Asterix category 048 - Monoradar Target Reports

category: 048

edition: 1.32

date: 2024-07-01

Preamble

Surveillance data exchange.

Description of standard data items

I048/010 - Data Source Identifier

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

Group

I048/010/SAC - System Area Code

Element
bit size: 8
Raw Content

I048/010/SIC - System Identification Code

Element
bit size: 8
Raw Content

Note:
- The up-to-date list of SACs is published on the EUROCONTROL Web Site (http://www.eurocontrol.int/asterix).

I048/020 - Target Report Descriptor

definition: Type and properties of the target report.

Extended

I048/020/TYP

Element
bit size: 3
Values:

- **0:** No detection
- **1:** Single PSR detection
- **2:** Single SSR detection
- **3:** SSR + PSR detection
- **4:** Single ModeS All-Call
- **5:** Single ModeS Roll-Call
- **6:** ModeS All-Call + PSR
- **7:** ModeS Roll-Call +PSR

I048/020/SIM

Element
bit size: 1
Values:

- **0:** Actual target report
- **1:** Simulated target report

I048/020/RDP

Element
bit size: 1
Values:

0: Report from RDP Chain 1
1: Report from RDP Chain 2

I048/020/SPI

Element
bit size: 1
Values:

0: Absence of SPI
1: Special Position Identification

I048/020/RAB

Element
bit size: 1
Values:

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

(FX) - extension bit
I048/020/TST

Element
bit size: 1
Values:

0: Real target report
1: Test target report

I048/020/ERR

Element
bit size: 1
Values:

0: No Extended Range
1: Extended Range present

I048/020/XPP

Element
bit size: 1
Values:

0: No X-Pulse present
1: X-Pulse present

I048/020/ME

Element
bit size: 1
Values:

0: No military emergency
1: Military emergency

I048/020/MI

Element
bit size: 1
Values:

0: No military identification
1: Military identification

I048/020/FOEFRI

Element
bit size: 2
Values:

0: No Mode 4 interrogation
1: Friendly target
2: Unknown target
3: No reply

(FX) - extension bit

I048/020/ADSB - On-Site ADS-B Information

Group

I048/020/ADSB/EP - ADSB Element Populated Bit

Element
bit size: 1
Values:

0: ADSB not populated
1: ADSB populated

I048/020/ADSB/VAL - On-Site ADS-B Information

Element
bit size: 1
Values:

0: Not available
1: Available

I048/020/SCN - Surveillance Cluster Network Information

Group

I048/020/SCN/EP - SCN Element Populated Bit

Element
bit size: 1
Values:

0: SCN not populated
1: SCN populated

I048/020/SCN/VAL - Surveillance Cluster Network Information

Element
bit size: 1
Values:

0: Not available
1: Available

I048/020/PAI - Passive Acquisition Interface Information

Group

I048/020/PAI/EP - PAI Element Populated Bit

Element
bit size: 1
Values:

0: PAI not populated
1: PAI populated

I048/020/PAI/VAL - Passive Acquisition Interface Information

Element
bit size: 1
Values:

0: Not available
1: Available

Spare bits: 1

(FX) - extension bit

I048/020/ACASXV - Extended Version

Group

I048/020/ACASXV/EP - ACASXV Element Populated Bit

Element
bit size: 1
Values:

0: ACASXV not populated
1: ACASXV populated

I048/020/ACASXV/VAL - ACAS Extended Version Value

Element
bit size: 4
Values:

0: Non-Extended Version
1: ACAS Xa Version 1
2: ACAS Xu Version 1

I048/020/POXPR - PO Transponder Capability

Group

I048/020/POXPR/EP - POXPR Element Populated Bit

Element
bit size: 1
Values:

0: POXPR not populated
1: POXPR populated

I048/020/POXPR/VAL - PO Transpomder Capability

Element
bit size: 1
Values:

0: PO not supported (PPM only)
1: PO supported

(FX) - extension bit

I048/020/POACT - PO Active for Current Plot

Group

I048/020/POACT/EP - POACT Element Populated Bit

Element
bit size: 1
Values:

0: POACT not populated
1: POACT populated

I048/020/POACT/VAL - POACT Active for Current Plot

Element
bit size: 1
Values:

0: PO not active
1: PO active

I048/020/DTFXPR - Basic Dataflash Transponder Capability

Group

I048/020/DTFXPR/EP - DTFXPR Element Populated Bit

Element
bit size: 1
Values:

0: DTFXPR not populated
1: DTFXPR populated

I048/020/DTFXPR/VAL - Basic Dataflash Transponder Capability

Element
bit size: 1
Values:

0: Basic Dataflash not supported
1: Basic Dataflash supported

I048/020/DTFACT - Basic Dataflash Active for Current Plot

Group

I048/020/DTFACT/EP - DTFACT Element Populated Bit

Element
bit size: 1
Values:

0: DTFACT not populated
1: DTFACT populated

I048/020/DTFACT/VAL - Basic Dataflash in Current Plot

Element
bit size: 1
Values:

0: Basic Dataflash not active
1: Basic Dataflash active

Spare bits: 1
(FX) - extension bit

I048/020/IRMXPR - IRM Transponder Capability

Group

I048/020/IRMXPR/EP - IRMXPR Element Populated Bit

Element
bit size: 1
Values:

0: IRMXPR not populated
1: IRMXPR populated

I048/020/IRMXPR/VAL - Transponder IRM Capability

Element
bit size: 1
Values:

0: Transponder not IRM capable
1: Transponder IRM capable

I048/020/IRMACT - IRM Active for Current Plot

Group

I048/020/IRMACT/EP - IRM Element Populated Bit

Element
bit size: 1
Values:

0: IRMACT not populated
1: IRMACT populated

I048/020/IRMACT/VAL - IRM Active for Current Plot

Element
bit size: 1
Values:

0: IRM not active
1: IRM active

Spare bits: 3
(FX) - extension bit

Notes:

1. For Mode S aircraft, the SPI information is also contained in I048/230.

2. To bits 3/2 of extension 1 (FOE/FRI): IFF interrogators supporting a three level classification of the processing of the Mode 4 interrogation result shall encode the detailed response information in data item M4E of the Reserved Expansion Field of category 048. In this case the value for FOE/FRI in I048/020 shall be set to "00". However, even those interrogators shall use I048/020 to encode the information "No reply".

3. To bit 6 of extension 1 (XPP): This bit shall always be set when the X-pulse has been extracted, independent from the Mode it was extracted with.

4. To bit 7 of extension 1 (ERR): This bit set to "1" indicates that the range of the target is beyond the maximum range in data item I048/040.In this case – and this case only - the ERR Data Item in the Reserved Expansion Field shall provide the range value of the Measured Position in Polar Coordinates.

5. To Extension 2: The EUROCONTROL Specification for European Mode S Stations Edition 4.0 (EMS 4.0) [Ref. 4] defines new functionalities that can use external data inputs. The possibilities described in EMS 4.0 cover the presence of target information acquired via the on-site ADS-B, the Surveillance Cluster Network or the Passive Acquisition Interface. The second extension provides information – per target – on whether such information is available supporting performance improvements, e.g. Passive Acquisition, and new features, e.g. detection of a potential IC Conflict.

6. To Extensions 3, 4, and 5: The transponder MOPS ED-73F/DO-181F (Minimum Operational Performance Standard [Ref. 2]) defines new optional functionalities:
   - Basic Dataflash (to reduce BDS registers extractions by groundsystems)
   - IRM (Interrogation/Reply Monitoring)
   - Phase Overlay (to convey more data within a single long Roll Call Reply, using Downlink Formats 20 and 21)

7. To Extensions 3 and 4: To populate bits in these extensions, Mode S radars will have to decode/analyse the content of BDS register 1,0 (bits 15, 42 and 44) as per [Ref. 2].

I048/030 - Warning/Error Conditions and Target Classification

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

Repetitive

With FX extension bit.

Element
bit size: 7
Values:

0: Not defined; never used
1: Multipath Reply (Reflection)
2: Reply due to sidelobe interrogation/reception
3: Split plot
4: Second time around reply
5: Angel
6: Slow moving target correlated with road infrastructure (terrestrial vehicle)
7: Fixed PSR plot
8: Slow PSR target
9: Low quality PSR plot
10: Phantom SSR plot
11: Non-Matching Mode-3/A Code
12: Mode C code / Mode S altitude code abnormal value compared to the track

13: Target in Clutter Area
14: Maximum Doppler Response in Zero Filter
15: Transponder anomaly detected
16: Duplicated or Illegal Mode S Aircraft Address
17: Mode S error correction applied
18: Undecodable Mode C code / Mode S altitude code
19: Birds
20: Flock of Birds
21: Mode-1 was present in original reply
22: Mode-2 was present in original reply
23: Plot potentially caused by Wind Turbine
24: Helicopter
25: Maximum number of re-interrogations reached (surveillance information)
26: Maximum number of re-interrogations reached (BDS Extractions)
27: BDS Overlay Incoherence
28: Potential BDS Swap Detected
29: Track Update in the Zenithal Gap
30: Mode S Track re-acquired
31: Duplicated Mode 5 Pair NO/PIN detected
32: Wrong DF reply format detected
33: Transponder anomaly (MS XPD replies with Mode A/C to Mode A/C-only all-call)
34: Transponder anomaly (SI capability report wrong)
35: Potential IC Conflict
36: IC Conflict detection possible-no conflict currently detected
37: Duplicate Mode 5 PIN (refer to the Mode 5 items in the REF)

Notes:

1. It has to be stressed that a series of one or more codes can be reported per target report.
2. Data conveyed in this item are of secondary importance, and can generally also be derived from the processing of mandatory items.
3. As of Edition 1.28 of this specification it is possible to indicate specific Transponder Anomalies by means of dedicated Codes (such as Codes 33 and 34). Code 15 is kept for backwards compatibility. It needs to be understood that ASTERIX Encoders implementing Category 048 in line with Edition 1.27 or earlier of this specification cannot indicate specific Transponder Anomalies.
4. Values 25 to 30 have been defined to comply with the updated European Mode S Specification (EMS) and to provide the possibility to report the following information:
   - Code 25: the maximum number of permitted re-interrogations to acquire the surveillance information has been reached;
   - Code 26: the maximum number of permitted re-interrogations to extract BDS Registers has been reached;
   - Code 27: inconsistency detected between the contents of the message and the BDS register overlayed;
   - Code 28: a BDS swap has been detected and the respective information has been discarded;
   - Code 29: the track has been updated while being in the zenithal gap (also referred to as "Cone of Silence");
   - Code 30: the radar had lost track of an aircraft and subsequently re-acquired it.
   - Code 31: ???
   - Code 32: the transponder has used a wrong Downlink Format.
   - Code 33 & 34: reporting specific Transponder Anomalies.
   - Code 35 indicates that a plot has been obtained despite a high probability of an IC Conflict with another interrogator.

- Code 36 indicates that a plot is in a configuration that it would be possible to detect an IC Conflict with another interrogator. Currently no potential IC Conflict has been detected. NOTE: Although implementation dependent, the use of this code should be limited to the target acquisition phase.
5. Together with Codes 35 and 36 the possibility to communicate the area within which the detection of an IC Conflict is possible was implemented in the Category 034 Specification Ref. [5] by means of Message Type 008.
6. The use of this Data Item is implementation specific and shall be described in the ICD of the system generating the Category 048 target reports.

I048/040 - Measured Position in Polar Co-ordinates

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

Group

I048/040/RHO

Element
bit size: 16
Unsigned quantity
LSB = $1/2^8$ NM $\approx 3.90625e - 3$ NM
unit: "NM"
< 256.0

I048/040/THETA

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

Notes:

1. In case of no detection, the extrapolated position expressed in slant polar co-ordinates may be sent, except for a track cancellation message. No detection is signalled by the TYP field set to zero in I048/020 Target Report Descriptor.
2. This item represents the measured target position of the plot, even if associated with a track, for the present antenna scan. It is expressed in polar co-ordinates in the local reference system, centred on the radar station.
3. In case of combined detection by a PSR and an SSR, then the SSR position is sent.
4. For targets having a range beyond the maximum range the data item "Extended Range Report" has been added to the Reserved Expansion Field of category 048. The presence of this data item is indicated by the ERR bit set to one in data item I048/020, first extension. The ERR data item shall only be sent if the value of RHO is equal to or greater than 256NM. Please note that if this data item is used, the Encoding Rule to data item I048/040 still applies, meaning that the extra item in the Reserved Expansion Field shall be transmitted in addition to data item I048/040. If the Extended Range Report item in the Reserved Expansion Field is used, it is recommended to set the value of RHO in data item I048/040 to its maximum, meaning bits 32/17 all set to 1.

I048/042 - Calculated Position in Cartesian Co-ordinates

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

Group

I048/042/X - X-Component

Element
bit size: 16
Signed quantity
LSB = $1/2^7$ NM $\approx 7.8125e - 3$ NM
unit: "NM"
>= -256.0
<= 256.0

I048/042/Y - X-Component

Element
bit size: 16
Signed quantity
LSB = $1/2^7$ NM $\approx 7.8125e - 3$ NM
unit: "NM"
>= -256.0
<= 256.0

I048/050 - Mode-2 Code in Octal Representation

definition: Reply to Mode-2 interrogation.

Group

I048/050/V

Element
bit size: 1
Values:

  0: Code validated
  1: Code not validated

I048/050/G

Element
bit size: 1
Values:

  0: Default
  1: Garbled code

I048/050/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

I048/050/MODE2 - Mode-2 Code in Octal Representation

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

Note:
- Bit 15 has no meaning in the case of a smoothed Mode-2 and is set to 0 for a calculated track.

Note:
- For radar systems interrogation with various technologies (such as military radars interrogating in Mode S and Mode 5), element I048/REF/GEN48/ALTM2 provides the possibility to transmit an alternative Mode-2 value. If this Data Item carries a Mode-2 value that has been derived from a Mode 5 Reply/Report, then bit-4 in

I048/055 - Mode-1 Code in Octal Representation

definition: Reply to Mode-1 interrogation.

Group

I048/055/V

Element
bit size: 1
Values:

    0: Code validated
    1: Code not validated

I048/055/G

Element
bit size: 1
Values:

    0: Default
    1: Garbled code

I048/055/L

Element
bit size: 1
Values:

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

I048/055/MODE1 - Mode-1 Code

Element
bit size: 5
Raw Content

Notes:

1. Bit 7 has no meaning in the case of a smoothed Mode-1 and is set to 0 for a calculated track.
2. The values of the bits for V, G, L, A4, A2, A1, B2 and B1 shall be identical to the values of the corresponding bits in subfield #5 of data item "MD5 – Mode 5 Reports" and in subfield #5 of data item "MD5 – Mode 5 Reports, New Format" in the Reserved Expansion Field.

I048/060 - 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
I048/060/QA4

Element
bit size: 1
Values:

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

I048/060/QA2

Element
bit size: 1
Values:

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

I048/060/QA1

Element
bit size: 1
Values:

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

I048/060/QB4

Element
bit size: 1
Values:

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

I048/060/QB2

Element
bit size: 1
Values:

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

I048/060/QB1

Element
bit size: 1
Values:

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

I048/060/QC4

Element
bit size: 1
Values:

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

I048/060/QC2

Element
bit size: 1
Values:

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

I048/060/QC1

Element
bit size: 1
Values:

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

I048/060/QD4

Element
bit size: 1
Values:

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

I048/060/QD2

Element
bit size: 1
Values:
  0: High quality pulse D2
  1: Low quality pulse D2

I048/060/QD1

Element
bit size: 1
Values:
  0: High quality pulse D1
  1: Low quality pulse D1

I048/065 - Mode-1 Code Confidence Indicator

definition: Confidence level for each bit of a Mode-1 reply as provided by a monopulse SSR station.

Group

Spare bits: 3

I048/065/QA4

Element
bit size: 1
Values:
  0: High quality pulse A4
  1: Low quality pulse A4

I048/065/QA2

Element
bit size: 1
Values:
  0: High quality pulse A2
  1: Low quality pulse A2

I048/065/QA1

Element
bit size: 1
Values:
  0: High quality pulse A1
  1: Low quality pulse A1

I048/065/QB2

Element
bit size: 1
Values:
  0: High quality pulse B2
  1: Low quality pulse B2

I048/065/QB1

Element
bit size: 1
Values:
  0: High quality pulse B1
  1: Low quality pulse B1

I048/070 - Mode-3/A Code in Octal Representation

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

Group

I048/070/V

> Element
> bit size: 1
> Values:
>> **0:** Code validated
>> **1:** Code not validated

I048/070/G

> Element
> bit size: 1
> Values:
>> **0:** Default
>> **1:** Garbled code

I048/070/L

> Element
> bit size: 1
> Values:
>> **0:** Mode-3/A code derived from the reply of the transponder
>> **1:** Mode-3/A code not extracted during the last scan

Spare bits: 1

I048/070/MODE3A - Mode-3/A Reply in Octal Representation

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

Notes:

1. Bit 15 has no meaning in the case of a smoothed Mode-3/A code and is set to 0 for a calculated track. For Mode S, it is set to one when an error correction has been attempted.
2. For Mode S, bit 16 is normally set to zero, but can exceptionally be set to one to indicate a non-validated Mode-3/A code (e.g. alert condition detected, but new Mode-3/A code not successfully extracted).
3. For radar systems interrogation with various technologies (such as military radars interrogating in Mode S and Mode 5), element I048/REF/GEN48/ALTM3 provides the possibility to transmit an alternative Mode-3/A value. If this Data Item carries a Mode-3/A value that has been derived from a Mode 5 Reply/Report, then bit-3 in I048/REF/MD5/SF#1 or bit-3 in I048/REF/M5N/SF#1 shall be set to 1.

I048/080 - 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

I048/080/QA4

> Element
> bit size: 1
> Values:
>> **0:** High quality pulse A4
>> **1:** Low quality pulse A4

I048/080/QA2

> Element
> bit size: 1
> Values:

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

I048/080/QA1

Element
bit size: 1
Values:

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

I048/080/QB4

Element
bit size: 1
Values:

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

I048/080/QB2

Element
bit size: 1
Values:

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

I048/080/QB1

Element
bit size: 1
Values:

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

I048/080/QC4

Element
bit size: 1
Values:

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

I048/080/QC2

Element
bit size: 1
Values:

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

I048/080/QC1

Element
bit size: 1
Values:

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

I048/080/QD4

Element
bit size: 1
Values:

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

I048/080/QD2

Element
bit size: 1
Values:

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

I048/080/QD1

Element
bit size: 1
Values:

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

I048/090 - Flight Level in Binary Representation

definition: Flight Level converted into binary representation.

Group

I048/090/V

Element
bit size: 1
Values:

> **0:** Code validated
> **1:** Code not validated

I048/090/G

Element
bit size: 1
Values:

> **0:** Default
> **1:** Garbled code

I048/090/FL

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

Notes:

1. When Mode C code / Mode S altitude code is present but not decodable, the "Undecodable Mode C code / Mode S altitude code" Warning/Error should be sent in I048/030.
2. When local tracking is applied and the received Mode C code / Mode S altitude code corresponds to an abnormal value (the variation with the previous plot is estimated too important by the tracker), the "Mode C code / Mode S altitude code abnormal value compared to the track" Warning/Error should be sent in I048/030.
3. The value shall be within the range described by ICAO Annex 10
4. For Mode S, bit 15 (G) is set to one when an error correction has been attempted.
5. For radar systems interrogating with various technologies (such as military radars interrogating in Mode S and Mode 5), element I048/REF/GEN48/ALTFL provides the possibility to transmit an alternative Flight Level value. If this Data Item carries a Flight Level value that has been derived from a Mode 5 Reply/Report, then bit-2 in I048/REF/MD5/SF#1 or bit-2 in I048/REF/M5N/SF#1 shall be set to 1.

I048/100 - 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 MSSR/Mode S station.

Group

I048/100/V

> Element
> bit size: 1
> Values:
>
> > **0:** Code validated
> > **1:** Code not validated

I048/100/G

> Element
> bit size: 1
> Values:
>
> > **0:** Default
> > **1:** Garbled code

Spare bits: 2

I048/100/MODEC - Mode-C Reply in Gray Notation

> Element
> bit size: 12
> Raw Content

Spare bits: 4

I048/100/QC1

> Element
> bit size: 1
> Values:
>
> > **0:** High quality pulse C1
> > **1:** Low quality pulse C1

I048/100/QA1

> Element
> bit size: 1
> Values:
>
> > **0:** High quality pulse A1
> > **1:** Low quality pulse A1

I048/100/QC2

> Element
> bit size: 1
> Values:
>
> > **0:** High quality pulse C2
> > **1:** Low quality pulse C2

I048/100/QA2

> Element
> bit size: 1
> Values:
>
> > **0:** High quality pulse A2
> > **1:** Low quality pulse A2

I048/100/QC4

> Element
> bit size: 1
> Values:
>
> > **0:** High quality pulse C4
> > **1:** Low quality pulse C4

I048/100/QA4

Element
bit size: 1
Values:

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

I048/100/QB1

Element
bit size: 1
Values:

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

I048/100/QD1

Element
bit size: 1
Values:

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

I048/100/QB2

Element
bit size: 1
Values:

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

I048/100/QD2

Element
bit size: 1
Values:

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

I048/100/QB4

Element
bit size: 1
Values:

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

I048/100/QD4

Element
bit size: 1
Values:

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

Notes:

1. For Mode S, D1 is also designated as Q, and is used to denote either 25ft or 100ft reporting.
2. For Mode S, bit-31 (G) is set when an error correction has been attempted.

I048/110 - Height Measured by a 3D Radar

definition: Height of a target as measured by a 3D radar. The height shall use mean sea level as the zero reference level.

Group

Spare bits: 2

I048/110/3DH - 3D Height, in Binary Notation. Negative Values Are Expressed in Two's Complement

> Element
> bit size: 14
> Signed quantity
> LSB = 25 ft ≈ 25.0 ft
> unit: ”ft”

I048/120 - Radial Doppler Speed

definition: Information on the Doppler Speed of the target report.

Compound

I048/120/CAL - Calculated Doppler Speed

Group

I048/120/CAL/D

> Element
> bit size: 1
> Values:
>
> > **0:** Doppler speed is valid
> > **1:** Doppler speed is doubtful

Spare bits: 5

I048/120/CAL/CAL - Calculated Doppler Speed, Coded in Two's Complement

> Element
> bit size: 10
> Signed quantity
> LSB = 1 m/s ≈ 1.0 m/s
> unit: ”m/s”

I048/120/RDS - Raw Doppler Speed

Repetitive
Regular, 1 byte(s) REP field size.
Group

I048/120/RDS/DOP - Doppler Speed

> Element
> bit size: 16
> Unsigned quantity
> LSB = 1 m/s ≈ 1.0 m/s
> unit: ”m/s”

I048/120/RDS/AMB - Ambiguity Range

> Element
> bit size: 16
> Unsigned quantity
> LSB = 1 m/s ≈ 1.0 m/s
> unit: ”m/s”

I048/120/RDS/FRQ - Transmitter Frequency

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

Notes:

- Although the meaning of a positive or negative value is implementation dependent and shall be described in the ICD of the system generating the ASTERIX record, it is recommended to transmit a positive value for targets moving away from the radar.

I048/130 - Radar Plot Characteristics

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

Compound

I048/130/SRL - SSR Plot Runlength

description: SSR plot runlength, expressed as a positive binary value.

Element
bit size: 8
Unsigned quantity
LSB $= 360/2^1 3 ° \approx 4.39453125e - 2 °$
unit: "°"

I048/130/SRR - Number of Received Replies for (M)SSR

description: Number of Received Replies for (M)SSR

Element
bit size: 8
Unsigned integer

I048/130/SAM - Amplitude of (M)SSR Reply

description: Amplitude of (M)SSR Reply

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

I048/130/PRL - Primary Plot Runlength

description: Primary Plot Runlength, expressed as positive binary value

Element
bit size: 8
Unsigned quantity
LSB $= 360/2^1 3 ° \approx 4.39453125e - 2 °$
unit: "°"

I048/130/PAM - Amplitude of Primary Plot

description: Amplitude of Primary Plot

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

I048/130/RPD - Difference in Range Between PSR and SSR Plot

description: Range (PSR-SSR)

Element
bit size: 8
Signed quantity
LSB $= 1/2^8$ NM $\approx 3.90625e - 3$ NM
unit: "NM"

I048/130/APD - Difference in Azimuth Between PSR and SSR Plot

description: Azimuth (PSR-SSR)

Element
bit size: 8
Signed quantity
LSB = $360/2^14$ ° ≈ $2.197265625e - 2$ °
unit: "°"

Notes:

1. The total range covered is therefore from 0 to 11.21 °.
2. Negative values are coded in two's complement form.
3. The total range covered is therefore from 0 to 11.21 °.
4. Negative values are coded in two's complement form.
5. Negative values are coded in two's complement form.
6. The covered range difference is +/- 0.5 NM.
7. Sending the maximum value means that the difference in range is equal or greater than the maximum value.
8. Negative values are coded in two's complement form.
9. The covered azimuth difference is +/-360/2 7 = +/- 2.8125 °.
10. Sending the maximum value means that the difference in range is equal or greater than the maximum value.

I048/140 - Time of Day

definition: Absolute time stamping expressed as Co-ordinated Universal Time (UTC).

Element
bit size: 24
Unsigned quantity
LSB = $1/2^7$ s ≈ $7.8125e - 3$ s
unit: "s"
< 86400.0

Notes:

1. The time of day value is reset to 0 each day at midnight.
2. Every radar station using ASTERIX should be equipped with at least one synchronised time source

I048/161 - Track Number

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

Spare bits: 4
I048/161/TRN - Track Number
Element
bit size: 12
Raw Content

I048/170 - Track Status

definition: Status of monoradar track (PSR and/or SSR updated).
Extended

I048/170/CNF - Confirmed Vs. Tentative Track
Element
bit size: 1
Values:

0: Confirmed Track
1: Tentative Track

I048/170/RAD - Type of Sensor(s) Maintaining Track

Element
bit size: 2
Values:

0: Combined Track
1: PSR Track
2: SSR/Mode S Track
3: Invalid

I048/170/DOU - Signals Level of Confidence in Plot to Track Association Process

Element
bit size: 1
Values:

0: Normal confidence
1: Low confidence in plot to track association

I048/170/MAH - Manoeuvre Detection in Horizontal Sense

Element
bit size: 1
Values:

0: No horizontal man.sensed
1: Horizontal man. sensed

I048/170/CDM - Climbing / Descending Mode

Element
bit size: 2
Values:

0: Maintaining
1: Climbing
2: Descending
3: Unknown

(FX) - extension bit

I048/170/TRE - Signal for End_of_Track

Element
bit size: 1
Values:

0: Track still alive
1: End of track lifetime(last report for this track)

I048/170/GHO - Ghost Vs. True Target

Element
bit size: 1
Values:

0: True target track
1: Ghost target track

I048/170/SUP - Track Maintained with Track Information from Neighbouring Node B on the Cluster, or Network

Element
bit size: 1
Values:

0: No
1: Yes

I048/170/TCC - Type of Plot Coordinate Transformation Mechanism:

Element
bit size: 1
Values:

- **0:** Tracking performed in so-called 'Radar Plane', i.e. neither slant range correction nor stereographical projection was applied
- **1:** Slant range correction and a suitable projection technique are used to track in a 2D.reference plane, tangential to the earth model at the Radar Site co-ordinates

Spare bits: 3

(FX) - extension bit

I048/200 - Calculated Track Velocity in Polar Co-ordinates

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

Group

I048/200/GSP - Calculated Groundspeed

Element
bit size: 16
Unsigned quantity
LSB $= 1/2^1 4$ NM/s $\approx 6.103515625e - 5$ NM/s
unit: "NM/s"

I048/200/HDG - Calculated Heading

Element
bit size: 16
Unsigned quantity
LSB $= 360/2^1 6$ ° $\approx 5.4931640625e - 3$ °
unit: "°"

Notes:

- The calculated heading is related to the geographical North at the aircraft position.

I048/210 - Track Quality

definition: Track quality in the form of a vector of standard deviations.

Group

I048/210/SIGX - Sigma (X)) Standard Deviation on the Horizontal Axis of the Local Grid System

Element
bit size: 8
Unsigned quantity
LSB $= 1/2^7$ NM $\approx 7.8125e - 3$ NM
unit: "NM"

I048/210/SIGY - Sigma (Y)) Standard Deviation on the Vertical Axis of the Local Grid System

Element
bit size: 8
Unsigned quantity
LSB $= 1/2^7$ NM $\approx 7.8125e - 3$ NM
unit: "NM"

I048/210/SIGV - Sigma (V)) Standard Deviation on the Groundspeed Within the Local Grid System

Element
bit size: 8
Unsigned quantity
LSB = $1/2^14$ NM/s $\approx 6.103515625e - 5$ NM/s
unit: "NM/s"

I048/210/SIGH - Sigma (H)) Standard Deviation on the Heading Within the Local Grid System

Element
bit size: 8
Unsigned quantity
LSB = $360/2^12$ ° $\approx 8.7890625e - 2$ °
unit: "°"

Notes:

1. The standard deviation is per definition a positive value, hence the range covered is : 0<= Sigma(X)<2 NM
2. The standard deviation is per definition a positive value, hence the range covered is : 0<= Sigma(Y)<2 NM
3. The standard deviation is per definition a positive value, hence the range covered is: 0<=Sigma (V)<56.25 Kt
4. The standard deviation is per definition a positive value; hence the range covered is: 0 <= sigma (H) < 22.5 degrees.

I048/220 - Aircraft Address

definition: Aircraft address (24-bits Mode S address) assigned uniquely to each aircraft.

Element
bit size: 24
Raw Content

Note:
- The Encoding Rule for Data Item I048/220 has been relaxed in Edition 1.30 for the "End of Track Message". In order to prevent interoperability problems it is recommended that systems sending I048/220 in an "End of Track Message" continue to do so.

I048/230 - Communications/ACAS Capability and Flight Status

definition: Communications capability of the transponder, capability of the on-board ACAS equipment and flight status.

Group

I048/230/COM - Communications Capability of the Transponder

Element
bit size: 3
Values:

0: No communications capability (surveillance only)
1: Comm. A and Comm. B capability
2: Comm. A, Comm. B and Uplink ELM
3: Comm. A, Comm. B, Uplink ELM and Downlink ELM
4: Level 5 Transponder capability

I048/230/STAT - Flight Status

Element
bit size: 3
Values:

0: No alert, no SPI, aircraft airborne
1: No alert, no SPI, aircraft on ground
2: Alert, no SPI, aircraft airborne
3: Alert, no SPI, aircraft on ground
4: Alert, SPI, aircraft airborne or on ground
5: No alert, SPI, aircraft airborne or on ground
7: Unknown

I048/230/SI - SI/II Transponder Capability

Element
bit size: 1
Values:
0: SI-Code Capable
1: II-Code Capable

Spare bits: 1

I048/230/MSSC - Mode-S Specific Service Capability

Element
bit size: 1
Values:
0: No
1: Yes

I048/230/ARC - Altitude Reporting Capability

Element
bit size: 1
Values:
0: 100 ft resolution
1: 25 ft resolution

I048/230/AIC - Aircraft Identification Capability

Element
bit size: 1
Values:
0: No
1: Yes

I048/230/B1A - BDS 1,0 Bit 16

Element
bit size: 1
Raw Content

I048/230/B1B - BDS 1,0 Bits 37/40

Element
bit size: 4
Raw Content

Note:
- This item shall be present in every ASTERIX record conveying data related to a Mode S target, except for an "End of Track Message" (i.e. I048/170, First Extension, Bit 8 is set to "1") in which this Data Item is optional. If the datalink capability has not been extracted yet, bits 16/14 shall be set to zero.

I048/240 - Aircraft Identification

definition: Aircraft identification (in 8 characters) obtained from an aircraft equipped with a Mode S transponder.

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

Notes:

1. This data item contains the flight identification as available in the respective Mode S transponder registers.
2. The Encoding Rule for Data Item I048/240 has been relaxed in Edition 1.30 for the "End of Track Message". In order to prevent interoperability problems it is recommended that systems sending I048/240 in an "End of Track Message" continue to do so.

I048/250 - BDS Register Data

definition: BDS Register Data as extracted from the aircraft transponder.

Repetitive

Regular, 1 byte(s) REP field size.

Group

> **I048/250/MBDATA - Mode S Comm B Message Data**
>
> > Element
> > bit size: 56
> > Raw Content
>
> **I048/250/BDS1 - Comm B Data Buffer Store 1 Address**
>
> > Element
> > bit size: 4
> > Raw Content
>
> **I048/250/BDS2 - Comm B Data Buffer Store 2 Address**
>
> > Element
> > bit size: 4
> > Raw Content

Notes:

1. For the transmission of BDS Register 2,0, Data Item I048/240 is used.
2. For the transmission of BDS Register 3,0, Data Item I048/260 is used. In case of ACAS Xu (as defined in [3]), the Resolution Advisory consists of two parts (BDS Register 3,0 and BDS Register 3,1). BDS Register 3,1 will be transmitted using Data Item I048/250. For the detailed definition of BDS Register 3,0 and 3,1please refer to [2] Tables B-3-48a and B-3-49.
3. In case of data extracted via Comm-B broadcast, all bits of fields BDS1 and BDS2 are set to 0; in case of data extracted via GICB requests, the fields BDS1 and BDS2 correspond to the GICB register number.
4. The Encoding Rule for Data Item I048/250 has been relaxed in Edition 1.30 for the "End of Track Message". In order to prevent interoperability problems it is recommended that systems sending I048/250 in an "End of Track Message" continue to do so.

I048/260 - ACAS Resolution Advisory Report

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

> Element
> bit size: 56
> Raw Content

Notes:

1. Refer to ICAO Draft SARPs for ACAS for detailed explanations.

2. In case of ACAS Xu, the Resolution Advisory consists of two parts (BDS30 and BDS31). BDS31 will be transmitted using item 250.

I048/RE - Reserved Expansion Field

definition: Expansion

Explicit (ReservedExpansion)

I048/SP - Special Purpose Field

definition: Special Purpose Field

Explicit (SpecialPurpose)

User Application Profile

- 1: I048/010 - Data Source Identifier
- 2: I048/140 - Time of Day
- 3: I048/020 - Target Report Descriptor
- 4: I048/040 - Measured Position in Polar Co-ordinates
- 5: I048/070 - Mode-3/A Code in Octal Representation
- 6: I048/090 - Flight Level in Binary Representation
- 7: I048/130 - Radar Plot Characteristics
- (FX) - Field extension indicator
- 8: I048/220 - Aircraft Address
- 9: I048/240 - Aircraft Identification
- 10: I048/250 - BDS Register Data
- 11: I048/161 - Track Number
- 12: I048/042 - Calculated Position in Cartesian Co-ordinates
- 13: I048/200 - Calculated Track Velocity in Polar Co-ordinates
- 14: I048/170 - Track Status
- (FX) - Field extension indicator
- 15: I048/210 - Track Quality
- 16: I048/030 - Warning/Error Conditions and Target Classification
- 17: I048/080 - Mode-3/A Code Confidence Indicator
- 18: I048/100 - Mode-C Code and Code Confidence Indicator
- 19: I048/110 - Height Measured by a 3D Radar
- 20: I048/120 - Radial Doppler Speed
- 21: I048/230 - Communications/ACAS Capability and Flight Status
- (FX) - Field extension indicator
- 22: I048/260 - ACAS Resolution Advisory Report
- 23: I048/055 - Mode-1 Code in Octal Representation
- 24: I048/050 - Mode-2 Code in Octal Representation
- 25: I048/065 - Mode-1 Code Confidence Indicator
- 26: I048/060 - Mode-2 Code Confidence Indicator
- 27: I048/SP - Special Purpose Field
- 28: I048/RE - Reserved Expansion Field
- (FX) - Field extension indicator