Asterix category 010 - Transmission of Monosensor Surface Movement Data

category: 010

edition: 1.1

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Preamble

Surveillance data exchange.

Description of standard data items

I010/000 - Message Type

definition: This Data Item allows for a more convenient handling of the messages at the receiver side by further defining the type of transaction.

Element
bit size: 8
Values:

- **1:** Target Report
- **2:** Start of Update Cycle
- **3:** Periodic Status Message
- **4:** Event-triggered Status Message

Notes:

1. In applications where transactions of various types are exchanged, the Message Type Data Item facilitates the proper message handling at the receiver side.
2. All Message Type values are reserved for common standard use.
3. The list of items present for the four message types is defined in the following table. M stands for mandatory, O for optional, X for never present.

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```
Item Type [001, 002, 003, 004]
       [Target Report, Start of Update Cycle, Periodic Status Message, Event Status Message]

I010/000 Message Type M M M M
I010/010 Data Source Identifier M M M M
I010/020 Target Report Descriptor M X X X
I010/040 Measured Position in Polar Coordinates O X X X
I010/041 Position in WGS-84 Coordinates O X X X
I010/042 Position in Cartesian Coordinates O X X X
I010/060 Mode-3/A Code O X X X
I010/090 Flight Level in Binary Representation O X X X
I010/091 Measured Height O X X X
I010/131 Amplitude of Primary Plot O X X X
I010/140 Time of Day M M M M
I010/161 Track Number O X X X
I010/170 Track Status O X X X
I010/200 Calculated Track Velocity in Polar Coordinates O X X X
I010/202 Calculated Track Velocity in Cartesian Coordinates O X X X
```

```
I010/210 Calculated Acceleration O X X X
I010/220 Target Address O X X X
I010/245 Target Identification O X X X
I010/250 Mode S MB Data O X X X
I010/270 Target Size & Orientation O X X X
I010/280 Presence O X X X
I010/300 Vehicle Fleet Identification O X X X
I010/310 Pre-programmed Message O X X X
I010/500 Standard Deviation of Position O X X X
I010/550 System Status X O M M
```

I010/010 - Data Source Identifier

definition: Identification of the system from which the data are received.

Group

I010/010/SAC - System Area Code

Element
bit size: 8
Raw Content

I010/010/SIC - System Identification Code

Element
bit size: 8
Raw Content

NOTE - The SAC is fixed to zero to indicate a data flow local to the airport.

I010/020 - Target Report Descriptor

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

Extended

I010/020/TYP

Element
bit size: 3
Values:

- **0:** SSR multilateration
- **1:** Mode S multilateration
- **2:** ADS-B
- **3:** PSR
- **4:** Magnetic Loop System
- **5:** HF multilateration
- **6:** Not defined
- **7:** Other types

I010/020/DCR

Element
bit size: 1
Values:

- **0:** No differential correction (ADS-B)
- **1:** Differential correction (ADS-B)

I010/020/CHN

Element
bit size: 1
Values:

- **0:** Chain 1
- **1:** Chain 2

I010/020/GBS

Element
bit size: 1
Values:

- **0:** Transponder Ground bit not set
- **1:** Transponder Ground bit set

I010/020/CRT

Element
bit size: 1
Values:

- **0:** No Corrupted reply in multilateration
- **1:** Corrupted replies in multilateration

(FX) - extension bit

I010/020/SIM

Element
bit size: 1
Values:

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

I010/020/TST

Element
bit size: 1
Values:

- **0:** Default
- **1:** Test Target

I010/020/RAB

Element
bit size: 1
Values:

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

I010/020/LOP

Element
bit size: 2
Values:

- **0:** Undetermined
- **1:** Loop start
- **2:** Loop finish

I010/020/TOT

Element
bit size: 2
Values:

- **0:** Undetermined
- **1:** Aircraft
- **2:** Ground vehicle
- **3:** Helicopter

(FX) - extension bit

I010/020/SPI

Element
bit size: 1
Values:

- **0:** Absence of SPI
- **1:** Special Position Identification

Spare bits: 6
(FX) - extension bit

I010/040 - Measured Position in Polar Co-ordinates

definition: Measured position of a target in local polar co-ordinates.
Group

I010/040/RHO - RHO

Element
bit size: 16
Unsigned quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”
<= 65536.0

I010/040/TH - Theta

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

I010/041 - Position in WGS-84 Co-ordinates

definition: Position of a target in WGS-84 Co-ordinates.
Group

I010/041/LAT - Latitude

Element
bit size: 32
Signed quantity
LSB = $180/2^31$ ° ≈ $8.381903171539306640625e-8$ °
unit: ”°”
>= −90.0
<= 90.0

I010/041/LON - Longitude

Element
bit size: 32
Signed quantity
LSB = $180/2^31$ ° ≈ $8.381903171539306640625e-8$ °
unit: ”°”
>= −180.0
< 180.0

I010/042 - Position in Cartesian Co-ordinates

definition: Position of a target in Cartesian co-ordinates, in two’s complement form.
Group

I010/042/X - X Coordinate

Element
bit size: 16
Signed quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”
>= −32768.0
<= 32768.0

I010/042/Y - Y Coordinate

Element
bit size: 16
Signed quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”
>= −32768.0
<= 32768.0

I010/060 - Mode-3/A Code in Octal Representation

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

Group

I010/060/V - Validated

Element
bit size: 1
Values:

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

I010/060/G - Garbled

Element
bit size: 1
Values:

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

I010/060/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

I010/060/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).

I010/090 - Flight Level in Binary Representation

definition: Flight Level (Mode C / Mode S Altitude) converted into binary two's complement representation.

Group

I010/090/V - Validated

Element
bit size: 1
Values:

0: Code validated
1: Code not validated

I010/090/G - Garbled

Element
bit size: 1
Values:

0: Default
1: Garbled code

I010/090/FL - Flight Level

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

Notes:

1. The value shall be within the range described by ICAO Annex 10
2. For Mode S, bit 15 (G) is set to one when an error correction has been attempted.

I010/091 - Measured Height

definition: Height above local 2D co-ordinate reference system (two's complement) based on direct measurements not related to barometric pressure.

Element
bit size: 16
Signed quantity
LSB = $25/2^2$ ft ≈ 6.25 ft
unit: ”ft”
>= -204800.0
<= 204800.0

I010/131 - Amplitude of Primary Plot

definition: Amplitude of Primary Plot.

Element
bit size: 8
Raw Content

Notes:

- The value is radar-dependent, 0 being the minimum detectable level for that radar.

I010/140 - Time of Day

definition: Absolute time stamping expressed as UTC.

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

Notes:

- The time of day value is reset to zero each day at midnight.

I010/161 - Track Number

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

Group

Spare bits: 4

I010/161/TRK - Track Number

Element
bit size: 12
Raw Content

I010/170 - Track Status

definition: Status of track.

Extended

I010/170/CNF

Element
bit size: 1
Values:

0: Confirmed track
1: Track in initialisation phase

I010/170/TRE

Element
bit size: 1
Values:

0: Default
1: Last report for a track

I010/170/CST

Element
bit size: 2
Values:

0: No extrapolation
1: Predictable extrapolation due to sensor refresh period (see NOTE)
2: Predictable extrapolation in masked area
3: Extrapolation due to unpredictable absence of detection

I010/170/MAH

Element
bit size: 1
Values:

0: Default
1: Horizontal manoeuvre

I010/170/TCC

Element
bit size: 1
Values:

0: Tracking performed in 'Sensor Plane', i.e. neither slant range correction nor 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 Sensor Site co-ordinates

I010/170/STH

Element
bit size: 1
Values:

0: Measured position
1: Smoothed position

(FX) - extension bit

I010/170/TOM

Element
bit size: 2
Values:

0: Unknown type of movement
1: Taking-off
2: Landing
3: Other types of movement

I010/170/DOU

Element
bit size: 3
Values:

0: No doubt
1: Doubtful correlation (undetermined reason)
2: Doubtful correlation in clutter
3: Loss of accuracy
4: Loss of accuracy in clutter
5: Unstable track
6: Previously coasted

I010/170/MRS

Element
bit size: 2
Values:

0: Merge or split indication undetermined
1: Track merged by association to plot
2: Track merged by non-association to plot
3: Split track

(FX) - extension bit

I010/170/GHO

Element
bit size: 1
Values:

0: Default
1: Ghost track

Spare bits: 6

(FX) - extension bit

Notes:

1. Some sensors are not be able to scan the whole coverage in one refresh period. Therefore, track extrapolation is performed in un-scanned sectors. CST is then set to 01.
2. Bit-8 (GHO) is used to signal that the track is suspected to have been generated by a fake target.

I010/200 - Calculated Track Velocity in Polar Co-ordinates

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

Group

I010/200/GSP - Ground Speed

Element
bit size: 16
Unsigned quantity
LSB = $1/2^14$ NM/s ≈ $6.103515625e-5$ NM/s
unit: ”NM/s”
<= 2.0

I010/200/TRA - Track Angle

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

I010/202 - Calculated Track Velocity in Cartesian Co-ordinates

definition: Calculated track velocity expressed in Cartesian co-ordinates, in two’s complement representation.

Group

I010/202/VX - X Velocity

Element
bit size: 16
Signed quantity
LSB = $1/2^4$ m/s ≈ $6.25e-2$ m/s
unit: ”m/s”
>= -8192.0
<= 8192.0

I010/202/VY - Y Velocity

Element
bit size: 16
Signed quantity
LSB = $1/2^4$ m/s ≈ $6.25e-2$ m/s
unit: ”m/s”
>= -8192.0
<= 8192.0

I010/210 - Calculated Acceleration

definition: Calculated Acceleration of the target, in two’s complement form.

Group

I010/210/AX - X Acceleration

Element
bit size: 8
Signed quantity
LSB = $1/2^4$ m/s² ≈ $6.25e-2$ m/s²
unit: ”m/s²”
>= -31.0
<= 31.0

I010/210/AY - Y Acceleration

Element
bit size: 8
Signed quantity
LSB = $1/2^4$ m/s² ≈ $6.25e-2$ m/s²
unit: ”m/s²”
>= -31.0
<= 31.0

I010/220 - Target Address

definition: Target address (24-bits address) assigned uniquely to each Target.

Element
bit size: 24
Raw Content

I010/245 - Target Identification

definition: Target (aircraft or vehicle) identification in 8 characters.

Group

I010/245/STI

Element
bit size: 2
Values:

0: Callsign or registration downlinked from transponder
1: Callsign not downlinked from transponder
2: Registration not downlinked from transponder

Spare bits: 6

I010/245/CHR - Characters 1-8 (Coded on 6 Bits Each) Defining Target Identification

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

Notes:

- See ICAO document Annex 10, Volume I, Part I, section 3.8.2.9 for the coding rules.

I010/250 - Mode S MB Data

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

Repetitive

Regular, 1 byte(s) REP field size.

Group

I010/250/MBDATA

description: 56-bit message conveying Mode S Comm B message data

Element
bit size: 56
Raw Content

I010/250/BDS1

description: Comm B Data Buffer Store 1 Address

Element
bit size: 4
Raw Content

I010/250/BDS2

description: Comm B Data Buffer Store 2 Address

Element
bit size: 4
Raw Content

Notes:

- For the transmission of BDS20, item 245 is used.

I010/270 - Target Size and Orientation

definition: Target size defined as length and width of the detected target, and orientation.

Extended

I010/270/LENGTH - Length

Element
bit size: 7
Unsigned quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”

(FX) - extension bit

I010/270/ORIENTATION - Orientation

Element
bit size: 7
Unsigned quantity
LSB = $360/2^7$ ° ≈ 2.8125 °
unit: ”°”

(FX) - extension bit

I010/270/WIDTH - Width

Element
bit size: 7
Unsigned quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”

(FX) - extension bit

Notes:

- The orientation gives the direction which the aircraft nose is pointing, relative to the Geographical North.

I010/280 - Presence

definition: Positions of all elementary presences constituting a plot.

Repetitive

Regular, 1 byte(s) REP field size.

Group

I010/280/DRHO

description: Difference between the radial distance of the plot centre and that of the presence.

Element
bit size: 8
Signed quantity
LSB = 1 m ≈ 1.0 m
unit: ”m”
>= −127.0
<= 127.0

I010/280/DTHETA

description: Difference between the azimuth of the plot centre and that of the presence.

Element
bit size: 8
Signed quantity
LSB = 3/20 ° ≈ 0.15 °
unit: ”°”
>= −19.05
<= 19.05

I010/300 - Vehicle Fleet Identification

definition: Vehicle fleet identification number.

Element
bit size: 8
Values:

0: Unknown
1: ATC equipment maintenance
2: Airport maintenance
3: Fire
4: Bird scarer
5: Snow plough
6: Runway sweeper
7: Emergency
8: Police
9: Bus
10: Tug (push/tow)
11: Grass cutter
12: Fuel
13: Baggage
14: Catering
15: Aircraft maintenance
16: Flyco (follow me)

I010/310 - Pre-programmed Message

definition: Number related to a pre-programmed message that can be transmitted by a vehicle.

Group

I010/310/TRB

Element
bit size: 1
Values:

0: Default
1: In Trouble

I010/310/MSG

Element
bit size: 7
Values:

1: Towing aircraft
2: “Follow me” operation
3: Runway check
4: Emergency operation (fire, medical...)
5: Work in progress (maintenance, birds scarer, sweepers...)

I010/500 - Standard Deviation of Position

definition: Standard Deviation of Position

Group

I010/500/DEVX - Standard Deviation of X Component

Element
bit size: 8
Unsigned quantity
LSB = $1/2^2$ m ≈ 0.25 m
unit: ”m”

I010/500/DEVY - Standard Deviation of Y Component

Element
bit size: 8
Unsigned quantity
LSB = $1/2^2$ m ≈ 0.25 m
unit: ”m”

I010/500/COVXY - Covariance in Two’s Complement Form

Element
bit size: 16
Signed quantity
LSB = $1/2^2$ m ≈ 0.25 m
unit: ”m”

I010/550 - System Status

definition: Information concerning the configuration and status of a System.

Group

I010/550/NOGO - Operational Release Status of the System

Element
bit size: 2
Values:

0: Operational
1: Degraded
2: NOGO

I010/550/OVL - Overload Indicator

Element
bit size: 1
Values:

0: No overload
1: Overload

I010/550/TSV - Time Source Validity

Element
bit size: 1
Values:

0: Valid
1: Invalid

I010/550/DIV

Element
bit size: 1
Values:

0: Normal Operation
1: Diversity degraded

I010/550/TTF

Element
bit size: 1
Values:

0: Test Target Operative
1: Test Target Failure

Spare bits: 2

Notes:

- For a radar, bit-4 (DIV) is set to zero either when diversity is not used, or when diversity is used and operational.

I010/RE - Reserved Expansion Field

definition: Expansion

Explicit (ReservedExpansion)

I010/SP - Special Purpose Field

definition: Special Purpose Field

Explicit (SpecialPurpose)

User Application Profile

- 1: `I010/010` - Data Source Identifier
- 2: `I010/000` - Message Type
- 3: `I010/020` - Target Report Descriptor
- 4: `I010/140` - Time of Day
- 5: `I010/041` - Position in WGS-84 Co-ordinates
- 6: `I010/040` - Measured Position in Polar Co-ordinates
- 7: `I010/042` - Position in Cartesian Co-ordinates
- (FX) - Field extension indicator
- 8: `I010/200` - Calculated Track Velocity in Polar Co-ordinates
- 9: `I010/202` - Calculated Track Velocity in Cartesian Co-ordinates
- 10: `I010/161` - Track Number
- 11: `I010/170` - Track Status
- 12: `I010/060` - Mode-3/A Code in Octal Representation
- 13: `I010/220` - Target Address
- 14: `I010/245` - Target Identification
- (FX) - Field extension indicator
- 15: `I010/250` - Mode S MB Data
- 16: `I010/300` - Vehicle Fleet Identification
- 17: `I010/090` - Flight Level in Binary Representation
- 18: `I010/091` - Measured Height
- 19: `I010/270` - Target Size and Orientation
- 20: `I010/550` - System Status
- 21: `I010/310` - Pre-programmed Message

- (FX) - Field extension indicator
- 22: `I010/500` - Standard Deviation of Position
- 23: `I010/280` - Presence
- 24: `I010/131` - Amplitude of Primary Plot
- 25: `I010/210` - Calculated Acceleration
- *Spare*
- 27: `I010/SP` - Special Purpose Field
- 28: `I010/RE` - Reserved Expansion Field
- (FX) - Field extension indicator