EUROCONTROL Specification for Surveillance Data Exchange

ASTERIX Part 10 Category 063 Sensor Status Reports

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Abstract

This document specifies the contents of ASTERIX Category 063 messages used for the transmission of Sensor Status Reports. Sensor for the purposes of this document may also include other SDPS.

Keywords

Data Exchange	Messages	SAC	SIC
Data Category	Data Field	Data Block	Data Item
ASTERIX	UAP	Sensor Status Reports	SDPS

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DOCUMENT APPROVAL

This document has been approved by the ASTERIX Maintenance Group (AMG).

For management approval of the complete set of ASTERIX documentation refer to Part 1.

DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION	DATE	REASON FOR CHANGE	SECTIONS PAGES AFFECTED
0.10	Jul. 1999	Creation of EUROCONTROL document	ALL
0.11	Dec. 1999	Modifications in definitions and items	ALL
0.12	Feb. 2000	Document renamed, New message type and item added	ALL
0.13	Jun. 2000	Modifications in items	ALL
0.14	Dec. 2000	Modifications in items	ALL
0.15	Mar. 2001	Editorial corrections	ALL
0.16	Oct. 2002	Suppression of data related to the transmission of Service Information messages	ALL
0.17	Dec. 2002	Modification of I063/060 Suppression of I063/100, I063/101, I063/102	5.2.5
0.18	March 2003	Modification of the title Correction of the UAP	5.3
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0.20	August 2003	Addition of “no plot warning” bit to I063/060	5.2.5
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1.1	March 2005	Document Identification Sheet updated Document Approval page updated	Page ii Page iii
1.2	April 2007	Document Identification Sheet updated Document Approval page updated	Page ii Page iii
1.3	July 2007	Length of item I063/070 in UAP corrected	5.3
1.4	May 2014	Reference to ASTERIX Part 1 updated Format and Octet count in I063/080 corrected Length of item I063/060 in UAP corrected	2.2 5.2.7 5.3

1.5	August 2019	Migration to new Template Definition of I063/070 updated	ALL
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1. INTRODUCTION

1.1 Scope

This document describes the structure for the transmission of sensor status messages. For the purposes of this document a sensor may also be another SDPS.

This document defines the data out of Category 063.

2. REFERENCES

2.1 General

The following Documents and Standards contain provisions which, through references in this text, constitute provisions of this EUROCONTROL Standard Document.

At the time of publication of this EUROCONTROL Standard Document, the editions indicated for the referenced documents and standards were valid.

Any revision of the referenced ICAO Documents shall be immediately taken into account to revise this EUROCONTROL Standard Document.

Revisions of the other referenced documents shall not form part of the provisions of this EUROCONTROL Standard Document until they are formally reviewed and incorporated into this EUROCONTROL Standard Document.

In the case of a conflict between the requirements of this EUROCONTROL Standard Document and the contents of the other referenced documents, this EUROCONTROL Standard Document shall take precedence.

2.2 Reference Documents

1. EUROCONTROL Specification for Surveillance Data Exchange: Part 1 “All Purpose Structured EUROCONTROL Surveillance Information Exchange (ASTERIX)”, Edition 3.1, 23/11/2021, Reference EUROCONTROL-SPEC-0149

3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

3.1 Definitions

For the purposes of this EUROCONTROL Document, the following definitions shall apply:

3.1.1	**Broadcast Service:**	A service not needing a session establishment between a user and a SDPS.
3.1.2	**Catalogue of Data Items:**	List of all the possible Data Items of each Data Category describing the Data Items by their reference, structure, size and units (where applicable).
3.1.3	**Data Block:**	Unit of information seen by the application as a discrete entity by its contents. A Data Block contains one or more Record(s) containing data of the same category.
3.1.4	**Data Category:**	Classification of the data in order to permit inter alia an easy identification.
3.1.5	**Data Field:**	Physical implementation for the purpose of communication of a Data Item, it is associated with a unique Field Reference Number and is the smallest unit of transmitted information.
3.1.6	**Data Item:**	The smallest unit of information in each Data Category.
3.1.7	**Record:**	A collection of transmitted Data Fields of the same category preceded by a Field Specification field, signalling the presence/absence of the various Data Fields
3.1.8	**Service:**	An SDPS information service is uniquely identified by a service identification and is composed of a track element and a sensor element. A track element is characterised by the track selection (e.g. set of Mode-3/A codes, filtering in height, primary only, secondary only…), the track item selection (e.g. WGS-84 position, Time of Day…), the track transmission characteristics (e.g. synchronised on sensor, periodical, a-periodical event-triggered). A sensor element is characterised by the sensor selection, the sensor item selection, the sensor transmission characteristics.
3.1.9	**Session:**	Point to point connection between a user and a SDPS.
3.1.10	**User Application Profile:**	The mechanism for assigning Data Items to Data Fields, and containing all necessary information which needs to be standardised for the successful encoding and decoding of the messages.

3.2 Acronyms and Abbreviations

For the purposes of this EUROCONTROL Document, the following shall apply:

°	Degree (angle)
ADS-B	Automatic Dependent Surveillance - Broadcast
ASTERIX	**A**ll Purpose **ST**ructured **E**urocontrol su**R**veillance **I**nformation E**X**change
CAT	Data Category
FRN	Field Reference Number
FSPEC	Field Specification
FX	Field Extension Indicator
ICAO	International Civil Aviation Organization
LEN	Length Indicator
LSB	Least Significant Bit
PSR	Primary Surveillance Radar
RE	Reserved Expansion Indicator
REP	Field Repetition Indicator
s	second, unit of time
SAC	System Area Code
SDPS	Surveillance Data Processing System
SIC	System Identification Code
SP	Special Purpose Indicator
SSR	Secondary Surveillance Radar
SURT	Surveillance Team
UAP	User Application Profile (see Definitions)
UTC	Co-ordinated Universal Time
WGS-84	World Geodetic System 84

4. GENERAL PRINCIPLES

4.1 General

This document describes the application of ASTERIX to Sensor Information messages. Category 063 is used to transmit from the SDPS to the User information related to the source systems used by the SDPS.

Since it is also possible to use data from another SDPS as input (amalgamation or track fusion) the Reserved Expansion Field has been defined to carry information specific to an SDPS used as input to the processing.

One message reports the status for one sensor/SDPS. For reports referring to an input SDPS the Reserved Expansion Field needs to be included.

4.2 Time Management

The timestamping shall comply with ICAO Annex 5.

4.3 Unused Bits in Data Items.

Decoders of ASTERIX data shall never assume and rely on specific settings of spare or unused Bits. However in order to improve the readability of binary dumps of ASTERIX records, it is recommended to set all spare Bits to zero.

4.4 User Application Profile and Data Blocks

A single User Application Profile (UAP) is defined and shall be used for SDPS Sensor Status Reports.

Data Blocks shall have the following layout.

CAT = 063	**LEN**	**FSPEC**	Items of the first record		**FSPEC**	Items of the last record

where:

- Data Category (CAT) = 063, is a one-octet field indicating that the Data Block contains SDPS status messages;
- Length Indicator (LEN) is a two-octet field indicating the total length in octets of the Data Block, including the CAT and LEN fields;
- FSPEC is the Field Specification.

4.5 Composition of messages

Messages shall be composed of Data Items assembled in the order defined by the Field Reference Number (FRN) in the associated UAP.

When sent, items shall always be transmitted in a Record with the corresponding FSPEC bits set to one.

5. LAYOUT OF MESSAGES

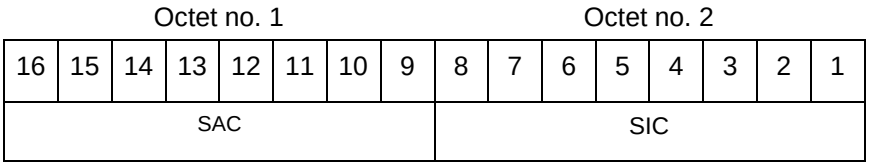
5.1 Standard Data Items

The standardised Data Items which shall be used for the transmission of SDPS service messages are described in the following pages.

5.2 Description of Standard Data Items

5.2.1 Data Item I063/010, Data Source Identifier

Definition : Identification of the SDPS sending the data
Format : Two-octet fixed length Data Item
Structure:



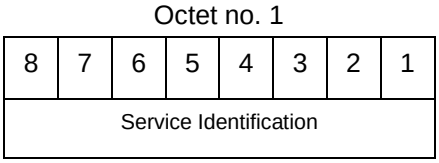
Bits 16/9	(SAC)	System Area Code
Bits 8/1	(SIC)	System Identification Code

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

Encoding Rule :
This Item shall be present in every ASTERIX record

5.2.2 Data Item I063/015, Service Identification

Definition : Identification of the service provided to one or more users.
Format : One-Octet fixed length data item.
Structure:



Bits 8/1	Service Identification

NOTE - The service identification is allocated by the SDPS

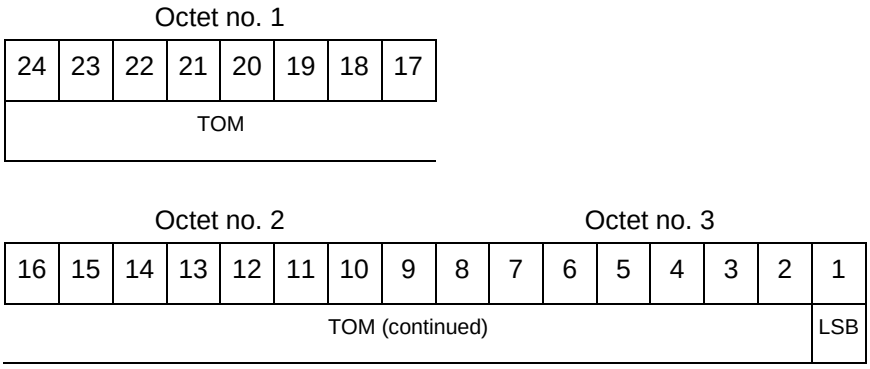
Encoding Rule :
This Item is optional

5.2.3 Data Item I063/030, Time of Message

Definition : Absolute time stamping of the message, in the form of elapsed time since last midnight, expressed as UTC.

Format : Three-Octet fixed length data item.

Structure:



Bits 24/1	(TOM)	Time of Message
Bit 1	(LSB)	= 2^{-7} s = 1/128 s

NOTE - The time of the day value is reset to zero at every midnight.

Encoding Rule :

This Item shall be present in every ASTERIX record

5.2.4 Data Item I063/050, Sensor Identifier

Definition : Identification of the Sensor to which the provided information are related.

Format : Two-byte fixed length data item

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SAC								SIC							

Bits 16/9	(SAC)	System Area Code
Bits 8/1	(SIC)	System Identification Code

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

NOTE - If the SAC/SIC refers to an SDPS used as input, the respective sensor status information will be transmitted using the Reserved Expansion Field.

Encoding Rule :

This Item shall be present in every ASTERIX record

5.2.5 Data Item I063/060, Sensor Configuration and Status

Definition : Configuration and status of the sensor

Format : Variable length data item comprising a first part of one octet, followed by one-octet extensions as necessary

Structure

Of First Part :

8	7	6	5	4	3	2	1
CON		PSR	SSR	MDS	ADS	MLT	FX

Bits 8/7 (CON) Sensor Connection Status from SDPS (Note 1)
= 00 Operational
= 01 Degraded
= 10 Initialization
= 11 Not currently connected

Bit 6 (PSR) PSR Status from Sensor (Note 2)
= 0 PSR GO
= 1 PSR NOGO

Bit 5 (SSR) SSR Status from Sensor (Note 2)
= 0 SSR GO
= 1 SSR NOGO

Bit 4 (MDS) Mode S Status from Sensor (Note 2)
= 0 Mode S GO
= 1 Mode S NOGO

Bit 3 (ADS) ADS-B Status from Sensor (Note 2)
= 0 ADS GO
= 1 ADS NOGO

Bit 2 (MLT) MLAT Status from Sensor (Note 2)
= 0 MLT GO
= 1 MLT NOGO

Bit 1 (FX) = 0 End of Data Item
= 1 Extension into first extension

Structure

Of First Extension :

8	7	6	5	4	3	2	1
OPS	ODP	OXT	MSC	TSV	NPW	0	FX

Bit 8 (OPS) Operational Release Status of the System from sensor (Note 2)
= 0 System is released for operational use
= 1 Operational use of System is inhibited,

Bit 7 (ODP) Data Processor Overload Indicator from sensor (Note 2)
= 0 Default, no overload
= 1 Overload in DP

Bit 6 (OXT) Transmission Subsystem Overload Status from sensor (Note 2)
= 0 Default, no overload
= 1 Overload in transmission subsystem

Bit 5 (MSC) Monitoring System Connected Status from sensor (Note 2)
= 0 Monitoring system connected
= 1 Monitoring system disconnected

Bit 4 (TSV) Time Source Validity from sensor (Note 2)
= 0 Valid
= 1 Invalid

Bit 3 (NPW) No Plot Warning (Note 4)
= 0 Default (no meaning)
= 1 No plots being received

Bit 2 (Spare) spare Bit set to zero

Bit 1 (FX) = 0 End of Data Item
= 1 Extension into next extension

Structure

Of Second Extension :

8	7	6	5	4	3	2	1
TTF		SPO		0	0	0	FX

Bits 8/7	(TTF)	Test Target Failure Status from sensor (Note 2)
Bit 8	(TTF#EP)	Element Populated Bit = 0 Element not populated = 1 Element populated
Bit 7	(TTF#VAL)	Test Target Failure Status values = 0 Test Target Operative = 1 Test Target Failure
Bits 6/5	(SPO)	Indication of spoofing attack from sensor (Note 2)
Bit 6	(SPO#EP)	Element Populated Bit = 0 Element not populated = 1 Element populated
Bit 5	(SPO#VAL)	Indication of spoofing attack values = 0 No spoofing detected = 1 Potential spoofing attack
Bits 4/2	(Spare)	spare Bits set to zero
Bit 1	(FX)	= 0 End of Data Item = 1 Extension into next extension

NOTES

1. The information (CON) is derived by the SDPS, is implementation dependent and **shall** be described in the ICD.
2. The information (PSR), (SSR), (MDS), (ADS) and (MLT) and well as (OPS), (ODP), (OXT), (MSC), (TSV), (SPO) and (TTF) are derived from the monosensor service message categories and are only relevant for operational sensors (i.e. CON = 0).
3. The sensor status derived from the SDPS indicating the use of a specific technology is provided in I063/REF/SSFS/PSR, I063/REF/SSFS/SSR, I063/REF/SSFS/MDS, I063/REF/SSFS/ADS and I063/REF/SSFS/MLT.
4. This legacy I063/060/NPW “No Plot Warning” might be either sensor or SDPS derived. A SDPS derived “No Plot Warning” is available in I063/REF/SSS/NPWS.

Encoding Rule :

This Item is optional

5.2.6 Data Item I063/070, Time Stamping Bias

Definition : Plot Time stamping bias, in two's complement form
Format : Two-byte fixed length data item.

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
TSB															LSB

Bit 1 (LSB) = 1ms

Encoding Rule :
This Item is optional

5.2.7 Data Item I063/080, SSR / Mode S Range Gain and Bias

Definition : SSR / Mode S Range Gain and Range Bias, in two's complement form.
Format : Four-byte fixed length data item.

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SRG															LSB

Octet no. 3								Octet no. 4							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SRB															LSB

Bits 32/17	(SRG)	SSR / Mode S Range Gain (LSB) = 10^{-5}
Bits 16/1	(SRB)	SSR / Mode S Range Bias (LSB) = 1/128 NM

NOTE - The following formula is used to correct range:

$$\rho_{corrected} = \left(\frac{\rho_{measured} - range\_bias}{1 + range\_gain} \right)$$

Encoding Rule :
This Item is optional

5.2.8 Data Item I063/081, SSR / Mode S Azimuth Bias

Definition : SSR / Mode S Azimuth Bias, in two's complement form.
Format : Two-byte fixed length data item.

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
SAB															LSB

Bit 1 (LSB) = 360°/ 2^{16} = 0.0055°

NOTE - The following formula is used to correct azimuth:

$$\theta_{corrected} = \theta_{measured} - azimuth\_bias$$

Encoding Rule :
This Item is optional

5.2.9 Data Item I063/090, PSR Range Gain and Bias

Definition : PSR Range Gain and PSR Range Bias, in two's complement form.
Format : Four-byte fixed length data item.

Octet no. 1								Octet no. 2							
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
PRG															LSB

Octet no. 3								Octet no. 4							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PRB															LSB

Bits 32/17 (PRG) PSR Range Gain
(LSB) = 10^{-5}

Bits 16/1 (PRB) PSR Range Bias
(LSB) = 1/128 NM

NOTE - The following formula is used to correct range:

$$\rho_{corrected} = \left(\frac{\rho_{measured} - range\_bias}{1 + range\_gain} \right)$$

Encoding Rule :
This Item is optional

5.2.10 Data Item I063/091, PSR Azimuth Bias

Definition : PSR Azimuth Bias, in two's complement form.
Format : Two-byte fixed length data item.

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PAB															LSB

Bit 1 (LSB) = 360°/ 2^{16} = 0.0055°

NOTE - The following formula is used to correct azimuth:

$$\theta_{corrected} = \theta_{measured} - azimuth\_bias$$

Encoding Rule :
This Item is optional

5.2.11 Data Item I063/092, PSR Elevation Bias

Definition : PSR Elevation Bias, in two's complement form.
Format : Two-byte fixed length data item.

Octet no. 1								Octet no. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
PEB															LSB

Bit 1 (LSB) = 360°/ 2^{16} = 0.0055°

Encoding Rule :
This Item is optional

5.3 User Application Profile for Category 063

The following User Application Profile shall be used for the transmission of Sensor status messages.

Table 1 – Sensor Status Messages UAP

FRN	Data Item	Information	Length
1	**I063/010**	Data Source Identifier	**2**
2	**I063/015**	Service Identification	**1**
3	**I063/030**	Time of Message	**3**
4	**I063/050**	Sensor Identifier	**2**
5	**I063/060**	Sensor Configuration and Status	**1+1**
6	**I063/070**	Time Stamping Bias	**2**
7	**I063/080**	SSR/Mode S Range Gain and Bias	**4**
FX	**-**	Field extension indicator	**-**
8	**I063/081**	SSR/Mode S Azimuth Bias	**2**
9	**I063/090**	PSR Range Gain and Bias	**4**
10	**I063/091**	PSR Azimuth Bias	**2**
11	**I063/092**	PSR Elevation Bias	**2**
12	**-**	spare	**-**
13	**RE**	Reserved Expansion Field	**1+1+**
14	**SP**	Special Purpose Field	**1+1+**
FX	**-**	Field extension indicator	**-**

In the above table

- the first column indicates the Field Reference Number (FRN) associated to each Data Item used in the UAP;
- the fourth column gives the format and the length of each item, a stand-alone figure indicates the octet-count of a fixed-length Data Item, 1+ indicates a variable-length Data Item comprising a first part of 1 octet followed by n-octets extensions as necessary.

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