

# Asterix category 010 - Transmission of Monosensor Surface Movement Data

**category:** 010

**edition:** 1.1

**date:** 2007-03-01

## 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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M stands for mandatory, O for optional, X for never present. :

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	0	X	X	X
I010/041	Position in WGS-84 Coordinates	0	X	X	X
I010/042	Position in Cartesian Coordinates	0	X	X	X
I010/060	Mode-3/A Code	0	X	X	X
I010/090	Flight Level in Binary Representation	0	X	X	X
I010/091	Measured Height	0	X	X	X
I010/131	Amplitude of Primary Plot	0	X	X	X
I010/140	Time of Day	M	M	M	M
I010/161	Track Number	0	X	X	X
I010/170	Track Status	0	X	X	X
I010/200	Calculated Track Velocity in Polar Coordinates	0	X	X	X
I010/202	Calculated Track Velocity in Cartesian Coordinates	0	X	X	X

I010/210 Calculated Acceleration 0 X X X  
 I010/220 Target Address 0 X X X  
 I010/245 Target Identification 0 X X X  
 I010/250 Mode S MB Data 0 X X X  
 I010/270 Target Size & Orientation 0 X X X  
 I010/280 Presence 0 X X X  
 I010/300 Vehicle Fleet Identification 0 X X X  
 I010/310 Pre-programmed Message 0 X X X  
 I010/500 Standard Deviation of Position 0 X X X  
 I010/550 System Status X 0 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  $\approx$  1.0 m  
unit: "m"  
 $\leq$  65536.0

### **I010/040/TH - Theta**

Element  
bit size: 16  
Unsigned quantity  
LSB =  $360/2^{16} \text{ }^\circ \approx 5.4931640625e-3 \text{ }^\circ$   
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 =  $180/2^{31} \text{ }^\circ \approx 8.381903171539306640625e-8 \text{ }^\circ$   
unit: "°"  
 $\geq -90.0$   
 $\leq 90.0$

### **I010/041/LON - Longitude**

Element  
bit size: 32  
Signed quantity  
LSB =  $180/2^{31} \text{ }^\circ \approx 8.381903171539306640625e-8 \text{ }^\circ$   
unit: "°"  
 $\geq -180.0$   
 $< 180.0$

## **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  $\approx$  1.0 m  
unit: "m"  
 $\geq -32768.0$   
 $\leq 32768.0$

### **I010/042/Y - Y Coordinate**

Element  
bit size: 16  
Signed quantity  
LSB = 1 m  $\approx$  1.0 m  
unit: "m"  
 $\geq -32768.0$   
 $\leq 32768.0$

### **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  $\approx$  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  $\approx$  6.25 ft  
unit: "ft"  
 $\geq -204800.0$   
 $\leq 204800.0$

#### **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  $\approx$  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  $\approx 6.103515625e-5$  NM/s

unit: "NM/s"

$\leq 2.0$

#### **I010/200/TRA - Track Angle**

Element

bit size: 16

Unsigned quantity

LSB =  $360/2^{16}$  °  $\approx 5.4931640625e-3$  °

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  $\approx 6.25e-2$  m/s

unit: "m/s"

$\geq -8192.0$

$\leq 8192.0$

#### **I010/202/VY - Y Velocity**

Element

bit size: 16

Signed quantity

LSB =  $1/2^4$  m/s  $\approx 6.25e-2$  m/s

unit: "m/s"

$\geq -8192.0$

$\leq 8192.0$

### **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/s<sup>2</sup>  $\approx 6.25e-2$  m/s<sup>2</sup>

unit: "m/s<sup>2</sup>"

$\geq -31.0$

$\leq 31.0$

#### **I010/210/AY - Y Acceleration**

Element  
bit size: 8  
Signed quantity  
 $\text{LSB} = 1/2^4 \text{ m/s}^2 \approx 6.25e - 2 \text{ m/s}^2$   
unit: "m/s<sup>2</sup>"  
 $\geq -31.0$   
 $\leq 31.0$

### **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  $\approx$  1.0 m  
unit: "m"

(FX) - extension bit

#### **I010/270/ORIENTATION - Orientation**

Element  
bit size: 7  
Unsigned quantity  
LSB =  $360/2^7$  °  $\approx$  2.8125 °  
unit: "°"

(FX) - extension bit

#### **I010/270/WIDTH - Width**

Element  
bit size: 7  
Unsigned quantity  
LSB = 1 m  $\approx$  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  $\approx$  1.0 m  
unit: "m"  
 $\geq -127.0$   
 $\leq 127.0$

#### **I010/280/DTHETA**

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

Element  
bit size: 8  
Signed quantity  
LSB =  $3/20^\circ \approx 0.15^\circ$   
unit: "°"  
 $\geq -19.05$   
 $\leq 19.05$

#### **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  
 $\text{LSB} = 1/2^2 \text{ m} \approx 0.25 \text{ m}$   
unit: "m"

### **I010/500/DEVY - Standard Deviation of Y Component**

Element  
bit size: 8  
Unsigned quantity  
 $\text{LSB} = 1/2^2 \text{ m} \approx 0.25 \text{ m}$   
unit: "m"

### **I010/500/COVXY - Covariance in Two's Complement Form**

Element  
bit size: 16  
Signed quantity  
 $\text{LSB} = 1/2^2 \text{ m} \approx 0.25 \text{ m}$   
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