

EUROCONTROL STANDARD DOCUMENT

FOR

RADAR DATA EXCHANGE

Part 3

**Transmission of Monoradar Derived
Weather Information**

SUR.ET1.ST05.2000-STD-03-01

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Abstract

This document describes the application of ASTERIX to the transmission of monoradar derived weather information.

Keywords

Radar Data Source
Data Block

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UAP

Message Structure

Data Item

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DOCUMENT APPROVAL

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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
Proposed	May 1997	<ul style="list-style-type: none">• New format and numbering to comply with EATCHIP Document Configuration rules.• The "S" in SAC/SIC renamed System instead of Source, to allow for both source and destination codes.	ALL
1.0	November 1997	Adoption by the Eurocontrol Permanent Commission	

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FOREWORD

1 Responsible Body

This Standard has been developed and is maintained by the Surveillance Task Force on Radar Data Exchange (STFRDE) of the European Air Traffic Control Harmonisation and Integration Programme (EATCHIP).

2 EATCHIP Work Programme Document

This Standard is identified as deliverable 02 in the EATCHIP Work Programme Document (EWPD), Surveillance Domain, Executive Task 01, Specialist Task 05.

3 Approval of the Standard

3.1 This Standard is adopted in accordance with the procedures outlined in the Directives for Eurocontrol Standardisation, Ref 000 - 2 - 93.

3.2 This Standard becomes effective upon adoption by the Permanent Commission of Eurocontrol.

4 Technical Corrigenda and Amendments

This Standard is kept under review by the responsible body who, when changes or corrections are necessary, will prepare the required amendments or technical corrigenda. The procedure for the maintenance of this Standard is laid down in Annex H of the Directives for the Uniform Drafting and Presentation of Eurocontrol Standard Documents, Ref 000 - 1 - 92.

5 Editorial Conventions

5.1 The format of this Standard complies with the Directives for the Uniform Drafting and Presentation of Eurocontrol Standard Documents.

5.2 The following practice has been adhered to in order to indicate at a glance the status of each statement:

- Normative Elements have been printed in light face roman text;
- Recommended Elements have been printed in light face italics, the status being indicated by the prefix **Recommendation**.

5.3 The following editorial practice has been followed in the writing of specifications:

- for Normative Elements the operative verb "shall" is used;
- for *Recommended Elements* the operative verb "should" is used.

5.4 Any information which is essential to the understanding of a particular indent will be integrated within the text as a note. It will not contain specifications and will be placed immediately after the indent to which it refers.

6 Relationship to Other Standard Documents

This Standard is related to the Eurocontrol Standard for Radar Surveillance in En-Route Airspace and Major Terminal Areas Ref 006 - 95.

7 Status of Annexes to This Document

There are no Annexes to this Part of the Standard Document.

8 Language Used

The original version of this Standard Document is in the English language.

1. INTRODUCTION

1.1 Purpose

1.1.1 General

The present Eurocontrol Standard concerns the transmission of radar related data between radar data sources (e.g. radar stations, Radar Data Processing (RDP) systems) and sinks (end user data processing systems) and describes the message structure for the exchange of radar related data between radar stations and centres and between Air Traffic Control (ATC) centres, to be used in the Eurocontrol area.

The transmission of radar data makes use of the message structure, known by the acronym **ASTERIX**, standing for **All Purpose STructured Eurocontrol Radar Information EXchange**, devised by the Study Group on the Exchange of radar related data between processors of ATC systems, this group was a subgroup of the former Radar Systems Specialist Panel (RSSP), whose responsibilities have been taken over by the EATCHIP Surveillance Team as from April 1994. ASTERIX was approved by the former RSSP at their 15th Meeting held on 1/4 July 1986.

1.1.2 Notification of Differences

Eurocontrol Member States and other States making use of this Standard are required to notify the Agency of any differences between their National Standard for the exchange of radar data and this Eurocontrol Standard and any amendments thereto.

Further, States are invited to keep the Agency currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified.

A specific request for notification of differences will be sent to States immediately after the adoption of each amendment to this Standard.

Differences notified by States will be published as a supplement to this Standard.

1.1.3 Structure of The Eurocontrol Standard for Radar Data Exchange

This Eurocontrol Standard for Radar Data Exchange contains the following Parts:

Part 1: All Purpose Structured Eurocontrol Radar Information Exchange-ASTERIX

This Part contains the specifications and the conventions used in the framework of ASTERIX.

Part 2a: Transmission of Monoradar Target Reports

This Part describes the standard application of ASTERIX for the transmission of monoradar target reports (plots, tracks) from a radar station to one or more RDP system(s).

Part 2b: Transmission of Monoradar Service Messages

This Part describes the standard application of ASTERIX for the transmission of monoradar service messages from a radar station to one or more RDP system(s).

Part 3: Transmission of Monoradar Derived Weather Information

This Part describes the standard application of ASTERIX for the transmission of relatively simple meteorological images of precipitation areas of various intensity levels from a radar station to one or more RDP system(s).

NOTE - Other Parts will be added to this Eurocontrol Standard as new applications using the ASTERIX message structure are identified and deemed suitable to be standardised.

1.2 SCOPE

1.2.1 The present document describes the transmission of relatively simple meteorological images of precipitation areas of various intensity levels, from a radar station to one or more data processing system(s).

1.2.2 This Part of the Eurocontrol Standard specifies the message structure and contents of weather information transmitted by a stand alone radar station conforming to the ASTERIX Standard.

1.2.3 Weather information is data out of Data Category 008.

1.2.4 This Part of the Eurocontrol Standard shall be effective from December 1997.

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 Standard 000-1-92. Directives for the Uniform Drafting and Presentation of Eurocontrol Standard Documents. 1992.
2. Eurocontrol Standard SUR.ET1.ST05.2000-STD-01-01. All Purpose Structured Eurocontrol Radar Information Exchange - ASTERIX.

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3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

3.1 Definitions

For the purposes of this Eurocontrol Standard document, the following definitions shall apply:

- 3.1.1 Calculated Item:** A piece of information (e.g. the position of a target) derived from the raw radar information through an intermediate processing such as transformation of coordinates, tracking, code conversion, etc.
- 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 Measured Item:** A piece of information (e.g. the position of a target) directly derived from the radar information and transmitted without any intermediate processing.
- 3.1.8 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
- 3.1.9 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 Standard Document the following shall apply:

°	Degree (angle)
ASTERIX	All Purpose ST Structured Eurocontrol Radar Information EX change
ATC	Air Traffic Control
CAT	Data Category
EATCHIP	European Air Traffic Control Harmonisation and Integration Programme
EOP	End Of Picture
EWPD	EATCHIP Work Programme Document
f	Scaling factor
FRN	Field Reference Number
FSPEC	Field Specification
FX	Field Extension Indicator
ICAO	International Civil Aviation Organization
LEN	Length Indicator
LSB	Least Significant Bit
NM	Nautical Mile, unit of distance (6 080 feet)
RDP	Radar Data Processing (system)
REP	Field Repetition Indicator
RFS	Random Field Sequencing
RSSP	Radar Systems Specialist Panel
s	second, unit of time
SAC	System Area Code
SIC	System Identification Code
SOP	Start Of Picture
SP	Special Purpose Indicator
SPF	Standard Precision Format
STFRDE	Surveillance Task Force on Radar Data Exchange
UAP	User Application Profile (see Definitions)
UTC	Coordinated Universal Time

4. GENERAL PRINCIPLES

4.1 General

The transmission of monoradar derived weather information requires the transmission of two types of messages:

- data messages containing elements of the weather image;
- control messages.

NOTE - Both type of messages are composed from Data Items belonging to Data Category 008.

4.2 Data Messages

4.2.1 Representation and Transmission of Precipitation Zones

4.2.1.1 Images of precipitation zones shall be represented and transmitted according to one of the three methods as detailed below.

4.2.1.2 Shaded Areas of Polar Vectors

4.2.1.2.1 A zone of precipitation shall be represented by means of a series of closely spaced vectors, expressed in local polar coordinates.

4.2.1.2.2 **Recommendation** This method should typically be applied for the transmission of precipitation zones from a weather data extractor to a remote computer system in an ATC centre for further processing and/or display.

4.2.1.3 Shaded Areas of Cartesian Vectors

4.2.1.3.1 A precipitation zone shall be represented by means of sets of parallel vectors, expressed in a cartesian coordinate system the origin of which is either the radar site reference point, or another site reference point.

4.2.1.3.2 **Recommendation** It should be possible to use more than one shading orientation, to express different precipitation intensity levels.

4.2.1.4 Contours of Precipitation Zones

4.2.1.4.1 A precipitation zone shall be represented by a set of consecutive summit points which constitute a closed area contour. The summit points being expressed in a local coordinate system.

4.2.1.4.2 **Recommendation** *This method should typically be applied if the precipitation zones are visualised by other display techniques than shaded area, e.g. by colouring the area, according to the intensity level.*

NOTE - The method 'Contours of Precipitation Zones' appears attractive if a lower capacity narrow-band transmission medium is used; especially if contour-point reduction techniques are used at the expense of some degradation in precision.

4.2.2 Precision in Data Items Expressing a Distance

4.2.2.1 All Data Items expressing a distance shall use a one-octet (sub)field for the parameter range, vector length and coordinates of a contour point (i.e. Standard Precision Format (SPF)).

4.2.2.2 Due to the great diversity with regard to maximum coverage and precision requirements in the various ATC applications, a fixed value shall not be assigned to the Least Significant Bit (LSB) of Data Items expressing a distance in Data Category 008.

4.2.2.3 The decisive factors for a proper LSB setting shall be the maximum coverage range and the intrinsic precision of the radar sensor. The application of a scaling factor (f) is the mechanism to match precision to the prevailing conditions, i.e. the binary value will multiplied by 2^f (binary shift over f positions) to yield the real parameter value.

4.2.2.4 As the standard quantisation units, the following values shall be chosen:

- (2^{-6}) NM, for vector length and coordinates of contour points;
- (2^{-7}) NM, for range.

NOTE - The consequences for the LSB, minimum and maximum values for the various parameters are given in Table 1.

Table 1 - Standard Quantisation Units

Data Item	LSB	Parameter Range
Range (start,end)	$2^{(-7+f)}$	$0 < p < 2^{(1+f)}$
Length	$2^{(-6+f)}$	$0 < p < 2^{(2+f)}$
(x,y)	$2^{(-6+f)}$	$-2^{(1+f)} < p < 2^{(1+f)}$

4.2.2.5 The possibilities of such a mechanism for dealing with ranges shall be as illustrated below:

- for a radar with a maximum range of 32 NM a value $f = 4$ may be chosen, which yields an $LSB = 0.125$ NM;
- for a weather radar device with a coverage range up to 250 NM a value of $f = 7$ may be selected. This means however a limited precision due to an $LSB = 1$ NM.

NOTE - A negative value $f = -1$ may be adopted, resulting in a high precision of $1/256$ NM (this is only useful if justified by the precision of the sensor).

4.2.2.6 The scaling factor, f, shall be a parameter of the Start Of Picture (SOP) message.

4.2.3 Weather Messages

4.2.3.1 Weather messages shall contain images of precipitation zones in only one of the three possible representations.

4.2.3.2 Recommendations

1. *A variable number of elements of the weather of the same intensity should be packed within one ASTERIX Record.*
2. *A number of Records should be packed together into one ASTERIX Data Block.*

4.3 Control Messages

Two types of control messages are identified:

- **Start of Picture (SOP)**
This message shall be used to signal the start of a new data renewal cycle and to provide additional information such as the time of day and actual processing and configuration status of the radar station.
- **End of Picture (EOP)**
This message shall be used to signal the end of a data renewal cycle and to provide a count of the total number of items constituting the weather image transmitted. The latter value allows the receiver to verify whether all items were actually received.

4.4 Transmission of Monoradar Derived Weather Information

4.4.1 User Application Profile

A single User Application Profile (UAP) has been defined and standardised and shall be used to transmit weather information (data and control messages).

Since data and control messages are composed from Data Items out of the same Data Category, it is possible to mix both type of messages within a Data Block.

4.4.2 Message Transmission

4.4.2.1 At the start of a data renewal cycle, the data messages shall be preceded by an SOP message.

4.4.2.2 At the end of a data renewal cycle, the data messages shall be followed by an EOP message.

4.4.3 Data Block

Data Blocks containing monoradar derived weather information shall have the following layout:

CAT = 008	LEN	FSPEC	Items of the first record		FSPEC	Items of the last record
------------------	------------	--------------	---------------------------	--	--------------	--------------------------

where:

- Data Category (CAT) = 008, is a one-octet field indicating that the Data Block contains monoradar derived weather information;
- 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

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

4.5.2 Data Items shall be either compulsory or optional.

4.5.2.1 Compulsory items represent commonly used data required by any application, they shall be implemented.

4.5.2.2 Optional items represent more specific data and their implementation shall be negotiated between users.

4.5.3 Whether Data Items are compulsory or optional, they shall be either always transmitted or conditionally transmitted.

4.5.3.1 When compulsory, they shall always be transmitted in a Record with the corresponding FSPEC bits set to one.

4.5.3.2 When optional, they shall be present in a Record only if certain conditions are met (e.g. availability of the data). The corresponding FSPEC bits being set to one or to zero according to the presence or absence of the fields.

5. LAYOUT OF THE WEATHER MESSAGES

5.1 Standard Data Items

The standardised Data Items which shall be used for the transmission of monoradar derived weather information are defined in Table 2 and described in the following pages.

Table 2 - Standard Data Items of Category 008

Data Item Ref. No.	Description	System Units
I008/000	Message Type	N.A.
I008/010	Data Source Identifier	N.A.
I008/020	Vector Qualifier	N.A.
I008/034	Sequence of Polar Vectors in SPF Notation	Range: $2^{(-7+f)}$ NM Azimuth: $360^\circ/(2^{16})$
I008/036	Sequence of Cartesian Vectors in SPF Notation	X,Y: $2^{(-6+f)}$ NM
I008/038	Sequence of Weather Vectors in SPF Notation	X,Y: $2^{(-6+f)}$ NM
I008/040	Contour Identifier	N.A.
I008/050	Sequence of Contour Points in SPF Notation	X, Y: $2^{(-6+f)}$ NM
I008/090	Time of Day	1/128 s
I008/100	Processing Status	N.A.
I008/110	Station Configuration Status	N.A.
I008/120	Total number of Items Constituting One Weather Picture	N.A.

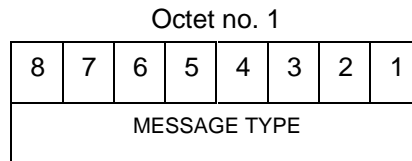
5.2 Description of Standard Data Items

5.2.1 Data Item I008/000, 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.

Format: One-octet fixed length Data Item.

Structure:



The following Message Types are standardised for category 008 records:

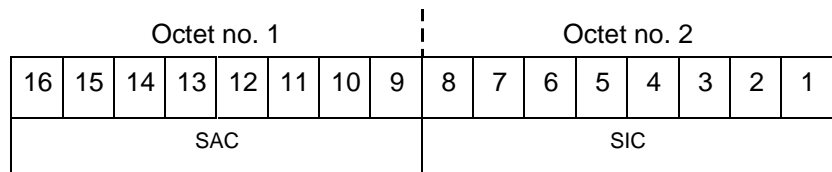
- 001, Polar vector;
- 002, Cartesian vector of start point/ length;
- 003, Contour record;
- 004, Cartesian start point and end point vector;
- 254, SOP message;
- 255, EOP message.

5.2.2 Data Item I008/010, Data Source Identifier

Definition: Identification of the radar station from which the data are received.

Format: Two-octet fixed length Data Item.

Structure:



bits-16/9 (SAC)

System Area Code

bits-8/1 (SIC)

System Identification Code

NOTES

1. The defined SACs are listed in Part 1, Table 2 [Ref. 2].
2. The defined SICs are listed in Part 1, Annex B [Ref. 2].

5.2.3 Data Item I008/020, Vector Qualifier

Definition: Precipitation intensity level, shading orientation of the vectors representing the precipitation area and coordinate system used.

Format: Variable length Data Item comprising a first part of one-octet, followed by one-octet extents as necessary.

Structure of First Part:

Octet no. 1							
8	7	6	5	4	3	2	1
ORG	I1	I2	I3	S1	S2	S3	FX

bit-8 (ORG) = 0 Local Coordinates
 = 1 System Coordinates

bits-7/5 (I1/I2/I3) Intensity level (range zero to seven)

bits-4/2 (S1/S2/S3) Shading orientation with respect to North, as follows:

S1	S2	S3	Heading
0	0	0	0°
0	0	1	22.5°
0	1	0	45°
0	1	1	67.5°
1	0	0	90°
1	0	1	112.5°
1	1	0	135°
1	1	1	157.5°

bit-1 (FX) = 0 End of Data Item
 = 1 Extension into first extent

NOTE - For polar vectors bits-4/2 are meaningless and are set to zero.

**Structure
of First Extent:**

Octet no. 1							
8	7	6	5	4	3	2	1
0	0	0	0	0	TST	ER	FX

bits-8/4

Spare bits set to 0

bit-3 (TST)

= 0 Default
= 1 Test vector

bit-2 (ER)

= 0 Default
= 1 Error condition
encountered

bit-1 (FX)

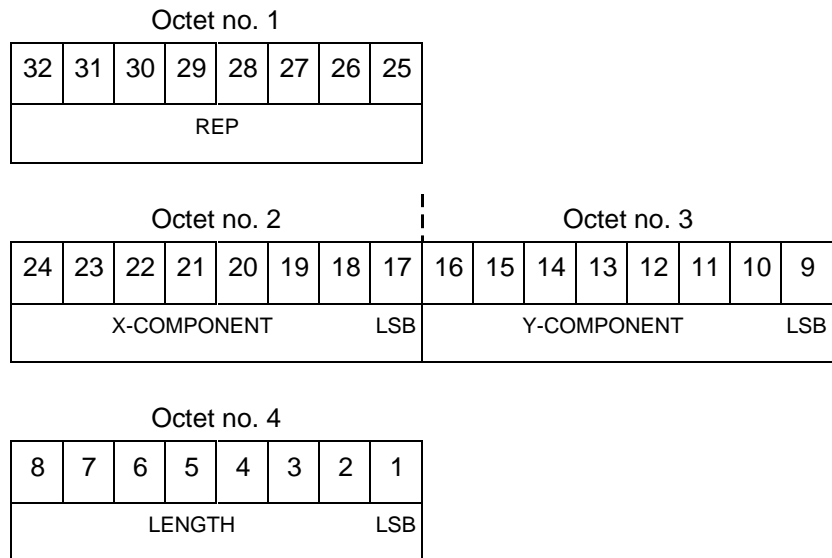
= 0 End of Data Item
= 1 Extension into next
extent

5.2.5 Data Item I008/036, Sequence of Cartesian Vectors in SPF Notation

Definition: Sequence of weather vectors, in the representation start point/ length, in local or in system cartesian coordinates.

Format: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP) indicating the number of vectors, followed by series of three-octets (vector components) as necessary.

Structure:



bits-32/25 (REP)		Number of weather vectors
bit-17 (LSB)	=	$2^{(-6+f)}$ NM
bit-9 (LSB)	=	$2^{(-6+f)}$ NM
bit-1 (LSB)	=	$2^{(-6+f)}$ NM

NOTES

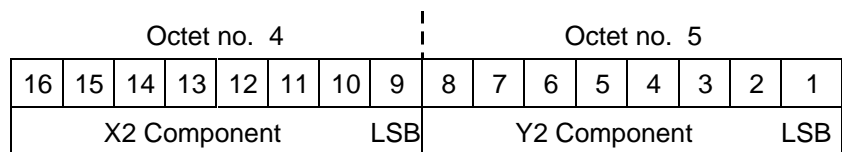
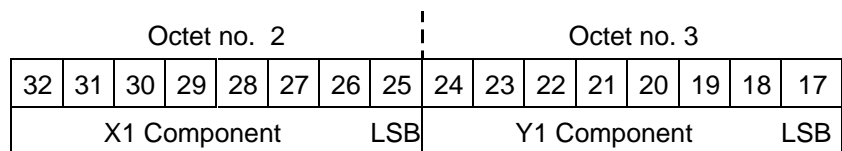
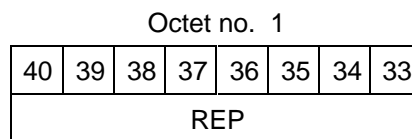
1. f is a parameter of the SOP message.
2. Negative values are expressed in 2's complement form, bit-24 and bit-16 are set to 0 for positive values and 1 for negative values.

5.2.6 Data Item I008/038, Sequence of Weather Vectors in SPF Notation

Definition: Sequence of weather vectors, in the representation start point/ end point, in local or in system cartesian coordinates.

Format: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP), indicating the number of vectors, followed by a series of four-octets (vector components) as necessary.

Structure:



- | | | | |
|--------------|-------|---|---------------------------|
| bits - 40/33 | (REP) | = | Number of weather vectors |
| bit - 25 | (LSB) | = | $2^{(-6+f)}$ NM |
| bit - 17 | (LSB) | = | $2^{(-6+f)}$ NM |
| bit - 9 | (LSB) | = | $2^{(-6+f)}$ NM |
| bit - 1 | (LSB) | = | $2^{(-6+f)}$ NM |

NOTES

1. f is a parameter of the SOP message.
2. Negative values are expressed in 2's complement form, bits-32, 24, 16 and 8 are set to 0 for positive values and 1 for negative values.

5.2.7 Data Item I008/040, Contour Identifier

Definition: Contour serial number together with the precipitation intensity levels and the coordinates system used.

Format: Two-octet fixed length Data Item.

Structure:

Octet no. 1									Octet no. 2						
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
ORG	I1	I2	I3	0	0	FST/LST		CONTOUR SERIAL NUMBER							

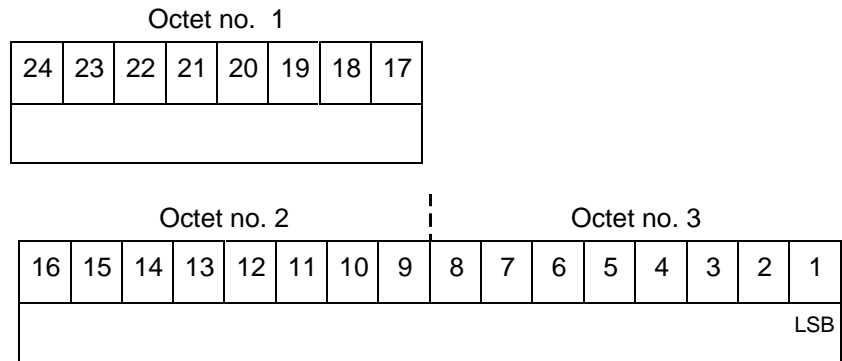
- bit-16 (ORG) = 0 Local coordinates
 = 1 System coordinates
- bits-15/13 (I1/I2/I3) Intensity levels (range zero to seven)
- bits-12/11 Spare bits set to 0
- bits-10/9 (FST/LST) = 00 Intermediate record of a contour
 = 01 Last record of a contour of at least two records
 = 10 First record of a contour of at least two records
 = 11 First and only record, fully defining a contour

5.2.9 Data Item I008/090, Time of Day

Definition: Absolute time stamping expressed as Coordinated Universal Time (UTC) time.

Format: Three-octet fixed length Data Item.

Structure:



bit-1 (LSB) = $2^{(-7)}$ s = 1/128 s

NOTES

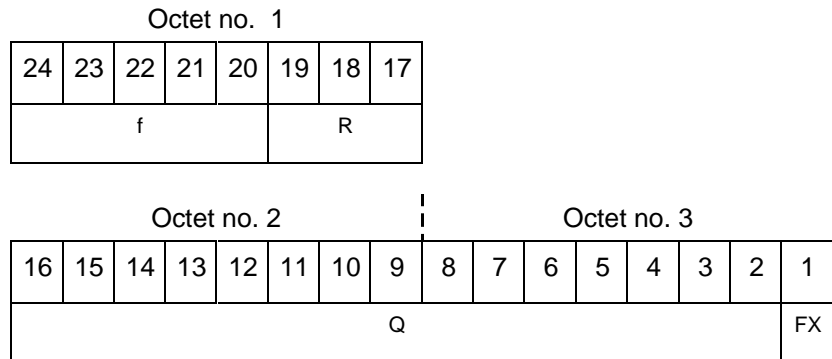
1. The time of day value is reset to zero each day at midnight.
2. For time management in radar transmission applications, refer to Part 1, paragraph 5.4 [Ref. 2].

5.2.10 Data Item I008/100, Processing Status

Definition: Information concerning the scaling factor currently applied, current reduction step in use, etc.

Format: Variable length Data Item comprising a first part of three-octets, followed by one-octet extents as necessary.

Structure of First Part:



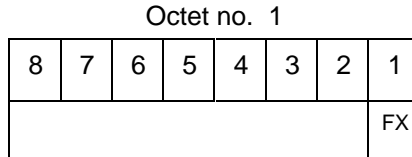
- | | | |
|----------------|-----|---|
| bits-24/20 (f) | | Scaling factor, negative values are represented in 2's complement form, bit-24 is set to 0 for positive values and 1 for negative values. |
| bits-19/17 (R) | | Current reduction stage in use. Normal operation is indicated by a value of zero. The actual bit signification is application dependent. |
| bits-16/2 (Q) | | Processing parameters. The actual bit signification is application dependent. |
| bit-1 (FX) | = 0 | End of Data Item |
| | = 1 | Extension into first extent |

5.2.11 Data Item I008/110, Station Configuration Status

Definition: Information concerning the use and status of some vital hardware components of a radar system .

Format: Variable length Data Item comprising a first part of one-octet, followed by one-octet extents as necessary.

Structure of First Part:



bit-1 (FX)	= 0	End of Data Item
	= 1	Extension into first extent

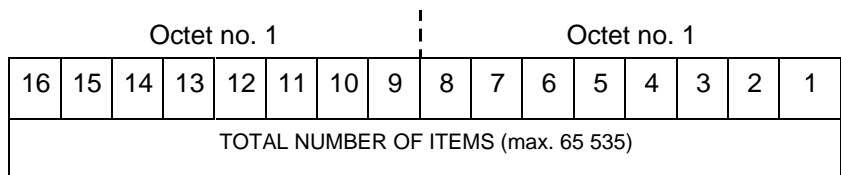
NOTE - Due to the diversity in hardware design and requirements of present and future radar stations, it is felt impractical to attempt to define individual bits.

5.2.12 Data Item I008/120, Total Number of Items Constituting One Weather Picture

Definition: Total number of vectors, respectively contour points, constituting the total weather image, provided with the EOP message.

Format: Two-octet fixed length Data Item.

Structure:



5.3 Transmission of Weather Messages

5.3.1 Standard User Application Profile and Use of Standardised Data Items

5.3.1.1 User Application Profile

The following standard UAP shown in Table 3 shall be used for the transmission of monoradar derived weather information:

Table 3 - Standard User Application Profile

FRN	Data Item	Information	Length in Octets
1	I008/010	Data Source Identifier	2
2	I008/000	Message Type	1
3	I008/020	Vector Qualifier	1+
4	I008/036	Sequence of Cartesian Vectors in SPF Notation	(1 + 3 x n)
5	I008/034	Sequence of Polar Vectors in SPF Notation	(1 + 4 x n)
6	I008/040	Contour Identifier	2
7	I008/050	Sequence of Contour Points in SPF Notation	(1 + 2 x n)
FX		Field Extension Indicator	-
8	I008/090	Time of Day	3
9	I008/100	Processing Status	3+
10	I008/110	Station Configuration Status	1+
11	I008/120	Total Number of Items Constituting One Weather Picture	2
12	I008/038	Sequence of Weather Vectors in SPF Notation	(1 + 4 x n)
13	-	Reserved for Special Purpose (SP) Indicator	-
14	-	Reserved for the RFS Indicator	-
FX	-	Field Extension Indicator	-

where:

- the first column indicates the 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 one-octet followed by n-octets extents as necessary.

5.3.1.2 Use of Standardised Data Items

The use of the standardised Data Items in the different messages shall be as depicted in Table 4.

Table 4 - Use of Standardised Data Items

Data Item	Control Messages		Data Messages			
	SOP	EOP	Sequence of Cartesian Vectors	Sequence of Weather Vectors	Sequence of Polar Vectors	Sequence of Contour Points
I008/010	X	X	X	X	X	X
I008/000	X	X	X	X	X	X
I008/020			X	X	X	
I008/036			X			
I008/034					X	
I008/040						X
I008/050						X
I008/090	X	X				
I008/100	X					
I008/110	X	X				
I008/120		X				
I008/038				X		

5.3.2 Encoding Rules

5.3.2.1 Data Messages

5.3.2.1.1 Data Item I008/010 (Data Source Identifier) is compulsory and shall be transmitted in each Data Block, at least in the first Record of a sequence of Records originating from the same data source.

Recommendation *The Data Source Identifier should be transmitted in every Record.*

5.3.2.1.2 Data Item I008/000 (Message Type) is compulsory and shall be transmitted in each Data Block, at least in the first Record of a sequence of Records of the same type.

5.3.2.1.3 Data Item I008/020 (Vector Qualifier) is compulsory for each vector message and shall always be transmitted.

5.3.2.1.4 Either Data Item I008/036 (Sequence of Cartesian Vectors in SPF Notation) or Data Item I008/038 (Sequence of Weather Vectors in SPF Notation) is compulsory for weather images transmitted as cartesian vectors and shall always be transmitted.

NOTE - The length of these Data Items is respectively $(1 + 3 \times n)$ and $(1 + 4 \times n)$ octets where n is the number of vectors transmitted.

5.3.2.1.5 Data Item I008/034 (Sequence of Polar Vectors in SPF Notation) is compulsory for weather images transmitted as polar vectors and shall always be transmitted.

NOTE - The length of this item is $(1 + 4 \times n)$ octets where n is the number of vectors transmitted.

5.3.2.1.6 Data Item I008/040 (Contour Identifier) is compulsory for weather images transmitted as sequence of contour points and shall always be transmitted.

NOTE - When a sequence of contour points is spread over more than one Record, this Data Item is transmitted in each record.

5.3.2.1.7 Data Item I008/050 (Sequence of Contour Points) is compulsory for weather images transmitted as contour points and shall always be transmitted.

5.3.2.1.8 **General Notes for Encoding all Data Messages**

1. For messages containing a sequence of cartesian vectors, the bits 5, 6 and 7 of the FSPEC field are meaningless and are set to 0. In normal operation the length of the corresponding FSPEC is one octet.
2. For messages containing a sequence of polar vector, the bits 4, 6 and 7 of the FSPEC fields are meaningless and set to 0. In normal operation, the length of the corresponding FSPEC is one octet.
3. For messages containing a sequence of contour points, the bits 3, 4 and 5 of the FSPEC field are meaningless and set to 0. In normal operation, the length of the corresponding FSPEC is one octet.

5.3.2.2 **Control Messages**

5.3.2.2.1 Data Item I008/010 (Data Source Identifier) is compulsory and shall always be transmitted.

5.3.2.2.2 Data Item I008/000 (Message Type) is compulsory and shall always be transmitted.

NOTE - This item allows to distinguish between records containing weather data and records containing control information.

5.3.2.2.3 Data Item I008/090 (Time of Day) is optional in control messages. When used, it shall be transmitted when available.

NOTE - This item allows the time-stamping of SOP and EOP messages at the radar station site. The time information coded in three octets, is the time of an event relating to the SOP or EOP expressed as the number of 1/128 s elapsed since last midnight.

5.3.2.2.4 Data Item I008/100 (Processing Status) is compulsory in SOP messages only and shall always be transmitted.

Recommendation *Although Data Item I008/100 is designed as a variable length Data Item, it is possible for most applications to limit its length to three-octets (i.e. its first part). Due to the diversity in hardware design and requirements of radar stations, coding and interpretation of bits-19/17 (reduction stage in use) and of bits-16/2 (processing parameters) in Data Item I008/100 should be defined and mutually agreed by the users concerned.*

5.3.2.2.5 Data Item I008/110 (Station Configuration Status) is optional in both control messages. When used, it shall be transmitted only if at least one bit of the field is set to a one.

NOTE - This item provides information on some vital hardware components of the radar station. Its contents, which are application dependent, being agreed between the users concerned.

Recommendation *Although Data Item I008/110 is designed as a variable length Data Item, it is possible for most applications to limit its length to one-octet (i.e. its first part). Due to the diversity in hardware design and requirements of radar stations, coding and interpretation of Data Item I008/110 should be defined and mutually agreed by the users concerned.*

5.3.2.2.6 Data Item I008/120 (Total Number of Items Constituting One Weather Picture) is compulsory for EOP messages only and shall always be transmitted in such messages.

5.3.2.2.7 General Notes for Encoding all Control Messages

1. For a SOP message, the bits 3, 4, 5, 6, 7 and 11 of the FSPEC field are meaningless and set to zero. The maximum length of the corresponding FSPEC is two octets.
2. For an EOP message, the bits 3, 4, 5, 6, 7, and 9 of the FSPEC field are meaningless and set to zero. The maximum length of the corresponding FSPEC is two octets.

5.3.2.3. General Notes for Encoding all Standardised Data Items

1. Bit-13 of FSPEC is reserved for the SP Indicator. This allows the transmission of a variable length field. The contents of such a field being mutually agreed between the users concerned, while those not concerned can skip the data. The first octet contains the field length, including the length octet itself.
2. Bit-14 of FSPEC is reserved for the RFS indicator. This allows the transmission of standard Data Items in any order.
3. Non-standardised, specific information is transmitted using the SP field and not the RFS field(s).