- 6: `I001/130` - Radar Plot Characteristics
- 7: `I001/141` - Truncated Time of Day
- (FX) - Field extension indicator
- 8: `I001/050` - Mode-2 Code in Octal Representation
- 9: `I001/120` - Measured Radial Doppler Speed
- 10: `I001/131` - Received Power
- 11: `I001/080` - Mode-3/A Code Confidence Indicator
- 12: `I001/100` - Mode-C Code and Code Confidence Indicator
- 13: `I001/060` - Mode-2 Code Confidence Indicator
- 14: `I001/030` - Warning/Error Conditions
- (FX) - Field extension indicator
- 15: `I001/150` - Presence of X-Pulse
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- 20: `I001/SP` - Special Purpose Field
- *RFS indicator*
- (FX) - Field extension indicator

track

- 1: `I001/010` - Data Source Identifier
- 2: `I001/020` - Target Report Descriptor
- 3: `I001/161` - Track Plot Number
- 4: `I001/040` - Measured Position in Polar Co-ordinates
- 5: `I001/042` - Calculated Position in Cartesian Co-ordinates
- 6: `I001/200` - Calculated Track Velocity in Polar Co-ordinates
- 7: `I001/070` - Mode-3/A Code in Octal Representation
- (FX) - Field extension indicator
- 8: `I001/090` - Mode-C Code in Binary Representation
- 9: `I001/141` - Truncated Time of Day
- 10: `I001/130` - Radar Plot Characteristics
- 11: `I001/131` - Received Power
- 12: `I001/120` - Measured Radial Doppler Speed
- 13: `I001/170` - Track Status
- 14: `I001/210` - Track Quality
- (FX) - Field extension indicator
- 15: `I001/050` - Mode-2 Code in Octal Representation
- 16: `I001/080` - Mode-3/A Code Confidence Indicator
- 17: `I001/100` - Mode-C Code and Code Confidence Indicator
- 18: `I001/060` - Mode-2 Code Confidence Indicator
- 19: `I001/030` - Warning/Error Conditions
- 20: `I001/SP` - Special Purpose Field
- *RFS indicator*
- (FX) - Field extension indicator
- 22: `I001/150` - Presence of X-Pulse
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- *Spare*
- (FX) - Field extension indicator