Application Note AN112-182

Data Interface Specification Document Asterix CAT182

Title	Description	Version	Date
Asterix Category (CAT) 182 ($B6_h$)	**Flight Extended State Data**	**1.1**	**August 21, 2019**

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1. General

The purpose of this Asterix Pseudo Category is to transmit data that are not ADS-B data items made available by CAT 021. The items concerned are Mode-S packets in response to Mode-S radar Enhanced (EHS) interogations UF20 and UF21.

These data packets are contained inside the MB fields of Downlink Formats DF20 and DF21. Asterix provides CAT 048 for undecoded carriage of these MB fields, but decoding has to be performed on the client side. Therefore CAT 182 eases client side processing as it provides fully decoded data.

1.1. Disclaimer and Warning

Mode-S data items transmitted by CAT 182 are decoded by using a heuristic method, because the Mode-S UF interrogation packets are not known to the PlaneTRack surveillance receive, the aircraft identity is not CRC secured and the MB/BDS type of response must be determined by estimation according to certain bit patterns. This method yields 95% correct results, but the data items cannot be verified and therefore must not be use for operational purposes. Planevision Systems cannot warrant the correctness of the data transmitted, nor can it be held liable for any malfunction or damages by the use of these data. By using these data the user holds harmless Planevision Systems from any claims with regard to the use of these data.

1.2 User Application Profile and Data Blocks

CAT = 182 ($B6_h$)	**LEN**	**FSPEC**	**Items of the first record**		**FSPEC**	**Items of the last record**
1 octet	2 octets	1, 2 or 3 octets			n.a.	n.a.

Note: only 1 record will be sent for each airframe

1.3 Standard Data Items

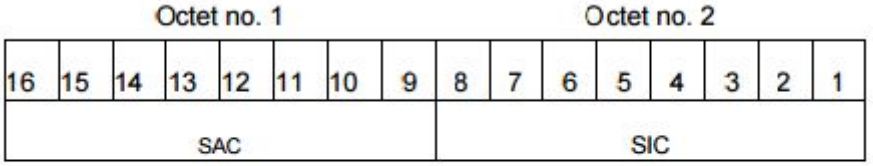
Data Item Reference Number	Description	Resolution	Octets (Bytes)	Remark
I182/010	Data Source Identifier	n.a.	2	mandatory
I182/080	Target Address	n.a.	3	mandatory
I182/085	Time of report	1/128 sec	3	mandatory
I182/091	Distance from receiver	0.1 NM	2	optional
I182/095	Flight Status	n.a.	1	optional
I182/100	Age of BDS 4.0 data	1 sec	1	optional
I182/105	Age of BDS 5.0 data	1 sec	1	optional
I182/110	Age of BDS 6.0 data	1 sec	1	optional
I182/120	Selected Altitude (from BDS 4.0)	0.25 FL	2	optional
I182/125	Altimeter setting (from BDS 4.0)	1 hPa	1	optional
I182/135	True Air Speed (from BDS 5.0)	1 kt	2	optional
I182/140	Roll Angle (from BDS 5.0)	1 deg/sec	2	optional
I182/145	Track Angle Rate (from BDS 5.0)	1 deg/sec	2	optional
I182/150	Ground Speed (from BDS 5.0)	1 kt	2	optional
I182/155	Magnetic Heading (from BDS 6.0)	1 deg	2	optional
I182/160	Indicated Air Speed (from BDS 6.0)	1 kt	2	optional
I182/165	Mach number (from BDS 6.0)	0.001 M	2	optional
I182/170	Barometric Vertical Rate (from BDS 6.0)	1 ft/min	2	optional
I182/175	Geometric Vertical Rate (from BDS 6.0)	1 ft/min	2	optional

2. Description of Standard Data Items

2.1 Data Item I182/010, Data Source Identifier

Data Item	Name	Definition	Format	Remark
I182/010	Data Source Identifier	Identification of the system sending the data	Two-octet fixed length	This Item shall be present in every ASTERIX record

Encoding Rule



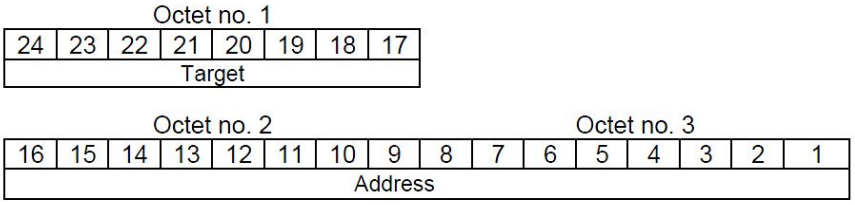
bits-16/9 (SAC) System Area Code

bits 8/1 (SIC) System Identification Code

2.2 Data Item I182/080, Target Address

Data Item	Name	Definition	Format	Remark
I182/080	Target Address	Target address (emitter identifier) assigned uniquely to each target. (ICAO 24 Bit)	Three-octet fixed length	This Item shall be present in every ASTERIX record

Encoding Rule



bits-24/1 24-Bits address, A23 to A0

2.3 Data Item I182/085, Time of Report

Data Item	Name	Definition	Format	Remark
I182/085	Time of Report	Time of report, in the form of elapsed time since last midnight, expressed as UTC.	Three-octet fixed length, binary	This Item is mandatory

Encoding Rule

Octet no. 1								Octet No. 2							
24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
MSB															

Octet no. 3							
8	7	6	5	4	3	2	1
LSB							

NOTE -: LSB = 2^{-7} sec = 1/128 sec, however the accuracy of the timestamp is 1 second
NOTE - The time of applicability value is reset to zero at every midnight.

2.4 Data Item I182/091, Distance from Receiver

Data Item	Name	Definition	Format	Remark
I182/091	Distance from receiver	Slant range distance from receiver to flight, in the form of 0.1 Nautical Miles multiple	Two-octet fixed length, binary	This Item is mandatory

Encoding Rule

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

NOTE: Resolution = 0.1 NM

2.5 Data Item I182/095, Flight Status

Data Item	Name	Definition	Format	Remark
I182/095	Flight Status		One-octet fixed length	This Item is optional

Encoding Rule

Octet no. 1							
8	7	6	5	4	3	2	1
n.a	n.a	n.a	n.a	Autopilot Mode			Ground Status

bits 4-2 Encoding for Autopilot Mode (from DF20/21 BDS 4.0)

0 = no data available
1 = VNAV
2 = Alt Hold mode
3 = VNAV + Alt Hold
4 = Approach mode
5 = VNAV + Approach mode
6 = Alt Hold + Approach mode
7 = VNAV + Alt Hold + Approach

bit 1 Ground status is set, when an On-ground condition is received (1 = On-Ground)

NOTE: If the encoding rule results in a Flight Status data item of 0, this data item is not transmitted.

2.6 Data Item I182/100, Age of BDS4.0 data

Data Item	Name	Definition	Format	Remark
I182/100	Age of BDS4.0 data	Age of BDS4.0 data	One-octet fixed length, binary	This Item is optional

Encoding Rule

Octet no. 1							
8	7	6	5	4	3	2	1
LSB							

NOTE: LSB = 1 sec.
NOTE: This data item is not transmitted if no BDS4.0 data were received.

2.7 Data Item I182/105, Age of BDS5.0 data

Data Item	Name	Definition	Format	Remark
I182/105	Age of BDS5.0 data	Age of BDS5.0 data	One-octet fixed length, binary	This Item is optional

Encoding Rule

Octet no. 1							
8	7	6	5	4	3	2	1
LSB							

NOTE: LSB = 1 sec.
NOTE: This data item is not transmitted if no BDS5.0 data were received.

2.8 Data Item I182/110, Age of BDS6.0 data

Data Item	Name	Definition	Format	Remark
I182/110	Age of BDS6.0 data	Age of BDS6.0 data	One-octet fixed length, binary	This Item is optional

Encoding Rule

Octet no. 1							
8	7	6	5	4	3	2	1
LSB							

NOTE: LSB = 1 sec.
NOTE: This data item is not transmitted if no BDS6.0 data were received.

2.9 Data Item I182/120, Selected Altitude

Data Item	Name	Definition	Format	Remark
I182/120	Selected Altitude	The Selected Altitude as provided by the avionics and corresponding either to the MCP/FCU Selected Altitude (the ATC cleared altitude entered by the flight crew into the avionics) or to the FMS Selected Altitude.	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bit-16 (SAS) Source Availability
= 0 No source information provided
= 1 Source Information provided

bit-15/14 (Source) = 00 Unknown
= 01 Aircraft Altitude (Holding Altitude)
= 10 MCP/FCU Selected Altitude
= 11 FMS Selected Altitude

bits- 13/1 (Altitude) Altitude in two’s complement form
LSB = 25 ft
-1300ft <= Altitude <= 100000ft

NOTE: This data item is derived from DF20/21 BDS4.0.
NOTE: The formatting of this data item corresponds to Asterix CAT021 V2.4 I021/146
NOTE: The Selected Altitude provided in this field is not necessarily the “Target Altitude” as defined by ICAO.
NOTE: The value of “Source” (bits 15/14) indicating “unknown” or “Aircraft Altitude” is kept for backward compatibility as these indications are not provided by “version 2” systems as defined by data item I021/210, bits 6/4.
NOTE: "Altitude" is the Flight Level QNH 1013.25 hPa

2.10 Data Item I182/125, Altimeter Setting

Data Item	Name	Definition	Format	Remark
I182/125	Altimeter Setting	Altimeter Setting	One-octet fixed length, binary	This Item is optional

Encoding Rule

Octet no. 1							
8	7	6	5	4	3	2	1
hPa - 900							

NOTE: This data item is derived from DF20/21 BDS4.0.
NOTE: LSB = 1 hPa
NOTE: 900 hPa must be added to the encoded value, e.g. 113 => 113 + 900 = 1013

2.11 Data Item I182/135, True Airspeed

Data Item	Name	Definition	Format	Remark
I182/135	True Air Speed	True Air Speed in kts	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 True Air Speed
(LSB) = 1 knot

NOTE: This data item is derived from DF20/21 BDS 5.0.
NOTE: The resolution of this data item corresponds to Asterix CAT021 V2.4 I021/151

2.12 Data Item I182/140, Roll Angle

Data Item	Name	Definition	Format	Remark
I182/140	Roll angle	The roll angle, in two's complement form, of an aircraft executing a turn.	Two-octet fixed length, signed binary	This Item is optional

Encoding Rule

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

bits-16/1 Roll Angle
(LSB) = 1 degree
-180 <= Roll Angle <= 180

NOTE - Negative Value indicates "Left Wing Down".
NOTE - Resolution provided by the technology "1090 MHz Extended Squitter" is 1 degree.
NOTE: This data item is derived from DF20/21 BDS 5.0.
NOTE: The resolution of this data item does not correspond to Asterix CAT021 V2.4 I021/230

2.13 Data Item I182/145, Track Angle Rate

Data Item	Name	Definition	Format	Remark
I182/145	Track Angle Rate	Rate of Turn, in two's complement form.	Two-octet fixed length, signed binary	This Item is optional

Encoding Rule

Octet no. 1								Octet No. 2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0	0	0	Track Angle Rate								LSB	

bits-10/1 Track Angle Rate
(LSB) = 1 °/sec
-16°/sec <= Track Angle Rate <= +16°/sec

NOTE - A positive value represents a right turn, whereas a negative value represents a left turn.
NOTE: This data item is derived from DF20/21 BDS 5.0.
NOTE: The resolution of this data item does not correspond to Asterix CAT021 V2.4 I021/165

2.14 Data Item I182/150, Ground Speed

Data Item	Name	Definition	Format	Remark
I182/150	Ground Speed	Ground Speed in kts	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Ground Speed
(LSB) = 1 knot

NOTE: This data item is derived from DF20/21 BDS 5.0.

2.15 Data Item I182/155, Magnetic Heading

Data Item	Name	Definition	Format	Remark
I182/155	Magnetic Heading	Magnetic Heading	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Magnetic Heading
(LSB) = 1 bit

NOTE: This data item is derived from DF20/21 BDS 6.0.
NOTE: The resolution of this data item does not correspond to Asterix CAT021 V2.4 I021/152

2.16 Data Item I182/160, Indicated Air Speed

Data Item	Name	Definition	Format	Remark
I182/160	Indicated Air Speed	Indicated Air Speed in kts	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Air Speed (IAS)
LSB = 1 kt

NOTE: This data item is derived from DF20/21 BDS 6.0.

2.17 Data Item I182/165, Mach Number

Data Item	Name	Definition	Format	Remark
I182/165	Mach Number	Mach Number	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Mach number
LSB = 0.001 M

NOTE: This data item is derived from DF20/21 BDS 6.0.

2.18 Data Item I182/170, Barometric Vertical Rate

Data Item	Name	Definition	Format	Remark
I182/170	Barometric Vertical Rate	Barometric Vertical Rate, in two's complement form	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Barometric Vertical Rate
LSB = 1 ft/min

NOTE: This data item is derived from DF20/21 BDS 6.0.
NOTE: The resolution of this data item does not correspond to Asterix CAT021 V2.4 I021/155

2.19 Data Item I182/175, Geometric Vertical Rate

Data Item	Name	Definition	Format	Remark
I182/175	Geometric Vertical Rate	Geometric Vertical Rate, in two's complement form, with reference to WGS-84.	Two-octet fixed length, binary	This Item is optional

Encoding Rule

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

bits-16/1 Gemeotric Vertical Rate
LSB = 1 ft/min

NOTE: This data item is derived from DF20/21 BDS 6.0.
NOTE: The resolution of this data item does not correspond to Asterix CAT021 V2.4 I021/157

3. User Application Profile for Category 182

Data Block Header

		Information	Length (octets)
		CAT Identifier of Data Block (182 = $B6_h$)*	1
		Length of Data Block in Octets (Bytes)*	2
		FSPEC*	1, 2 or 3

FSPEC contents

FRN	Data Item	Information	Length (octets)
1	I182/010	Data Source Identifier (always 1)*	2
2	I182/080	Target Address (always 1)*	3
3	I182/085	Time of report (always 1)*	3
4	I182/091	Distance from receiver (0 or 1)	2
5	I182/095	Flight Status (0 or 1)	1
6	I182/100	Age of BDS 4.0 data (0 or 1)	1
7	I182/105	Age of BDS 5.0 data (0 or 1)	1
FX	-	(0 or 1)	
8	I182/110	Age of BDS 6.0 data (0 or 1)	1
9	I182/120	Selected Altitude (0 or 1)	2
10	I182/125	Altimeter setting (0 or 1)	1
11	I182/135	True Air Speed (0 or 1)	2
12	I182/140	Roll Angle (0 or 1)	2
13	I182/145	Track Angle Rate (0 or 1)	2
14	I182/150	Ground Speed (0 or 1)	2
FX	-	(0 or 1)	
15	I182/155	Magnetic Heading (0 or 1)	2

16	I182/160	Indicated Air Speed (0 or 1)	2
17	I182/165	Mach Number (0 or 1)	2
18	I182/170	Barometric Vertical Rate (0 or 1)	2
19	I182/175	Geometric Vertical Rate (0 or 1)	2
20		(always 0)	
21		(always 0)	
FX	-	(always 0)	

Note: * these items are mandatory

Record of Revisions

0.1	Aug 21, 2017	Initial issue
1.0	Aug 25, 2017	LSB resolution revised for several items to ease processing; editorial
1.1	Aug 21, 2019	I182/091 marked as optional, I182/150, 170 and 175: RE bit removed