OGP

OGP P1/11 Geophysical position data exchange format

Report No. 483-1
November 2012

This document is accompanied by a User Guide, which contains further details and instruction on implementation of the OGP P1/11 format and examples of its use. It is recommended that the User Guide is read in conjunction with this format description.

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Contents

1. Executive Summary

The P Formats for the exchange of positioning data are recommended by the International Association of Oil & Gas Producers (OGP) Geomatics Committee for general use in the upstream oil and gas industry. They supersede earlier UKOOA P1, P2 and P6 formats. Parallel discussions with the Society of Exploration Geophysicists (SEG) covered deprecation of their SEG-P1 format and recognition of the revised OGP P1/11 format as its replacement.

These formats have been developed in response to ever evolving acquisition and processing technologies. This had made obsolete the previous UKOOA formats, which were no longer able to handle modern acquisition systems, and this had led to a proliferation of variations of these formats. This resulted in a divergence from the original formats, and standards being no longer standards.

These formats have been developed on behalf of the OGP Geomatics Committee by a Task Force consisting of representatives from operators, major survey and seismic contractors, major service providers, software vendors and other companies with a professional interest in these formats.

Any comments and suggestions for improvement are welcome and should be addressed to:

The Chairman, Geomatics Committee
OGP
London

2. General Information

2.1. Logical File Structure

The data is stored in a series of variable length ASCII comma-separated data records, each terminated by a carriage return (Hex 0x0D) and/or a line feed (Hex 0x0A) character. Line termination shall be consistent throughout each file.

As the format is designed primarily for access by a computer program, there is no fixed limit on the length of each individual data record, and many record definitions allow multiple data items to be written into a single record. However, while it is recommended that systems make use of this facility to reduce file size where it is possible to do so, it is also recommended that records should not be written to excessive length but should instead be split across multiple records.

Although the format is primarily intended for computer access, it is also common for the file to be visually inspected, particularly the Common Header records. Thus it is recommended that, particularly for the Common Header block, systems writing the files make use of spaces to pad any repeated records to ensure the data is aligned in columns to facilitate readability.

Thus, if possible, common header records should be written as:

```
HC,1,5,2,Latitude of natural origin                    ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                   ,1,8802,   -15,3,degree
HC,1,5,2,Scale factor at natural origin                ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                 ,1,8806,500000,1, metre
HC,1,5,2,False northing                                ,1,8807,     0,1, metre
```

However it should be noted, unless the field width is specifically stated in the record field definition, this padding of records for readability is a recommendation and not an absolute requirement.

Any physical storage medium can be used to store the format, by prior agreement between the parties involved in exchange of the data.

The file naming convention for a P1/11 file is ***filename.p111***. For P2/11 and P6/11 files the file extensions are .p211 and .p611 respectively. The 'p' can be upper or lower case. Header records will precede data records. Files without mandatory header and data records are considered invalid.

Multiple seismic lines and positional data types per file are allowed, as long as all data and header records are consistent with each other.

2.2. Record Identifiers

The format defines that for most records the first comma-separated sections of each record contain the record identifying codes. The first section always contains two characters, which are used to identify the general record type. The first character identifies the type of record. Two common record types are defined across all formats, an "H" record indicates a header record and a "C" record indicates a comment record. Other characters including "E", "M", "N", "P", "R", "S", "T" and "X" are used for data records.

The second character indicates the data format:

2nd Character	Format Type
C	Common to all formats
1	Geophysical Position Data Exchange (P1/11)
2	Positioning Data Exchange (P2/11)
6	Seismic Bin Grid Data Exchange (P6/11)

Table 1: Format Types

Thus "HC" is a header record common to all formats ("Common Header") and T2 is a time data record from the P2/11 format.

All header records are identified by four comma-separated sections. Data records are identified by two, three or four sections. Where relevant, the remaining comma-separated sections contain numeric values which identify the record – thus record **HC,0,1,0** contains the project name whereas **E2,1,0,0** contains information about an event such as a shot point in the P2/11 format, and **R1** contains information about a receiver location in the P1/11 format.

2.3. Data Types used in the Format Definition

The following data types are used in this format definition document:

Name	Description	Conditions	Value
Single Items			
Integer	Integer Number		341234
Float	Floating Point Number		12.345678
Engineering	Engineering Format Floating Point Number		1.23456E+03
Text	Free Text	L J n: Specifies the text should be left justified to the minimum width specified	Hello World
Description	Record Description	A text field left justified to 50 characters	Project Name
Date	Date		YYYY:MM:DD
Time	Time		HH:MM:SS
Note: Time can be recorded to any number of decimal places, as defined by the data recorded			
Variant	Any of the above data types		
Lists (All of general format xx&xx&xx&xx)			
Integer List	List of Integer Numbers		12&34&56&78&9
Float List	List of Floats		1.23&4.56&6.78
Engineering List	List of Engineering		1.23456E3&7.89012E4&3.456E2
Text List	List of Text		Hello&world
Variant List	List of Items of Variant format		1&Hello&1.45

Table 2: Format Data Types

For some fields the data type is given as "variant". This may take the form of any of the data types. The codes used to define variant data stored within the data records are defined in Table 4 below.

All individual text fields should contain only ASCII characters in the range 32 (Hex 0x20) to 126 (Hex 0x7E) and the following characters are additionally not to be used to ensure format rigidity:

Character	Description	ASCII Code	Usage in Format
,	Comma	44	Separates Fields
;	Semi Colon	59	Separates items in a Standard Record Extension Definition and Record Extension Fields
:	Colon	58	Separates items in Date and Time fields
&	Ampersand	38	Separates items in a Variant List

Table 3: Reserved Characters

2.4. Record Data Types [DATATYPEREF]

The following codes are used within the format to define the data format of an item that can be of variant type:

Code	Name	Format	Example	Comments
General				
1	Integer	XX	23453	
2	Floating Point Number	XX.XX	12.345	
3	Engineering Format Floating Point Number	XX.XXE±NN	1.23456E+03	
4	Text	ABC	Hello World	
Time				
10	Relative Time	D:HH:MM:SS.SS	0:23:34:12.22	
11	Date and Time	YYYY:MM:DD:HH:MM:SS.SS	2010:04:20:23:34:12.22	
12	Julian Day and Time	YYYY:JDD:HH:MM:SS.SS	2010:134:23:34:12.22	
Note: Time can be recorded to any number of decimal places, as defined by the data recorded				
Degree Representation				
20	Degree Hemisphere	DDD.DDD H	34.442340 N	EPSG# 9116
21	Degree Minute	DDD MM.MMM	34 26.540400	EPSG# 9115
22	Degree Minute Hemisphere	DDD MM.MMM H	34 26.540400 N	EPSG#9118
23	Degree Minute Second	DDD MM SS.SSS	34 26 32.4240	EPSG#9107
24	Degree Minute Second Hemisphere	DDD MM SS.SSS H	34 26 32.4240 N	EPSG#9108
25	Hemisphere Degree	H DDD.DDDD	N 34.442340	EPSG#9117

26	Hemisphere Degree Minute	H DDD MM.MMMM	N 34 26.540400	EPSG#9119
27	Hemisphere Degree Minute Second	H DDD MM SS.SSSS	N 34 26 32.4240	EPSG#9120
28	Sexagesimal DM	DDD.MMMMMM	34.26540400	EPSG#9111
29	Sexagesimal DMS	DDD.MMSSSSSS	34.26324240	EPSG#9110
30	Sexagesimal DMS.S	DDDMMSS.SSSSS	342632.4240	EPSG#9121

Table 4: DATATYPEREF Data Types

When recording a floating point number, the number shall be written to the relevant precision as defined by the precision inherent in the value recorded.

The degree representation codes are only used when listing geodetic parameters, which should be quoted in the same format as originally provided from the source geodetic dataset. EPSG unit code 9122 "degree (supplier to define representation)" should be regarded as decimal degrees within the 'P' formats. **All coordinates in degrees should be written as decimal degrees (EPSG unit code 9102, for example 34.4483444).**

Unless a DATATYPEREF code is specifically listed for a variant data type, the DATATYPEREF code is referenced through the corresponding UNITREF code (see section 5.1).

2.5. Use of Relevant Header Records

Each file shall begin with the **OGP** file identification record and then records **HC,0,1,0** to **HC,0,7,0**. The sequence of the remainder of the survey header records is not crucial but they should follow the logical groupings indicated in this document.

2.6. Redundant Information

In a number of places the format requires redundant information to be recorded. The purpose of this is to allow integrity checks on the supplied data to take place. Redundant information should therefore not conflict with information supplied elsewhere in the format.

2.7. Record Extension through Additional Fields

In designing the format, the taskforce was aware that it would not be possible to define all the data values which may be required in the future. As such, the format has been designed to allow for maximum flexibility while retaining the core format structure.

To handle the case where additional data values may need to be defined alongside the core data values as part of a data record, the concept of "Record Extension Fields" is used. The Record Extension Field is a single field of the data record that can contain a number of extra data values, separated by semi-colons. Using a single field in this way ensures that the number of fields in a record is constant, which is important for the format integrity of those records that can repeat blocks of fields.

The data values recorded in the Record Extension Field block are defined in the relevant header record using the Record Extension Field Definition. Unlike the Record Extension Field block, this definition is split into multiple fields and is located at the end of the header record so that the variable number of fields does not cause a problem for any decoding process.

The first field in the Record Extension Field Definition defines the number of extension field items. Each subsequent field defines the data that is to be logged in the data record using a "Standard Record Extension Field Definition". The Standard Record Extension Field Definition consists of 4 items separated by semicolons, as follows:

Item	Description	Comments
First	Record Extension Identifier	1 - 99 defined by format (Table 17), 100 onwards defined by user
Second	Conditional Additional Parameter	Required for some record extensions (Table 17)
Third	Extension Description	The name of the data value
Fourth	Data Units Code	The UNITREF code for the units of measure data value

Table 5: Contents of the Standard Record Extension Field Definition

- The Record Extension Identifier is a unique code that identifies the data value. This identifier is either defined in a table in this format definition document, or it is a user defined value, in which case it is numbered from 100 onwards. The table defines the identifier for commonly used record extensions to ensure that these values have the same code regardless of the system generating the data, to drive standardisation.
- A conditional Additional Parameter is required for some Record Extension definitions to provide additional attributes about the value. For instance, when recording the water depth at a position the additional parameter specifies the Vertical Reference System to which the water depth is referenced. This additional parameter can be either an integer or an integer list, as required. The conditionality for when it is mandatory is defined in Table 17. In other circumstances this subfield shall be unpopulated.
- The Extension Description is a text block that allows for the definition of the name of the data value.
- The Data Units Code specifies, where relevant, the units of measure of the data value.

As an example, consider the logging of a GPS position into the P2/11 format. The GPS receiver issues the position at a set time and this is the primary recorded data written into the data record. However, the receiver will also issue a number of additional attributes such as PDOP, HDOP, Age of Correction, etc depending on the type of receiver and the output message read. These additional attributes are thus defined and written as record extension fields.

In the header, the fields are defined as shown below (colour coding shown for clarification purposes only):

```
H2,5,4,0,1,1000,…,3,5;;PDOP;4,6;;HDOP;4,9;;Age of Correction;6
```

The first field in the Record Extension Field Definition defines the number of record extension fields (3 in this case). Then the record extension fields are defined. Thus in the first example above 5;;PDOP;4, we have extension identifier "5" with no conditional parameter, description "PDOP" and unit code "4" which links to a definition in the units of measure records, in this case defining the value as unit less with floating point formatting.

In the data record, the record extension field list will then be written as:

```
T2,5,4,0,10,…,5.2;4.5;1.2,
```

2.8. Record Examples

To aid with the clarity of the examples contained in this document, the space characters contained in a "Description" field are where necessary replaced by an ellipsis. (The record may also be wrapped and indented on the next line).

Thus

```
HC,0,1,0,Project Name…,Test,TEST01,2012:03:19,2012:03:22
```

Should actually be implemented as

```
HC,0,1,0,Project Name                                    ,Test,TEST01,2012:03:19,2012:03:22
```

2.9. File Common Header

Common Header records are common across all Px/11 formats. The Common Header consists of the following records:

- File Identification Record
- Survey Summary
- Reference Systems Definition
- Survey Configuration

These are described in sections 3 through 6.

2.10. Comment Records

The Comment record is also common to all Px/11 formats. Comment records may be inserted into both header and data parts of the file. The Comment record is described in section 7.

3. Common Header: File Identification Record

OGP: File Identification Record

Field	Description	Data Type	Reference Code	Comments
1	"OGP"	Text		
2	Contents Description	Text		e.g. "OGP P1"
3	Format Code	Integer List	FORMATREF	See table 6 below
4	Format Version Number	Float		
5	File Issue Number	Integer		
6	Date File Written	Date		YYYY:MM:DD
7	Time File Written	Time		HH:MM:SS
8	Name of File	Text		
9	Prepared By	Text		

Note: the date and time of the file write is intended as a general reference. It should ideally be set to UTC, but can be different if this is not possible, in which case a comment record detailing the time reference used should follow this record.

Format Type Codes (FORMATREF)

Format Code	Format type
0	Common Header Only
1	P1/11
2	P2/11
6	P6/11

Table 6: FORMATREF Format Type Codes

Example File Identification Records:

```
OGP,OGP P1,1,1.0,1,2010:02:12,21:43:01,SPEC201001.P111,OilFinder Ltd
OGP,OGP P6,6,1.0,1,2010:02:12,21:53:01,1001.P611,OilFinder Ltd
```

4. Common Header: Survey Summary

HC,0,1,0: Project Name

Field	Description	Data Type	Comments
5	"Project Name"	Description	
6	Project identifier	Text	
7	Project name	Text	
8	Start Date of Project	Date	
9	End Date of Project	Date	This field can be left blank if it is not known at the time of file production.

Example

```
HC,0,1,0,Project Name…,Test Dataset,TEST01,2010:08:01,2010:09:04
```

HC,0,2,0: Survey Description

Field	Description	Data Type	Comments
5	"Survey Description"	Description	
6	Survey General Type	Text	e.g. 3D Towed Streamer
7	Survey Layout Description	Text	e.g 10 streamer 2 source
8	Survey Location	Text	Free text
9	Numeric Country Codes	Integer List	ISO 3166-1 Numeric Codes
10	Text Country Codes	LJ3 Text List	ISO 3166-1 Alpha-3 Codes

Example

```
HC,0,2,0,Survey Description…,3D Towed Streamer,1 Vessel 2 Source 10 Streamer,North
      Sea,826,GBR
```

HC,0,3,0: Geographic Extent

Field	Description	Data Type	Comments
5	"Geographic Extent"	Description	
6	Bounding Box Westernmost Longitude	Float	-180<=x<=+180 degrees. In general W_lon <= E_lon but if area crosses the 180° meridian the value of W_lon will be greater than the value of E_lon.
7	Bounding Box Easternmost Longitude	Float	-180<=x<=+180 degrees. In general E_lon >= W_lon but if area crosses the 180° meridian the value of E_lon will be less than the value of W_lon.
8	Bounding Box Southernmost Latitude	Float	-90<=x<=+90 degrees, S_lat <= N_lat
9	Bounding Box Northernmost Latitude	Float	-90<=x<=+90 degrees, N_lat >= S_lat

This record details the approximate geographic extent for the data contained within the file through a "north up" rectangle. It is intended to aid any application searching for data by location. The positions need not be given to any high accuracy, two decimal places of a degree should suffice, and this coarseness means that no geodetic CRS needs be defined, although WGS 84 is assumed.

Example

```
HC,0,3,0,Geographic Extent…,36.77,36.98,-16.26,-16.04
```

HC,0,4,0: Client

Field	Description	Data Type	Comments
5	"Client"	Description	
6	Client Company Name	Text	

Example

```
HC,0,4,0,Client…,Wight Oil Limited
```

HC,0,5,0: Geophysical Contractor

Field	Description	Data Type	Comments
5	"Geophysical Contractor"	Description	
6	Geophysical Contractor Company Name	Text	

Example

```
HC,0,5,0,Geophysical Contractor…,OilFinder LLC
```

HC,0,6,0: Positioning Contractor

Field	Description	Data Type	Comments
5	"Positioning Contractor"	Description	
6	Positioning Contractor Company Name	Text	

This record can be repeated if multiple positioning contractors are in use.

Example

```
HC,0,6,0,Positioning Contractor…,TruePos Inc
```

HC,0,7,0: Position Processing Contractor

Field	Description	Data Type	Comments
5	"Position Processing Contractor"	Description	
6	Position Processing Contractor Company Name	Text	

This record can be repeated if multiple position processing contractors are in use.

Example

```
HC,0,7,0,Position Processing Contractor…,Navigation Positioning Ltd
```

5. Common Header: Reference System Definitions

Three basic reference systems are defined in this part of the Common Header:

1) Unit reference systems (section 5.1)
2) Time reference systems (section 5.2)
3) Coordinate reference systems including transformations between CRSs (section 5.3)

The number of reference systems and transformations used in the file is provided in the following header record:

HC,1,0,0: Reference Systems Summary Information

Field	Description	Data Type	Comments
5	"Reference Systems Summary"	Description	
6	Number of Units of Measure defined	Integer	
7	Number of Time Reference Systems defined	Integer	
8	Number of Coordinate Reference Systems defined	Integer	
9	Number of Coordinate Transformations defined	Integer	

Example

```
HC,1,0,0,Reference Systems Summary                    ,5,1,4,2
```

5.1. Unit Reference Systems Definition

This section of the Common Header allows for the definition of all units of measure used within the file, along with the data type used for this unit. For each unit of measure the conversion factors to convert that unit to the base unit for that measurement type shall be given. Additionally, the information source from which the unit information has been derived should be specified.

Each unit of measure is defined with a unique UNITREF code, which is then used in the remainder of the header to reference data recorded with that unit. The following UNITREF codes are reserved, user defined UNITREF codes should start from 5 onwards.

UNITREF	Units	Quantity Type	Format Code	Comments
1	Metres	Length	Floating Point	Base unit for length
2	Radians	Angle	Floating Point	Base unit for angles other than degree representations (including degree itself)
3	Degrees	Angle	Floating Point	Base unit for degree representations
4	Unity	Scale	Floating Point	Base unit for scale

Table 7: Reserved UNITREF Codes

It is important to note that the unit of measure definition also defines the format code (see the DATATYPEREF Table 4 earlier in this document) used to record the data, as well as the units of measure of that data. Thus you may have a "Degrees" unit of measure repeated twice with different UNITREF code, one formatted as decimal degrees, and the other formatted using a "Degree Minute Second Hemisphere" representation. In this case, both degrees units of measure will be defined relative to the base SI unit of Radians. The angular base unit is radians.

For raw data logging in a P2/11 file, the data should be logged in the same units as it is received from the original measuring system.

HC,1,1,0: Units of Measure Definition

Field	Description	Data Type	Reference Code	Comments
5	"Unit of Measure"	Description		
6	Unit Number	Integer	UNITREF	1 onwards (see above)
7	Unit Name	Text		
8	Quantity Type Name	Text		e.g. "length"
9	Format Reference	Integer	DATATYPEREF	See Table 4
10	Base Unit Number	Integer	UNITREF	Blank if this unit is the base unit, else must be 1, 2 or 4
11	Conversion Factor A	Float		Blank if this unit is the base unit
12	Conversion Factor B	Float		Blank if this unit is the base unit
13	Conversion Factor C	Float		Blank if this unit is the base unit
14	Conversion Factor D	Float		Blank if this unit is the base unit
15	Description	Text		
16	EPSG Unit Code	Integer		If available
17	Source Description	Text		Defines the data source which provided details of this unit
18	Source Version Details	Text		Defines the version of the data source which provided details of this unit
19	Source Unit Code	Variant		Defines the unit code used by the data source which provided details of this unit. This item is written in the units used to define unit codes by the data source.

Note: To convert a unit X to the base unit Y
$Y = (A + BX) / (C + DX)$

HC,1,1,1: Example Unit Conversion

Field	Description	Data Type	Reference Code	Comments
5	"Example Unit Conversion"	Description		
6	Example number	Integer		
7	Unit Number	Integer	UNITREF	
8	Value	Variant		Format as defined for UNITREF

Fields 7 onwards can be repeated as required, or the record repeated. For each example unit conversion, at least two converted values should be listed.

Example Units of Measure Definition

```
HC,1,1,0,Unit of Measure… , 1,                  metre,                  length, 2,  ,      ,          ,       , ,  SI base unit of length,9001, EPSG Dataset      ,7.6,  9001
HC,1,1,0,Unit of Measure… , 2,                 radian,                   angle, 2,  ,      ,          ,       , , SI angular measure unit,9101, EPSG Dataset      ,7.6,  9101
HC,1,1,0,Unit of Measure… , 3,                 degree,                   angle, 2, 2,     0,3.141592654,    180,0,  Measure of plane angle,9102, EPSG Dataset      ,7.6,  9102
HC,1,1,0,Unit of Measure… , 4,                  unity,                   scale, 2,  ,      ,          ,       , ,   For unitless entities,9201, EPSG Dataset      ,7.6,  9201
HC,1,1,0,Unit of Measure… , 5,                 second,                    time,12,  ,      ,          ,       , ,    SI base unit of time,    ,POSC UOM Dictionary,2.2,     s
HC,1,1,0,Unit of Measure… , 6,                 second,                    time,11,  ,      ,          ,       , ,    SI base unit of time,    ,POSC UOM Dictionary,2.2,     s
HC,1,1,0,Unit of Measure… , 7,           cubic metres,                  volume, 2,  ,      ,          ,       , ,          metric volume,    ,POSC UOM Dictionary,2.2,    m3
HC,1,1,0,Unit of Measure… , 8,             cubic inch,                  volume, 2, 7,     0,0.000016387,      1,0,         US cubic volume,    ,POSC UOM Dictionary,2.2, cu_in
HC,1,1,0,Unit of Measure… , 9,                 pascal,          force per area, 2,  ,      ,          ,       , ,  SI measure of pressure,    ,POSC UOM Dictionary,2.2,    Pa
HC,1,1,0,Unit of Measure… ,10,pounds force/square inch,          force per area, 2, 9,     0, 6894.757  ,       1,0, Imperial pressure unit,    ,POSC UOM Dictionary,2.2,lbfPin2
HC,1,1,0,Unit of Measure… ,11,                 second,                    time, 2,  ,      ,          ,       , ,    SI base unit of time,    ,POSC UOM Dictionary,2.2,     s
HC,1,1,0,Unit of Measure… ,12,           milliseconds,                    time, 2,11,     0,      0.001,      1,0,      1/1000 of a second,    ,POSC UOM Dictionary,2.2,    ms
HC,1,1,0,Unit of Measure… ,13,             arc-second,                   angle, 2, 2,     0,3.141592654, 648000,0,      1/3600 of a degree,9104, EPSG Dataset      ,7.6,  9104
HC,1,1,0,Unit of Measure… ,14,      parts per million,                   scale, 2, 4,     0,          1,1000000,0, 0.000001          unity,9202, EPSG Dataset      ,7.6,  9202
HC,1,1,0,Unit of Measure… ,15,          metres/second,                velocity, 2,  ,      ,          ,       , ,SI derived unit of speed,    ,POSC UOM Dictionary,2.2,   mPs
HC,1,1,0,Unit of Measure… ,16,                 kelvin,thermodynamic temperature, 2,  ,      ,          ,       , ,SI temperature base unit,    ,POSC UOM Dictionary,2.2,     K
HC,1,1,0,Unit of Measure… ,17,        degrees Celsius,thermodynamic temperature, 2,16,273.15,          1,      1,0,       Temperature scale,    ,POSC UOM Dictionary,2.2,  degC
HC,1,1,0,Unit of Measure… ,18,                 euclid,           dimensionless, 2,  ,      ,          ,       , ,Dimensionless base value,    ,POSC UOM Dictionary,2.2,   Euc
HC,1,1,0,Unit of Measure… ,19,     parts per thousand,    volumic concentration, 2,18,     0,      0.001,      1,0,  Dimensionless fraction,    ,POSC UOM Dictionary,2.2,   ppk
HC,1,1,0,Unit of measure… ,20,      parts per million,         scale difference, 2, 4,     0,          1,1000000,0,          delta Scale dS,    ,                   ,   ,   ppm
```

Example Unit Conversion

```
HC,1,1,1,Example Unit Conversion                          ,1,2,1.0,3,57.295779513
```

This example is unit conversion example number 1, with unit code 2 (radian) having a value of 1.0 and unit code 3 (degree) having a value of 57.295779513, where both units are as defined in the example above as floating point numbers.

5.2. Time Reference Systems Definition

The format allows for data to be logged in a number of different time systems. The ability to record data in multiple time systems is intended primarily for the P2/11 format, where timestamps received from a measuring system should be logged in their original time domain.

Each Time Reference System (TRS) is defined with a unique TRSREF code, which is then used in the remainder of the header to reference data recorded with timing data in that reference system.

By linking to a Units of Measure code, each Time Reference System also defines the format of the time stamp written into the data records. Thus you may have multiple Time Reference Systems defined, each representing the same base time reference (e.g. UTC) but with different Units of Measure codes with different formatting codes, such as Date and Time (DATATYPEREF #11) and Julian Day and Time (DATATYPEREF #12)

HC,1,2,0: Time Reference System

Field	Description	Data Type	Reference Code	Comments
5	"Time Reference System"	Description		
6	TRS Number	Integer	TRSREF	
7	Time Reference Code	Integer	TIMEREF	See Table 8
8	Time Reference Offset from UTC	Float		In Seconds, a positive offset is ahead of the base time
9	Reference Description	Text		
10	Relative Flag	Integer		0 = time is absolute 1 = time is relative to the reference date
11	Reference Date	Date		YYYY:MM:DD
12	Unit Code	Integer	UNITREF	

HC,1,2,1: Example Time Conversions

Field	Description	Data Type	Reference Code	Comments
5	"Example Time Conversion"	Description		
6	Example Number	Integer		
7	TRS Number	Integer	TRSREF	
8	Time Value	Variant		Format as defined for TRS See Appendix A

Fields 7 onwards can be repeated as required, or the record repeated. For each example time conversion, at least two converted values should be listed.

TIMEREF: Time Reference Codes

Code	Name
1	UTC (formerly GMT)
2	GPS Time
3	Glonass Time
4	Galileo System Time (GST)

Table 8: TIMEREF Codes

Example Time Reference System Definitions Block

```
HC,1,2,0,Time Reference System                    ,1,1, 0.0,UTC,0,          ,5
HC,1,2,0,Time Reference System                    ,2,2,15.0,GPS,0,1980:01:06,6
HC,1,2,1,Example Time Conversion                  ,1,1,2011:02:04:13:19:59.0
HC,1,2,1,Example Time Conversion                  ,1,2,980860814.0
```

5.3. Coordinate Reference Systems Definition

To ensure that coordinates given in the data records are unambiguous in their description of position, this format requires specification of their coordinate reference system. The OGP 'P' formats Common Header allows any Coordinate Reference System (CRS) or coordinate transformation in use in the oil and gas industry to be defined. The format makes reference to the EPSG Geodetic Parameter Dataset ("EPSG Dataset") during the definition of the CRS and coordinate transformation parameters. However, this should not preclude the full definition of all the coordinate reference system parameters in the header, simply referencing the EPSG codes is not acceptable. To ensure that coordinates given in the data records are unambiguous in their description of position, this format requires specification of geodetic parameters giving the full and complete definition of the coordinate reference systems (CRSs) in use during the survey, including transformations between different coordinate reference systems.

In general, a CRS or a coordinate transformation may be described in two ways:

- Implicit identification through citation of an EPSG code. The defining attributes and their values may then be obtained from the EPSG Dataset; or
- Explicit statement of all necessary defining attributes and their values.

In this format implicit identification alone is not acceptable. It is required by this format that header records always contain the full defining parameters for all CRSs and any transformations used ("explicit definition"), and also includes implicit identification whenever the CRS or coordinate transformation data is in the EPSG Dataset.

To ensure that the format handles cases where the EPSG Dataset is cannot be referenced in the definition of the geodetic parameters, the format defines internal codes for CRS Number (CRSREF) and Coordinate Transformation Number (COTRANSREF). If the EPSG Dataset is referenced then these internal codes are cross referenced to the EPSG code in the header. The internal codes are always the values used within the data records.

In addition to the CRSs to which the coordinates in the file are referenced, the full set of survey geodetic information of earlier CRSs should be described in the Common Header to ensure that any transformation back to the earlier CRS or a common coordinate reference system (such as WGS 84) uses the correct parameters.

Latitude and longitude in the data records shall be given in decimal degrees, but when parameters in transformation and conversion definitions they should be written in the same unit and to the same resolution as supplied by the information source. Thus EPSG unit code 9122 "degree (supplier to define representation)" should be regarded as decimal degrees within the 'P' formats.

The format follows the structure of the EPSG Geodetic Parameter Dataset and requires the use of the following parameter codes from that dataset.

- Coordinate Operation Method Codes for Map Projections and Transformations.
- Coordinate Operation Parameter Codes for Map Projections and Transformations.
- Coordinate Axis Codes

Any additional codes are provided for cross reference and need only be included if the geodetic parameters are directly extracted from an EPSG Dataset.

When writing explicit defining attributes and their values, if the application is referencing values from an EPSG-compliant database, the parameter names, values and units must be exactly as given in the that database.

In the EPSG Dataset, most coordinate transformations utilise the 2 dimensional variant of a coordinate reference system, whereas a GNSS system will provide positions in the 3 dimensional variant of the coordinate reference system. Thus, to ensure the EPSG structure is followed, it will be necessary to include both these coordinate reference systems and specify the correct 3D to 2D conversion.

The table below defines the coordinate fields for each CRS type:

CRS Type	Coordinate Field 1	Coordinate Field 2	Coordinate Field 3
Projected[1]	Easting or northing[2]	Northing or easting[2]	(not used, leave blank)
Geographic 2D	Latitude	Longitude	(not used, leave blank)
Geographic 3D	Latitude	Longitude	Ellipsoidal height
Geocentric	Geocentric X	Geocentric Y	Geocentric Z
Vertical	(not used, leave blank)	(not used, leave blank)	Gravity-related height or depth[3]
Engineering 1D[4]	Distance along X axis	(not used, leave blank)	(not used, leave blank)
Engineering 2D[4,5]	Distance along X axis	Distance along Y axis	(not used, leave blank)
Engineering 3D[4]	Distance along X axis	Distance along Y axis	Distance along Z axis
Compound[6]	According to horizontal CRS	According to horizontal CRS	According to vertical CRS

Table 9: Coordinate Reference System Types and associated Coordinate Field content

Notes:

1. *Sometimes called "map grid".*
2. *There is significant variation worldwide in the convention used for projected CRS axis order and abbreviation. In some cases the easting will be given before the northing and in other cases the order will be northing before easting. In both of these scenarios the axes may be labelled X and Y; in such instances the first coordinate will be labelled X regardless of whether easting or northing and the second coordinate labelled Y.*
3. *Whether vertical coordinates are heights (positive up) or depths (positive down) is given in the CRS definition.*
4. *1D, 2D, and 3D engineering types are not explicitly split out in CRSTYPEREF (Table 10) but implicitly differentiated through the Coordinate System (CS) dimension instead (field 11 in HC,1,6,0).*
5. *Seismic bin grids are described through both an engineering 2D CRS and an associated affine transformation.*
6. *Compound CRS is a construct which allows coordinates from complementary horizontal 2D and vertical 1D CRSs to be linked together to form a single pseudo-3-dimensional tuple. For clarity, the horizontal CRS and vertical CRS are listed with all the relevant details, the compound CRS simply links them together into a single entity. The horizontal and vertical CRS details are not repeated in the compound CRS.*

5.3.1. Coordinate Reference System Implicit Identification

HC,1,3,0: Coordinate Reference System Implicit Identification

Mandatory for all CRSs

Field	Description	Data Type	Reference Code	Comments
5	"CRS Number/EPSG Code/ Name/Source"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG CRS Code	Integer		Blank if an EPSG-compliant database is not referenced
8	CRS Name	Text		
9	Version of EPSG-compliant database referenced	Text		Blank if an EPSG-compliant database is not referenced
10	Date of EPSG-compliant database referenced	Date		Blank if an EPSG-compliant database is not referenced
11	Source of EPSG-compliant database referenced	Text	e.g EPSG	Blank if an EPSG-compliant database is not referenced
12	Any Other Details	Text		Optional

Example Coordinate Reference System Implicit Identification

```
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,1,      ,WGS 84 / UTM zone 31N / EGM96,    ,           ,     ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,2,32631,         WGS 84 / UTM zone 31N,7.6,2010:11:02,EPSG,Loaded
         from EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,3, 4326,                       WGS 84,7.6,2010:11:02,EPSG,Loaded
         from EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,4, 5773,            EGM96 Geoid Height,7.6,2010:11:02,EPSG,Loaded
         from EPSG_v7_6.mdb
```

5.3.2. Coordinate Reference System Explicit Definition

HC,1,4,0: Coordinate Reference System Details (Explicit Definition)

Mandatory for all CRSs

Field	Description	Data Type	Reference Code	Comments
5	"CRS Number/EPSG Code/ Type/Name"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG CRS Code	Integer		Blank if an EPSG-compliant database is not referenced
8	CRS Type Code	Integer	CRSTYPEREF	See Table 10
9	CRS Type	Text		As detailed in the CRSTYPEREF Table 10
10	CRS Name	Text		Use EPSG name if EPSG CRS code given

CRSTYPEREF: CRS Type Codes

Code	Name
1	projected
2	geographic 2D
3	geographic 3D
4	geocentric
5	vertical
6	engineering
7	compound

Table 10: CRSTYPEREF Codes

Example

```
HC,1,4,0,CRS Number/EPSG Code/Type/Name…,1,32628,1,projected,WGS 84 / UTM zone 28N
```

HC,1,4,1: Compound CRS Horizontal CRS Identification

Mandatory when CRS type is compound. Shall not be given for any other CRS type. The horizontal CRS type shall be either Geographic 2D or Projected or Engineering. The horizontal CRS details shall be defined as a separate CRS entry.

Field	Description	Data Type	Reference Code	Comments
5	"Compound Horizontal CRS"	Description		
6	Compound CRS Number	Integer	CRSREF	
7	Horizontal CRS Number	Integer	CRSREF	
8	Horizontal CRS Name	Text		

The Horizontal CRS is a Geographic 2D CRS, Engineering 2D CRS or a Projected CRS. Its full details shall be described within the file.

Example

```
HC,1,4,1,Compound Horizontal CRS…,4,1,WGS 84 / UTM zone 28N
```

HC,1,4,2: Compound CRS Vertical CRS Identification

Mandatory when CRS type is compound. Shall not be given for any other CRS type. The vertical CRS type shall be Vertical. The vertical CRS details shall be defined as a separate CRS entry.

Field	Description	Data Type	Reference Code	Comments
5	"Compound Vertical CRS"	Description		
6	Compound CRS Number	Integer	CRSREF	
7	Vertical CRS Number	Integer	CRSREF	
8	Vertical CRS Name	Text		

The vertical CRS full details shall be described within the file.

Example

```
HC,1,4,2,Compound Vertical CRS…,4,3,MSL depth
```

HC,1,4,3: Base Geographic CRS Details

Mandatory when CRS type is projected. Shall not be given for any other CRS type.

Field	Description	Data Type	Reference Code	Comments
5	"Base Geographic CRS"	Description		
6	CRS Number	Integer	CRSREF	
7	Base Geographic CRS Number	Integer	CRSREF	
8	EPSG Base Geographic CRS Code	Integer		Blank if an EPSG-compliant database is not referenced

The base CRS full details shall be described within the file.

Example

```
HC,1,4,3,Base Geographic CRS…,1,2,4326
```

HC,1,4,4: Geodetic Datum Details

Mandatory when CRS type is geocentric, geographic 3D, geographic 2D or projected. Shall not be given when CRS type is vertical, engineering or compound.

Field	Description	Data Type	Reference Code	Comments
5	"Geodetic Datum"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Datum Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Datum name	Text		Use EPSG name if EPSG datum code given

Example

```
HC,1,4,4,Geodetic Datum…,1,6326,World Geodetic System 1984
```

HC,1,4,5: Prime Meridian Details

Mandatory when both the CRS type is geocentric, geographic 3D, geographic 2D or projected, and the prime meridian name is not 'Greenwich' or the Greenwich longitude is not zero. Shall not be given when CRS type is vertical, engineering or compound.

Field	Description	Data Type	Reference Code	Comments
5	"Prime Meridian"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Prime Meridian Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Prime Meridian name	Text		
9	Greenwich Longitude	Variant		As defined by Unit Code
10	Unit Code	Integer	UNITREF	
11	Units of Measure Name	Text		

Example

```
HC,1,4,5,Prime Meridian…,1,8909,Ferro,-17.40,8,sexagesimal DMS
```

HC,1,4,6: Ellipsoid Details

Mandatory when CRS type is geocentric, geographic 3D, geographic 2D or projected. Shall not be given when CRS type is vertical, engineering or compound.

Field	Description	Data Type	Reference Code	Comments
5	"Ellipsoid"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Ellipsoid Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Ellipsoid Name	Text		Use EPSG name if EPSG ellipsoid code given
9	Semi-major axis (a)	Float		
10	Unit Code	Integer	UNITREF	
11	Units of Measure Name	Text		
12	Inverse flattening (1/f)	Float		

Example

```
HC,1,4,6,Ellipsoid…,1,7030,WGS 84,6378137.0,1,metre,298.257223563
```

HC,1,4,7: Vertical Datum Details

Mandatory when CRS type is vertical. Shall not be given for any other CRS type.

Field	Description	Data Type	Reference Code	Comments
5	"Vertical Datum"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Datum Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Datum Name	Text		Use EPSG name if EPSG datum code given

Example

```
HC,1,4,7,Vertical Datum…,3,5100,Mean Sea Level
```

HC,1,4,8: Engineering Datum Details

Mandatory when CRS type is engineering. Shall not be given for any other CRS type.

Field	Description	Data Type	Reference Code	Comments
5	"Engineering Datum"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Datum Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Datum Name	Text		Use EPSG name if EPSG datum code given

Example

```
HC,1,4,8,Engineering Datum…,3,9315,Seismic bin grid datum
```

HC,1,5,0: Map Projection Details

Mandatory when CRS type is projected. Shall not be given for any other CRS type.

Field	Description	Data Type	Reference Code	Comments
5	"Map Projection"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Coordinate Operation Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Projection Name	Text		Use EPSG name if EPSG code given

Example

```
HC,1,5,0,Map Projection                                    ,1,16028,UTM zone 28N
```

HC,1,5,1: Projection Method Details

Mandatory when CRS type is projected. Shall not be given for any other CRS type.

Field	Description	Data Type	Reference Code	Comments
5	"Projection Method"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Coordinate Operation Method Code	Integer		Use EPSG Dataset method code
8	Coordinate Operation Method Name	Text		Use EPSG name
9	Number of Projection Parameters	Integer		As defined in EPSG method. The number of **HC,1,5,2** records listed for this map projection should equal this value

Example

```
HC,1,5,1,Projection Method…,1,9807,Transverse Mercator,5
```

HC,1,5,2: Projection Parameter Details

Mandatory when CRS type is projected. Shall not be given for any other CRS type. For each map projection definition the number of HC,1,5,2 records shall equal the number of projection parameters for that map projection's projection method.

Field	Description	Data Type	Reference Code	Comments
5	Parameter Name	Description		Use EPSG name
6	CRS Number	Integer	CRSREF	
7	EPSG Coordinate Operation Parameter Code	Integer		Use EPSG Dataset Parameter Code
8	Parameter Value	Variant		As defined by Unit Code
9	Unit Code	Integer	UNITREF	
10	Units of Measure Name	Text		

Example

```
HC,1,5,2,Latitude of natural origin                    ,1,8801      0,3,degree
HC,1,5,2,Longitude of natural origin                   ,1,8802,   -15,3,degree
HC,1,5,2,Scale factor at natural origin                ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                 ,1,8806,500000,1, metre
HC,1,5,2,False northing                                ,1,8807,     0,1, metre
```

HC,1,6,0: Coordinate System Details

Mandatory when CRS type is geocentric, geographic 3D, geographic 2D, projected, vertical or engineering. Shall not be given when CRS type is compound.

Field	Description	Data Type	Reference Code	Comments
5	"Coordinate System"	Description		
6	CRS Number	Integer	CRSREF	
7	EPSG Coordinate System Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Coordinate System Name	Text		
9	Coordinate System Type Reference	Integer	CSTYPEREF	See Table 11
10	Coordinate System Type Name	Text		As detailed in Table 11
11	Dimension	Integer		The number of **HC,1,6,1** records listed for this coordinate system should equal this value

CSTYPEREF: Coordinate System Type Reference

Code	Name	Used with CRS type(s)
1	Affine	engineering
2	Cartesian	geocentric, projected, engineering
3	Ellipsoidal	geographic 3D, geographic 2D
4	Polar	engineering
5	Vertical	vertical

Table 11: CSTYPEREF Codes and constraints in relation to CRS type

Example

```
HC,1,6,0,Coordinate System…,1,4400,Cartesian 2D CS,2,Cartesian,2
```

HC,1,6,1: Coordinate Axis Details

Mandatory when CRS type is geocentric, geographic 3D, geographic 2D, projected, vertical or engineering. Shall not be given when CRS type is compound. For each CRS definition the number of HC,1,6,1 records shall equal the Dimension for that CRS's Coordinate System as given in the HC,1,6,0 record field 11.

Field	Description	Data Type	Reference Code	Comments
5	"Coordinate System Axis n"	Description		Where 'n' is the Coordinate Order
6	CRS Number	Integer	CRSREF	
7	Coordinate Order	Integer		
8	EPSG Coordinate Axis Code	Integer		Use EPSG Dataset Axis code
9	Axis Name	Text		Use EPSG Axis Name
10	Axis Orientation	Text		
11	Axis Abbreviation	Text		Use EPSG abbreviation if EPSG axis code given
12	Unit Code	Integer	UNITREF	
13	Units of Measure Name	Text		

The Coordinate Order is a sequential number from 1 onwards where the maximum value n equals the coordinate system dimension. Thus for a 3D CRS there should be 3 records of type **HC,1,6,1** with Coordinate Order values of 1,2 and 3 respectively. Within data records, coordinates are ordered within tuples as described in Table 9. For a 1D CRS there should be one record of type **HC,1,6,1** , always with Coordinate Order value of *1*; when that 1D CRS is of CRS type vertical the vertical coordinate will be in the *third* field of the coordinate tuple.

Example

```
HC,1,6,1,Coordinate System Axis 1…,1,1,1, Easting, east,E,1,metre
HC,1,6,1,Coordinate System Axis 2…,1,2,2,Northing,north,N,1,metre
```

5.3.3. Coordinate Transformation Implicit Identification

HC,1,7,0: Coordinate Transformation Implicit Identification

Mandatory for all coordinate transformations

Field	Description	Data Type	Reference Code	Comments
5	"Transformation Number/ EPSG Code/Name/Source"	Description		
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	EPSG Coordinate Operation Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Transformation Name	Text		Use EPSG name if EPSG code given
9	Version of EPSG-compliant database referenced	Text		Blank if an EPSG-compliant database is not referenced
10	Date of EPSG-compliant database referenced	Date		Blank if an EPSG-compliant database is not referenced
11	Source of EPSG-compliant database referenced	Text	e.g EPSG	Blank if an EPSG-compliant database is not referenced
12	Any Other Details	Text		Optional

Example Coordinate Transformation Implicit Identification

```
HC,1,7,0,Transformation Number/EPSG Code/Name Source   ,1, 1613,ED50 to WGS 84
       (24)  ,7.4.1,2010:02:01,EPSG,Loaded from EPSG_v7_4_1.mdb
HC,1,7,0,Transformation Number/EPSG Code/Name Source   ,2,15593, geog3D to
       geog2D,7.4.1,2010:02:01,EPSG,Loaded from EPSG_v7_4_1.mdb
```

5.3.4. Coordinate Transformation Explicit Definition

HC,1,8,0: Coordinate Transformation Name

Mandatory for all Coordinate Transformations

Field	Description	Data Type	Reference Code	Comments
5	"Transformation Number/ EPSG Code/Name"	Description		
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	EPSG Coordinate Operation Code	Integer		Blank if an EPSG-compliant database is not referenced
8	Transformation Name	Text		Use EPSG name if EPSG code given
9	Transformation Accuracy	Variant		Optional. In metres. Should be given when known

Example

```
HC,1,8,0,Transformation Number/EPSG Code/Name…,1,1998,ED50 to WGS 84 (36),1
```

HC,1,8,1: Coordinate Transformation Details

Mandatory for all Coordinate Transformations

Field	Description	Data Type	Reference Code	Comments
5	"Source CRS/Target CRS/ Version"	Description		
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	Source CRS Number	Integer	CRSREF	
8	Source CRS EPSG Code	Integer		Blank if an EPSG-compliant database is not referenced
9	Source CRS Name	Text		
10	Target CRS Number	Integer	CRSREF	
11	Target CRS EPSG Code	Integer		Blank if an EPSG-compliant database is not referenced
12	Target CRS Name	Text		
13	Transformation Version	Text		Optional

Example

```
HC,1,8,1,Source CRS/Target CRS/Version…,1,2,4230,ED50,3,4326,WGS 84,EPSG-Ger Nsea
```

HC,1,8,2: Coordinate Transformation Method Details

Mandatory for all Coordinate Transformations

Field	Description	Data Type	Reference Code	Comments
5	"Transformation Method"	Description		
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	Coordinate Operation Method Code	Integer		Use EPSG Dataset method code
8	Coordinate Operation Method Name	Text		Use EPSG name
9	Operation Reversible Flag	Integer		0 = operation is not reversible 1 = operation is reversible
10	Number of Parameters	Integer		As defined in EPSG method. The number of **HC,1,8,3** or **HC,1,8,4** records listed for this transformation should equal this value

Example

```
HC,1,8,2,Transformation Method…,1,9606,Position Vector transformation (geog2D domain),1,7
```

HC,1,8,3: Transformation Parameter File Details

Mandatory if transformation method requires a parameter file

Field	Description	Data Type	Reference Code	Comments
5	Parameter File Name	Description		
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	Coordinate Operation Parameter Code	Integer		Use EPSG Dataset Parameter Code
8	Parameter File Name	Text		
9	Operation Parameter Sign Reversal	Integer		Mandatory if operation method is reversible (**HC,1,8,2** record field 9 = 1), not required if operation method is not reversible. 0 = operation parameter sign is not reversed for reverse transformation 1 = operation parameter sign is reversed for reverse transformation

Example

```
HC,1,8,3,Latitude difference file                    ,1,8657,conus.las,1
HC,1,8,3,Longitude difference file                   ,1,8658,conus.los,1
```

HC,1,8,4: Transformation Parameter Details

Mandatory if transformation method requires a set of parameters

Field	Description	Data Type	Reference Code	Comments
5	Parameter Name	Description		Use EPSG name
6	Coordinate Transformation Number	Integer	COTRANSREF	
7	Coordinate Operation Parameter Code	Integer		Use EPSG Dataset Parameter Code
8	Parameter Value	Variant		As defined by Unit Code
9	Unit Code	Integer	UNITREF	
10	Units of Measure Name	Text		
11	Operation Parameter Sign Reversal	Integer		Mandatory if operation method is reversible (**HC,1,8,2** record field 9 = 1), not required if operation method is not reversible. 0 = operation parameter sign is not reversed for reverse transformation 1 = operation parameter sign is reversed for reverse transformation

Example

```
HC,1,8,4,X-axis translation…,1,8605,-157.89, 1,            metre,1
HC,1,8,4,Y-axis translation…,1,8606, -17.16, 1,            metre,1
HC,1,8,4,Z-axis translation…,1,8607, -78.41, 1,            metre,1
HC,1,8,4,X-axis rotation…   ,1,8608,  2.118, 9,       arc-second,1
HC,1,8,4,Y-axis rotation…   ,1,8609,  2.697, 9,       arc-second,1
HC,1,8,4,Z-axis rotation…   ,1,8610, -1.434, 9,       arc-second,1
HC,1,8,4,Scale difference…  ,1,8611,  -5.38,10,parts per million,1
```

5.3.5. Example Point Conversion

HC,1,9,0: Example Point Conversion

Recommended

Field	Description	Data Type	Reference Code	Comments
5	"Example Point Conversion"	Description		
6	Point Number	Integer		
7	Point Name	Text		
8	CRS Number	Integer	CRSREF	
9	Coordinate 1	Variant		Format as defined for CRS
10	Coordinate 2	Variant		Format as defined for CRS
11	Coordinate 3	Variant		Format as defined for CRS

Fields 8 through 11 can be repeated as required, or the record repeated. For each point, the coordinates should be listed in at least two CRSs.

This record allows the coordinates for one or more test points to be listed referenced to different CRSs. This is to allow the configured coordinate reference systems to be checked. The point is identified by the "Point Number" which is repeated for each CRS in which the position of the point is shown.

Example Point Conversion Example

```
HC,1,9,0,Example Point Conversion… ,1,STN 1,1,674092.03,9716717.23,,2,-
       2.561968694,133.565880528,
```

6. Common Header: Survey Configuration Data

6.1. General Survey Configuration Information

HC,2,0,0: General Survey Configuration Information

Field	Description	Data Type	Reference Code	Comments
5	"Survey Configuration"	Description		
6	Number of Production Systems Defined	Integer		
7	Number of Receivers Defined	Integer		
8	Number of Positioning Objects Defined	Integer		
9	Offset Mode Unit Code	Integer	UNITREF	
10	Offset Mode Unit Name	Text		

Note: Offset mode is fixed to rectangular

Example

```
HC,2,0,0,Survey Configuration                                    ,2,1,23,1,metre
```

6.2. Production System Information

HC,2,1,0: Production System Information

Field	Description	Data Type	Reference Code	Comments
5	System Name	Description		
6	System Reference Number	Integer	PRODSYSREF	
7	System Type	Text		e.g. "Recording" or "Navigation"
8	System Model Details	Text		
9	Software Version	Text		
10	Software Version Date	Date		

A production system is any computer system used during survey operations, such as an Integrated Navigation System or Seismic Recording System

HC,2,1,1: Production System Attributes

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 12
6	System Reference Number	Integer	PRODSYSREF	
7	Attribute Reference Number	Integer	PSATTREF	See Table 12
8	Attribute Value	Variant		If fields 9 and 10 are blank, the Attribute Value is assumed to be of text data type
9	Attribute Units	Integer	UNITREF	
10	Attribute Unit Name	Text		

Record may be repeated

HC,2,1,2: Auxiliary Channel Definition

Field	Description	Data Type	Reference Code	Comments
5	"Auxiliary Channel n Definition"	Description		Where 'n' is the channel number
6	Recording System Ref. Number	Integer	PRODSYSREF	
7	Channel Number	Integer	AUXREF	
8	Channel Type	Text		
9	Channel Description	Text		Optional
10	Unit Code	Integer	UNITREF	
11	Unit Name	Text		

Production System Attribute Reference Numbers (PSATTREF)

Reference Number	Description
1	Polarity
2	Sample Interval
3	Record Length
4	Channels Per Record
5	Tape Type
6	Tape Format
7	Tape Density
8	High Cut Filter Frequency
9	High Cut Filter dB Level
10	High Cut Filter Slope
11	Notch Filter Center Frequency
12	Notch Filter Lower -3dB Point Frequency
13	Notch Filter Higher -3dB Point Frequency
14	Low Cut Filter Frequency
15	Low Cut Filter dB Level
16	Low Cut Filter Slope
17	Time Delay FTB to SOD
18	Time Delay FTB to SOD Applied to Data Flag
19	Components Recorded
20	Method Of Transfer With Recording System
100 onwards	User to provide Attribute Name description in HC,2,1,1

Table 12: Production System Attribute Reference Numbers

Example Production System Records

```
HC,2,1,0,SN388…                  ,1,Recording,007,1.0,2000:12:01
HC,2,1,1,Polarity…               ,1,  1,      SEG, ,
HC,2,1,1,Sample Interval…        ,1,  2,        2,6,milliseconds
HC,2,1,1,Record Length…          ,1,  3,        7,5,     seconds
HC,2,1,1,Channels per Record…    ,1,  4,      400, ,
HC,2,1,1,User-defined attribute…,1,100,some text, ,

HC,2,1,2,Auxiliary Channel 1 Definition…,1,1,Time Break,FTB,12,Milliseconds

HC,2,1,0,Seal…,1, Recording, 428,  1.0,2009:02:14
HC,2,1,0,Orca…,2,Navigation,Orca,1.3.4,2010:04:01
```

6.3. Receiver Information

HC,2,2,0: Receiver Information

Field	Description	Data Type	Reference Code	Comments
5	Receiver Name	Description		
6	Receiver Reference Number	Integer	OBJREF [RX]	
7	Receiver Short Name	Text	OBJNAME	e.g. "R1"
8	Receiver Type	Text		
9	Receiver Model Details	Text		

HC,2,2,1: Receiver Attributes (Land seismic only)

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 13
6	Receiver Reference Number	Integer	OBJREF [RX]	
7	Attribute Reference Number	Integer	RXATTREF	See Table 13
8	Attribute Value	Variant		If fields 9 and 10 are blank, the Attribute Value is assumed to be of text data type
9	Attribute Units	Integer	UNITREF	
10	Attribute Unit Name	Text		

Record may be repeated

Receiver Attribute Reference Numbers (RXATTREF)

Reference Number	Description
1	Polarity
2	Damping Coefficient
3	Natural Frequency
4	Number of Elements in Group
5	Inline Dimension of the Group
6	Crossline Dimension of the Group
7	Inline Distance Between Elements in the Group
8	Crossline Distance Between Elements in the Group
100 onwards	User to provide Attribute Name description in HC,2,2,1

Table 13: Receiver Attribute Reference Numbers

Example Receiver Records

```
HC,2,2,0,P44A                                          ,1,H1,P44A,OBC
HC,2,2,1,Polarity                                      ,1, 1, SEG, ,
HC,2,2,1,Damping Coefficient                           ,1, 2,0.70,5,unitless
HC,2,2,1,Natural Frequency                             ,1, 3,10.0,6,   Hertz
```

6.4. Definition of Positioning Objects

In order to achieve maximum flexibility, the P-formats use the concept of a positioning object. This object can be any main survey object for which a position is generated, such as a vessel or gun array.

Each positioning object is referenced by a reference number [OBJREF] that uniquely identifies the object, but also defines a short name [OBJNAME] which is used to provide a modicum of human readability to the P1/11 position records. Thus a vessel might be defined as reference number #1, with a full name of "M/V Seisco Oilfinder" and a short name of "V1".

Each positioning object can be defined with a nominal position relative to another positioning object to allow for the survey configuration to be defined. This position is relative to the defined local reference position of the parent positioning object.

Thus a simple source configuration would look as follows

```
HC,2,3,0,M/V Vessel…    ,1, V1,1, Vessel,,1, ,   ,    ,  ,NRP,,,
HC,2,3,0,Port Gun Array…,2,G01,4,Air Gun,, ,1, 25,-390,-6,COS,,,
HC,2,3,0,Stbd Gun Array…,3,G02,4,Air Gun,, ,1,-25,-390,-6,COS,,,
```

Recording the position of each object relative to a defined parent is recommended for field data, but it is possible to define a source without recording the parent vessel, or to define the source with a parent vessel without the nominal relative position if this is not known for any reason.

Thus you might have

```
HC,2,3,0,M/V Vessel…    ,1, V1,1, Vessel,,1, ,   ,    ,  ,NRP,,,
HC,2,3,0,Port Gun Array…,2,G01,4,Air Gun,, ,1, 25,-390,-6,COS,,,
HC,2,3,0,Stbd Gun Array…,3,G02,4,Air Gun,, ,1,-25,-390,-6,COS,,,
```

or

```
HC,2,3,0,M/V Vessel…    ,1, V1,1, Vessel,,1,  ,,,,,,,
HC,2,3,0,Port Gun Array…,2,G01,4,Air Gun,, , 1,,,,,,,
HC,2,3,0,Stbd Gun Array…,3,G02,4,Air Gun,, , 1,,,,,,,
```

or

```
HC,2,3,0,Port Gun Array…,1,G01,4,Air Gun,,,,,,,,,
HC,2,3,0,Stbd Gun Array…,2,G02,4,Air Gun,,,,,,,,,
```

Positioning objects should be defined as required by the file contents.

Positioning objects can be defined in two locations in the Common eader. A positioning object which is a Receiver is defined in the HC,2,2,0 record, and any other positioning object is defined in the HC,2,3,0 record. The OBJREF number is unique regardless of which record is used for definition.

Throughout the formats right-handed Cartesian co-ordinate frames are maintained to express offsets.

For marine surveys, the axes of the co-ordinate frames are defined as follows:

- **Across Offset**: Horizontal axis, perpendicular to the Along Axis, positive towards starboard.
- **Along Offset**: Parallel to the vessel's longitudinal axis, positive towards the bow.
- **Above Offset:** Perpendicular to the two horizontal axes, the axis completes a right-handed X,Y,Z co-ordinate frame. Hence, positive Z is upwards, synonymous with height.

For land surveys, the axes of the co-ordinate frames are defined as follows:

- **Across Offset:** Horizontal axis, perpendicular to the Along Axis, positive towards the right.
- **Along Offset:** Parallel to the object's longitudinal axis, positive towards the front.
- **Above Offset:** Perpendicular to the two horizontal axes, the axis completes a right-handed X,Y,Z co-ordinate frame. Hence, positive Z is upwards, synonymous with height.

Objects are defined with a single reference point relative to the parent object. All local offsets of any items located on the object are referenced to this location.

6.4.1. Object Reference Numbers

The object reference numbers (OBJREF) shall be unique within each file. The references OBJREF[RX] and OBJREF[NODE] are subsets of the OBJREF reference numbers and can be used in any place when an OBJREF is used. However, where an OBJREF[xxx] is specified, only the relevant subset object can be referred to.

6.5. Positioning Objects

HC,2,3,0: Object Summary Information

Field	Description	Data Type	Reference Code	Comments
5	Object Full Name	Description		
6	Object Reference Number	Integer	OBJREF	
7	Object Short Name	Text	OBJNAME	e.g. 'V1'
8	Object Type Reference Code	Integer	OBJTYPEREF	See Table 14
9	Object Type	Text	OBJTYPE	e.g. "Vessel" - see Table 14
10	Object Model Details	Text		Optional
11	Systems On This Object	Integer List	PRODSYSREF	Blank if n/a
12	"Towed By" Object Ref. Number	Integer	OBJREF	Blank if n/a
13	Across Offset	Float		blank if n/a
14	Along Offset	Float		blank if n/a
15	Above Offset	Float		blank if n/a
16	Description of Local Reference Point	Text		e.g. "Towpoint in Sea"
17	Number of Objects Towed By this Object	Integer		Blank if no objects towed by this object
18	Number of External Position Sensors	Integer		e.g. GNSS receivers. Blank if no position sensor data is listed for this object
19	Number of Nodes	Integer		Blank if no node data is listed for this object

The numbers given above are for items directly located on or towed by the Object

Object Type Codes (OBJTYPEREF) and Reserved OBJTYPE Text

OBJTYPEREF Code	OBJTYPE Text	Description
1	Vessel	Survey vessel
2	Streamer	Any towed or deployed streamer
3	Node	Any deployed node containing sensors
4	Air Gun	Any towed air gun array
5	Water Gun	Any towed water gun array
6	Vibroseis	Any Vibroseis source
7	Explosive	Any explosive source
8	Electromagnetic	Any EM source
9	Gun String	Any towed array substring.
10	Float	Any towed body, such as a tailbuoy or front float
11	Echo Sounder	Any fixed acoustic depth sensor
21-onwards	(User defined)	User to provide OBJTYPE (field 9) in HC,2,3,0

Table 14: OBJTYPEREF Codes

HC,2,3,1: Positioning Object Attributes

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 15
6	Object Reference Number	Integer	OBJREF	
7	Attribute Reference Number	Integer	OBJATTREF	See Table 15
8	Attribute Value	Variant		If fields 9 and 10 are blank, the Attribute Value is assumed to be of text data type
9	Attribute Units	Integer	UNITREF	
10	Attribute Unit Name	Text		

Record may be repeated

Object Attribute Reference Numbers (OBJATTREF)

Reference Number	Description
1	Polarity
2	Total Charge Size
3	Force
4	Air Volume
5	Vertical Fold of Stack
6	Number of Sweeps Per VP
7	Number of Elements in Pattern
8	Inline Dimension of the Pattern
9	Crossline Dimension of the Pattern
10	Inline Distance Between Elements in the Pattern
11	Crossline Distance Between Elements in the Pattern
12	Control Type
13	Correlator Type
14	Noise Suppression Type Applied Before Summing
15	Sweep Type
16	Sweep Length
17	Sweep Start Frequency
18	Sweep End Frequency
19	Taper Type
20	Taper Start Length
21	Taper End Length
22	Nominal Shot Depth
23	Length of Charge
24	Nominal Soil Type
25	Drilling Method
26	Nominal Weathering Thickness
27	Peak to Peak Output
28	Primary to Bubble Ratio
29	Nominal Air Pressure
30	Number of Sub Arrays
31	Nominal Towing Depth
32	Depth Corrections Applied

33	Sound Velocity Used
34	Heave Corrections Applied
35	Number of Receivers
36	Near Receiver Number
37	Far Receiver Number
38	Receiver Spacing
39	Shot Point Interval
100 onwards	User to provide Attribute Name in HC,2,3,1

Table 15: Object Attribute Reference Numbers

Example Object Summary Records

```
HC,2,3,0,Source                                    ,2,A1,4,Air Gun,,,,,,,,,
HC,2,3,1,Polarity                                  ,2,  1,      SEG, ,
HC,2,3,1,Air Volume                                ,2,  4,   1400.0,8,cm3
HC,2,3,1,Nominal Air Pressure                      ,2, 29,   2000.0,9,psi
HC,2,3,1,User-defined attribute                    ,2,100,some text, ,
```

```
HC,2,3,0,MV SeisFinder… , 2,V01, 1,  Vessel,        ,1&2, ,      ,       ,    ,     NRP,8,3, 6
HC,2,3,0,Streamer S1…   , 3,S01, 2,Streamer,Sentinel,   ,2, 250.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Streamer S2…   , 4,S02, 2,Streamer,Sentinel,   ,2, 150.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Streamer S3…   , 5,S03, 2,Streamer,Sentinel,   ,2,  50.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Streamer S4…   , 6,S04, 2,Streamer,Sentinel,   ,2, -50.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Streamer S5…   , 7,S05, 2,Streamer,Sentinel,   ,2,-150.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Streamer S6…   , 8,S06, 2,Streamer,Sentinel,   ,2,-250.0, -407.8,-6.5,     CNG,1, ,12
HC,2,3,0,Gun Array G1…  , 9,G01, 4, Air Gun,    Bolt,   ,2, -25.0, -284.5,-6.0,     COS, , , 6
HC,2,3,0,Gun Array G2…  ,10,G02, 4, Air Gun,    Bolt,   ,2,  25.0, -284.5,-6.0,     COS, , , 6
HC,2,3,0,Tailbuoy on S1…,11,T01,10,   Float,        ,   ,3,   0.0,-3083.1, 6.5,Towpoint, , , 2
HC,2,3,0,Tailbuoy on S2…,12,T02,10,   Float,        ,   ,4,   0.0,-3083.1, 6.5,Towpoint, , , 2
HC,2,3,0,Tailbuoy on S3…,13,T03,10,   Float,        ,   ,5,   0.0,-3083.1, 6.5,Towpoint, , , 2
HC,2,3,0,Tailbuoy on S4…,14,T04,10,   Float,        ,   ,6,   0.0,-3083.1, 6.5,Towpoint, , , 2
HC,2,3,0,Tailbuoy on S5…,15,T05,10,   Float,        ,   ,7,   0.0,-3083.1, 6.5,Towpoint, , , 2
HC,2,3,0,Tailbuoy on S6…,16,T06,10,   Float,        ,   ,8,   0.0,-3083.1, 6.5,Towpoint, , , 2
```

7. Comment Records

Comment records should be inserted as close as possible to the data items to which they refer. They may be inserted into the header or the data section but shall not be inserted before record **HC,0,1,0.**

CC,1,0,0: Additional Information

Field	Description	Data Type	Reference Code	Comments
5	Comment	Text		

Example

```
CC,1,0,0,SHOOTING POINT V1 MEAN CMP AT (0.0 -100.0)
CC,1,0,0,LINE CSL-T21001P9015 265 SHOTS (1004 TO 1268)
CC,1,0,0,GENERATED BY ORCA 1.8.1 FROM QC (NRT) DATABASE
CC,1,0,0,12 SOURCE MAPPING G2    A 2
CC,1,0,0,12 SOURCE MAPPING G1    B 1
CC,1,0,0,13 STREAMER MAPPING     A 1 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
```

8. P1-Specific Format Information

8.1. Position Records

Five position records are defined

- S1: For an energy source position
- R1: For a receiver position
- P1: For any additional position objects
- N1: For preplot positions
- M1: For survey perimeter positions

Each of these position records is linked to a record type definition given in the file header, in which the coordinate and time reference systems written into the position records are identified. These reference systems are defined in the header.

8.2. Relational Records

To allow for complex acquisition and the possibility of multiple positions within a single event, the format uses the concept of index numbering of positions within the event, along with a relational record (X1) to allow specific source positions to be linked to specific receiver positions.

The following record schemas are valid

- Single Event Recording: A single S1 energy source record is recorded, along with a single group of R1 receiver position records. In this case, the index number in both sets of records is left blank.
- Paired Multiple Event Recording: Multiple S1 energy source records are recorded, along with the same number of groups of R1 receiver position records. In this case, the index number in both sets of records is matched and no relational record is required.
- Variable Multiple Event Recording: Multiple S1 energy source records are recorded, along with a different number of groups of R1 receiver position records. In this case, the index number in both sets of records is matched by using an X1 relational record.

8.3. Quality Measures

Each position and receiver record allows for the recording of an error ellipse/ellipsoid, along with an additional definition to allow for the recording of any additional quality attributes which are relevant to the position.

9. P1 Header

9.1. P1 Header: File Content Definitions

H1,0,0,0: File Contents Description

Field	Description	Data Type	Reference Code	Comments
5	"File Contents Description"	Description		
6	Description	Text		
7	Any Other Details	Text		Optional

H1,0,1,0: File Processing Details

Field	Description	Data Type	Reference Code	Comments
5	"Processing Details"	Description		
6	Details	Text		

Record can be repeated as required

H1,0,2,0: File Contents Attribute

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 16
6	Attribute Reference Number	Integer	ATTREF	See Table 16
7	Attribute Value	Variant		If fields 8 and 9 are blank, the Attribute Value is assumed to be of text data type
8	Attribute Units	Integer	UNITREF	If not listed, the attribute value is assumed to be of text format
9	Attribute Unit Name	Text		If not listed, the attribute value is assumed to be of text format

Record can be repeated as required

File Contents Attribute Reference Numbers [ATTREF]

ATTREF Code	Description	Comments
1	Receiver Groups Per Shot	
2	Original File	Used when the file is converted from an original output file
3	Level of significance (α_o)	
4	Detection power ($\gamma_o = 1 - \beta_o$)	
5	Critical Value W-Test	
6	Scale Factor 95% Error Ellipse (2D)	
7	Scale Factor 95% Error Ellipse (3D)	
100 onwards	(User Defined)	User to provide Attribute Name in H1,0,2,0

Table 16: File Contents Attribute Reference Numbers

Example

```
H1,0,0,0,File Contents Description… ,Final Positions,Output by ORCA NRT Process
H1,0,1,0,Processing Details…        ,Computed in Real Time by CSL ORCA
H1,0,2,0,Realtime Filter Strength…  ,100,High,,
H1,0,2,0,Realtime Filter Width…     ,101,60.0,1,seconds

H1,0,0,0,File Contents Description… ,Digitised Final XYs,Converted from Old Map
H1,0,1,0,Processing Details…        ,Digitised from Original Survey Maps
H1,0,1,0,Processing Details…        ,Quality Controlled using First Break Data
H1,0,2,0,Source of Coordinates…     ,100,56424354.tif,,
H1,0,2,0,Scale of Map Used…         ,101,1:50000,,
H1,0,2,0,Method of GeoReferencing…  ,102,Interactive,,
```

9.2. P1 Header: Position Record Definitions

H1,1,0,0: P1/S1 Position Record Type Definitions

Field	Description	Data Type	Reference Code	Comments
5	"Position Record Type Definition"	Description		
6	Record Type Number	Integer	P1TYPEREF	
7	CRS 1 Number	Integer	CRSREF	
8	CRS 2 Number	Integer	CRSREF	
9	CRS 3 Number	Integer	CRSREF	
10	TRS Number	Integer	TRSREF	
11	Point Number Format Code	Integer	DATATYPEREF	
12	Number of Record Extension Fields Recorded Per Record	Integer		
13	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 13 is repeated as required.

It is a requirement of the format for position records of positioning objects that the first CRS (CRS 1 in field 7) is the projected CRS (or compound CRS encompassing the projected CRS), and the second CRS (CRS 2 in field 8) is the base geographic CRS of CRS 1, expressed in decimal degrees (recommended to 8 decimal places). It is recommended that the third CRS (CRS 3 in field 9) is the original or reference CRS of the acquisition phase. This provides a compatibility check between the coordinate transformation details defined in the Common Header and the coordinates for the first and second CRSs.

P1/S1 Position Record Extension Field Data Identifiers

Extension Identifier	Description	Additional Parameter
1	Water Depth	Vertical CRS Reference (CRSREF)
2	Vertical CRS Difference	The From (source) and To (target) Vertical CRS References (CRSREF), separated by an ampersand. Unit is in source CRS
3	Point Depth	Vertical CRS Reference (CRSREF)
4	Static Correction	
5	Seismic Datum Offset	Vertical CRS Reference (CRSREF)
6	Uphole Time	
7	Course Made Good	Relevant CRSREF
8	Field File Id (FFID)	
9	Charge Depth	
100 onwards	(User to define the measurement or attribute)	

Table 17: Position Record Extension Field Data Identifiers

H1,1,0,1: P1/S1 Position Record – Quality Definition

Field	Description	Data Type	Reference Code	Comments
5	"Position Record Quality Definition"	Description		
6	Record Type Number	Integer	P1TYPEREF	
7	Confidence Level	Float		Percent – e.g. "95"
8	Additional Information on Quality Values	Text		Optional
9	Error Ellipse Linear Unit Code	Integer	UNITREF	Mandatory if Error Ellipse data recorded
10	Error Ellipse Angle Unit Code	Integer	UNITREF	Mandatory if Error Ellipse data recorded
11	Number of Additional Quality Measures Recorded Per Record	Integer		
12	Additional Quality Measure Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 12 is repeated as required.

If no quality information is available, for instance when an older position format has been converted which does not contain this information, the Confidence Level (field 7) should be set to Zero to indicate this.

P1/S1 Position Quality Measures Field Identifiers

Extension Identifier	Description	Additional Parameter
100 onwards	(User to define the measurement or attribute)	

Table 18: Position Record Additional Quality Measure Identifiers

Example Position Record Definition

```
H1,1,0,0,Position Record Type Definition…   ,2,1,2,3,1,1,1,1;3;Water Depth;3
H1,1,0,1,Position Record Quality Definition…,2,95,Absolute Error Ellipses,2,1,0,
```

9.3. P1 Header: R1 Receiver Position Record Definitions

H1,2,0,0: R1 Receiver Record Type Definition

Field	Description	Data Type	Reference Code	Comments
5	"Receiver Record Type Definition"	Description		
6	Record Type Number	Integer	P1RXTYPEREF	
7	Maximum Receivers per File Record Line	Integer		The maximum number of receivers concatenated into a single 'R' record.
8	CRS 1 Number	Integer	CRSREF	
9	CRS 2 Number	Integer	CRSREF	
10	CRS 3 Number	Integer	CRSREF	
11	TRS Number	Integer	TRSREF	
12	Point Number Format Code	Integer	DATATYPEREF	
13	Receiver Group Number Format Code	Integer	DATATYPEREF	
14	Number of Record Extension Fields Recorded Per Record	Integer		
15	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 15 is repeated as required.

For information on the three coordinate tuples and the CRS definitions, see the P1/11 User Guide, which accompanies this format definition.

This record uses the same record extension field identifiers as the P1/S1 Position records.

H1,2,0,1: R1 Receiver Record – Quality Definition

Field	Description	Data Type	Reference Code	Comments
5	"Receiver Record Quality Definition"	Description		
6	Record Type Number	Integer	P1RXTYPEREF	
7	Confidence Level	Float		Percent – e.g. "95"
8	Additional Information on Quality Values	Text		
9	Error Ellipse Linear Unit Code	Integer	UNITREF	
10	Error Ellipse Angle Unit Code	Integer	UNITREF	
11	Number of Additional Quality Measures Recorded Per Record	Integer		
12	Additional Quality Measure Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 12 is repeated as required.

This record uses the same additional quality measure definition as the P1/S1 Position record.

Example Receiver Group Record Definition

```
H1,2,0,0,Receiver Record Type Definition…   ,1,30,1,2,3,1,1,1,0,
H1,2,0,1,Receiver Record Quality Definition…,1,95,Relative Error Ellipses,2,1,0,
```

9.4. P1 Header: X1 Relation Record Definition

H1,3,0,0: X1 Relation Record Definition

Field	Description	Data Type	Reference Code	Comments
5	"Relation Record Definition:"	Description		
6	Number of Record Extension Fields Recorded Per Position Record	Integer		
7	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 7 is repeated as required.

Example Relation Record Definition

```
H1,3,0,0,Relation Record Definition                              ,0,
```

9.5. P1 Header: N1 Preplot Position Record Definitions

H1,4,0,0: N1 Preplot Record Type Definition

Field	Description	Data Type	Reference Code	Comments
5	"Preplot Record Type Definition"	Description		
6	Preplot Type Reference Number	Integer	PREPLOTTYPEREF	1 onwards
7	Physical Position Reference Number	Integer List	OBJREF	Optional
8	Logical Position Reference Number	Integer List		0 for CMP 1 onwards is the logical number.
9	Line Dimension Type	Integer		2 = 2D Survey 3 = 3D Survey 4 = 4D Survey Other values user defined.
10	Line Dimension Description	Text		
11	CRS 1 Number	Integer	CRSREF	
12	CRS 2 Number	Integer	CRSREF	
13	Line Type	Integer		1 = Source 2 = Receiver 3 = Other
14	Point Number Format Code	Integer	DATATYPEREF	
15	Point Distance Interval Unit Code	Integer	UNITREF	Blank if the Preplot lines are specified only using point records.
16	Angular Unit Code	Integer	UNITREF	Blank if arc or spiral segments are not defined.
17	Number of Record Extension Fields Recorded Per Position Record	Integer		
18	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 18 is repeated as required.

Each Preplot Line Coordinates Record provides storage for the position referenced to two CRSs. CRS #1 will be the projected CRS or a compound CRS encompassing the projected CRS, and CRS #2 will be the base geographic CRS of CRS #1.

Either the Physical Position Reference Number – detailing an exact link to a positioning object defined in the survey summary data – or a Logical Position Reference Number – detailing a non-specific reference such as 1 and 2 for dual sources – need to be defined.

The format used for the variant point numbers in this and the following records will depend on the value in field 14.

Preplot Position Record Extension Field Extension Identifiers

Reference Number	Description	Additional Parameter
1	Base Feather	
2	Source ID	
100 onwards	(User to define the measurement or attribute)	

Table 19: Preplot Position Record Extension Field Extension Identifiers

Example Preplot Record Type Definition

```
H1,4,0,0,Preplot Record Type Definition…    ,1,1,,3,3D Survey,1,2,1,1,1,3,0,
```

9.6. P1 Header: M1 Survey Perimeter Position Definition

H1,5,0,0: M1 Survey Perimeter Definition

Field	Description	Data Type	Reference Code	Comments
5	"Survey Perimeter Definition"	Description		
6	Perimeter Number	Integer	PERIMREF	1 onwards
7	Name	Text		
8	CRS 1 Number	Integer	CRSREF	
9	CRS 2 Number	Integer	CRSREF	
10	Perimeter Type	Integer		1 = Data Extent 2 = Total Coverage 3 = Full Fold Coverage 4 = Null Full Fold Coverage 5 = Null Coverage 6 = Merged Survey Outline 7 onwards = User Defined
11	Perimeter Type Description	Text		
12	Number of Record Extension Fields Recorded Per Position Record	Integer		
13	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 13 is repeated as required.

Example Survey Perimeter Definition

```
H1,5,0,0,Survey Perimeter Definition…    ,1,Full Fold Boundary,2,1,3,Full Fold Coverage,0,
```

10. P1 Data Records

10.1. P1 Data Records: P1/S1 Position Record

P1/S1 Position Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		'P1' for any position record 'S1' for a fired energy source record
2	Record Version	Integer		0
3	Acquisition Line Name	Text		
4	Preplot Line Name	Text		Blank if n/a
5	Acquisition Point Number	Variant		Format as defined in H1,1,0,0
6	Preplot Point number	Variant		Blank if n/a. Format as defined in H1,4,0,0
7	Index Number	Integer		
8	Time	Variant		Format for TRS as listed in H1,1,0,0 and as defined in HC,1,2,0
9	Object Ref. Number	Integer List	OBJREF	
10	Object Short Name	Text List	OBJNAME	
11	Record Type Number	Integer	P1TYPEREF	
12	(Dummy field)			Required for format alignment
13	CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,1,0,0 and as defined in HC,1,6,1
14	CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,1,0,0 and as defined in HC,1,6,1
15	CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,1,0,0 and as defined in HC,1,6,1
16	CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,1,0,0 and as defined in HC,1,6,1
17	CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,1,0,0 and as defined in HC,1,6,1
18	CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,1,0,0 and as defined in HC,1,6,1
19	CRS 3 Coordinate 1	Variant		Format for CRS 3 as listed in H1,1,0,0 and as defined in HC,1,6,1
20	CRS 3 Coordinate 2	Variant		Format for CRS 3 as listed in H1,1,0,0 and as defined in HC,1,6,1

21	CRS 3 Coordinate 3	Variant	Format for CRS 3 as listed in H1,1,0,0 and as defined in HC,1,6,1
22	Error Ellipse Horizontal Semi Major Axis or Radial Error Estimate	Variant	Format as defined in H1,1,0,1
23	Error Ellipse Horizontal Semi Minor Axis	Variant	Format as defined in H1,1,0,1
24	Error Ellipse Horizontal Azimuth	Variant	Format as defined in H1,1,0,1
25	Error Ellipse Vertical Axis or Height Error Estimate	Variant	Format as defined in H1,1,0,1
26	Additional Quality Measures	Additional Field List	The number of items must equal that given in the H1,1,0,1 record
27	Additional Data Fields	Additional Field List	The number of items must equal that given in the H1,1,0,0 record

For the common use of these records, the Object Reference Number and Short Name will be a single definition of the object positioned. However, for the case where a combined position needs to be entered – such as for a CMP or Gun Array Mean position, the Object Reference Numbers and Short Names of all the combined objects should be listed.

Single Position Examples

```
S1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3, G2,1,,391297.22,4092985.73,,36.91761093,-16.29212461,,36.97417522,-16.22215758,,2.2,1.2,234.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,2, G1,1,,391341.12,4092961.71,,36.97258981,-16.22807496,,36.97451410,-16.22202793,,2.4,1.2,134.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3, G2,1,,391297.20,4092985.78,,36.97631093,-16.22172461,,36.97471522,-16.22257528,,2.2,1.2,234.2,1.0,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,25,T1,1,,388911.73,4087063.99,,36.92244626,-16.24718704,,36.92110146,-16.24849295,,3.1,1.2,154.2,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,26,T2,1,,388824.25,4087112.45,,36.92288594,-16.24815996,,36.92151314,-16.24942887,,3.2,1.1,164.2,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,27,T3,1,,388737.21,4087161.98,,36.92332562,-16.24914304,,36.92191672,-16.25047226,,3.3,1.1,174.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,28,T4,1,,388650.27,4087211.20,,36.92375972,-16.21501272,,36.92241012,-16.25145264,,3.4,1.0,184.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,29,T5,1,,388562.68,4087259.15,,36.98241842,-16.25211176,,36.92281262,-16.25242468,,3.1,1.0,194.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,30,T6,1,,388475.32,4087308.21,,36.92946118,-16.25231047,,36.92321538,-16.25343239,,3.6,1.1,204.2,1.0,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,31,T7,1,,388387.13,4087355.33,,36.92500268,-16.25314017,,36.92361687,-16.25443029,,3.4,1.1,214.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,32,T8,1,,388300.64,4087405.64,,36.92541698,-16.25408500,,36.92411118,-16.25540293,,3.8,1.1,224.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,33,T9,1,,388213.73,4087455.35,,36.92590174,-16.25506268,,36.92451494,-16.25639221,,3.4,1.2,234.2,1.0,,
```

Combined Position Examples

```
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&4, G2&S1,1,,391436.34,4092730.45,,36.92738255,-16.23196470,,36.97234683,-16.23209766,,2.2,1.2,154.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&5, G2&S2,1,,391392.56,4092755.40,,36.97340412,-16.22301413,,36.97263841,-16.22314710,,2.8,1.1,164.4,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&6, G2&S3,1,,391349.60,4092779.54,,36.97442561,-16.22036346,,36.97289389,-16.22139643,,2.1,1.4,174.7,0.9,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&7, G2&S4,1,,391305.37,4092803.69,,36.97445718,-16.22113289,,36.97311437,-16.22243586,,2.2,1.2,184.1,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&8, G2&S5,1,,391261.68,4092828.37,,36.97468567,-16.22162333,,36.97332935,-16.22295330,,2.4,1.2,194.8,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&9, G2&S6,1,,391218.00,4092852.78,,36.97490165,-16.22211635,,36.97354344,-16.22344633,,2.5,1.3,204.4,1.4,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&10,G2&S7,1,,391174.46,4092877.23,,36.92751173,-16.23226098,,36.97376301,-16.22339395,,2.1,1.1,214.5,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&11,G2&S8,1,,391130.47,4092901.72,,36.97353330,-16.22331042,,36.97397359,-16.22443339,,2.3,1.0,224.5,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&12,G2&S9,1,,391087.04,4092926.12,,36.97535479,-16.22335986,,36.97419037,-16.22492383,,2.2,1.2,234.8,1.2,,
```

10.2. P1 Data Records: R1 Receiver Position Record

R1: Receiver Position Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		R1
2	Record Version	Integer		0
3	Acquisition Line Name	Text		
4	Preplot Line Name	Text		Blank if n/a
5	Acquisition Point Number	Variant		Format as defined in H1,2,0,0
6	Preplot Point number	Variant		Blank if n/a. Format as defined in H1,4,0,0
7	Index Number	Integer		
8	Time	Variant		Format for TRS as listed in H1,1,0,0 and as defined in HC,1,2,0
9	Object Reference Number	Integer	OBJREF[RX]	
10	Object Short Name	Text	OBJNAME	
11	Record Type Number	Integer	P1RXTYPEREF	
12	Receiver Group Number	Variant		Format as defined in H1,2,0,0
13	CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,2,0,0 and as defined in HC,1,6,1
14	CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,2,0,0 and as defined in HC,1,6,1
15	CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,2,0,0 and as defined in HC,1,6,1
16	CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,2,0,0 and as defined in HC,1,6,1
17	CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,2,0,0 and as defined in HC,1,6,1
18	CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,2,0,0 and as defined in HC,1,6,1
19	CRS 3 Coordinate 1	Variant		Format for CRS 3 as listed in H1,2,0,0 and as defined in HC,1,6,1
20	CRS 3 Coordinate 2	Variant		Format for CRS 3 as listed in H1,2,0,0 and as defined in HC,1,6,1
21	CRS 3 Coordinate 3	Variant		Format for CRS 3 as listed in H1,2,0,0 and as defined in HC,1,6,1
22	Error Ellipse Horizontal Semi Major Axis or Radial Error Estimate	Variant		Format as defined in H1,2,0,1
23	Error Ellipse Horizontal Semi Minor Axis	Variant		Format as defined in H1,2,0,1

24	Error Ellipse Horizontal Azimuth	Variant	Format as defined in H1,2,0,1
25	Error Ellipse Vertical Axis or Height Error Estimate	Variant	Format as defined in H1,2,0,1
26	Additional Quality Measures	Additional Field List	The number of items must equal that given in the **H1,2,0,1** record
27	Additional Data Fields	Additional Field List	The number of items must equal that given in the **H1,2,0,0** record

Fields 12 onwards can be repeated as shown below, the coordinate tuples in CRS2 and CRS3 are not repeated, all subsequent receivers contain only a position in CRS1:

Field	Description	Data Type	Reference Code	Comments
28	Receiver Group Number	Variant		As above
29	CRS 1 Coordinate 1	Variant		As above
30	CRS 1 Coordinate 2	Variant		As above
31	CRS 1 Coordinate 3	Variant		As above
32	Error Ellipse Horizontal Semi Major Axis or Radial Error Estimate	Float		As above
33	Error Ellipse Horizontal Semi Minor Axis	Float		As above
34	Error Ellipse Horizontal Azimuth	Float		As above
35	Error Ellipse Vertical Axis or Height Error Estimate	Float		As above
36	Additional Quality Measures	Additional Field List		The number of items must equal that given in the **H1,2,0,1** record
37	Additional Data Fields	Additional Field List		The number of items must equal that given in the **H1,2,0,0** record

Receiver (Group) Record Example

```
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,480,391575.43,4092475.43,7.5,36.97154325,
        -16.21804830,,36.97018534,-16.21937736,,2.2,1.2,34.2,1.2,,
                                                ,479,391569.93,4092464.13,7.5,2.2,1.2,34.2,1.2,,
                                                ,478,391564.43,4092452.19,7.5,2.2,1.2,34.2,1.2,,
                                                …
                                                ,452,391411.12,4092161.18,7.5,2.1,1.1,34.2,1.2,,
                                                ,451,391415.51,4092150.51,7.5,2.1,1.1,34.2,1.2,,

R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,450,391410.10,4092139.46,7.5,36.96864953,
        -16.21198562,,36.96711381,-16.21211858,,2.1,1.1,34.2,1.2,,
                                                ,449,391404.51,4092128.22,7.5,2.1,1.1,34.2,1.2,,
                                                ,448,391399.01,4092116.92,7.5,2.1,1.1,34.2,1.2,,
                                                …
                                                ,422,391255.84,4091825.94,7.5,2.1,1.1,34.2,1.2,,
                                                ,421,391250.24,4091814.64,7.5,2.1,1.1,34.2,1.2,,
```

10.3. P1 Data Records: X1 Relational Record

Section 8.2 introduced the concept of Relational Records as a means of linking specific source and receiver positions.

X1: Relation Record

Field	Description	Data Type	Reference Code	Requirement	Comments
1	Record Identifier	Text		Mandatory	X1
2	Record Version	Integer		0	
3	Field Tape Number	Text		Mandatory	
4	Field Record Number	Integer		Mandatory	
5	Field Record Index	Integer		Mandatory	
6	Source Acquisition Line Name	Text		Mandatory	
7	Source Acq. Point Number	Variant		Mandatory	Format as defined in H1,1,0,0
8	Source Index Number	Integer		Mandatory	
9	From Channel Number	Integer		Mandatory	
10	To Channel Number	Integer		Mandatory	
11	Channel Increment	Integer		Mandatory	
12	Receiver Acquisition Line Name	Text		Mandatory	
13	From Receiver Acq. Point Number	Variant		Mandatory	Format as defined in H1,2,0,0
14	To Receiver Acq. Point Number	Variant		Mandatory	Format as defined in H1,2,0,0
15	Receiver Index Number	Integer		Mandatory	
16	Record Extension Fields	Variant List		The number of items must equal that given in the H1,3,0,0 record	

Relation Group Record Example

```
X1,0,388,1,1,2075.0,3118.0,1,  1,147,1,2141,2541,3125,1,
X1,0,388,1,1,2075.0,3118.0,1,148,295,1,2121,2541,3129,1,
X1,0,388,1,1,2075.0,3118.0,1,296,443,1,2101,2541,3129,1,
X1,0,388,1,1,2075.0,3118.0,1,444,595,1,2081,2541,3145,1,
X1,0,388,1,1,2075.0,3118.0,1,596,751,1,2061,2541,3161,1,
```

10.4. P1 Data Records: N1 Preplot Position Records

N1,0: Preplot Line Details

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		N1
2	Record Identifier	Integer		0
3	Preplot Type Reference Number	Integer	PREPLOTTYPEREF	As defined in H1,4,0,0
4	Preplot Line Reference Number	Integer	PREPLOTREF	1 onwards
5	Name	Text		
6	First Point Number	Variant		Format as defined in H1,4,0,0
7	Last Point Number	Variant		Format as defined in H1,4,0,0

The format used for the variant point numbers in this and the following preplot records will depend on the value defined in H1,4,0,0.

Following the definition of a Preplot line using a N1,0 record, the positions for the line are defined by a combination of the Preplot position records. The following position record types are defined.

- *Point Record: For describing all the points by coordinates*
- *Line Segment Record: For describing a continuous straight line between two points.*
- *Arc Segment Record: For describing a continuous curved line segment between two points at a continuous arc of curvature*
- *Spiral Segment Record: For describing a continuous curved line segment between two points where the arc of curvature is varying at a fixed rate*

N1,1: Preplot Line: Single Position Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		N1
2	Record Identifier	Integer		1
3	Preplot Line Reference Number	Integer	PREPLOTREF	As defined in N1,0
4	Segment Number	Integer	PPSECREF	1 onwards
5	Point Number	Variant		Format as defined in H1,4,0,0
6	CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
7	CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
8	CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
9	CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
10	CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
11	CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
12	Record Extension Fields	Additional Field List		The number of items must equal that given in the H1,4,0,0 record

Fields 5 onwards can be repeated as required.

Record can be repeated as required.

The position tuple in CRS 2 is mandatory for the first set of positions in each record, it is optional in the second and subsequent sets of positions, but optional fields must retain their field delimiters.

For lines with multiple segments, such as dog-leg lines, the Segment Number defines the segment to which a point belongs.

Example Preplot Single Position Definition

```
N1,0,1,1,6001,1001,1201
N1,1,1,1,1001,391194.94,4092809.86,,54.2344345434,-9.2344345434,,
N1,1,1,1,1002,391194.94,4092834.86,,54.2344345434,-9.2344345434,,
N1,1,1,1,1003,391194.94,4092859.86,,54.2344345434,-9.2344345434,,
N1,1,1,1,1004,391194.94,4092884.86,,54.2344345434,-9.2344345434,,
…
N1,1,1,1,1199,393695.00,4097090.00,,53.2344345434,-8.2344345434,,
N1,1,1,1,1200,393695.00,4097115.00,,53.2344345434,-8.2344345434,,
N1,1,1,1,1201,393695.00,4097140.00,,53.2344345434,-8.2344345434,,
```

N1,2: Preplot Line: Straight Line Segment Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		N1
2	Record Identifier	Integer		2
3	Preplot Line Reference Number	Integer	PREPLOTREF	As defined in N1,0
4	Segment Number	Integer	PPSECREF	1 onwards
5	Point Number Increment	Variant		Format as defined in H1,4,0,0
6	Point Distance Interval	Variant		Units as defined in H1,4,0,0
7	Point Computation Method	Integer		0 = geographical 1 = grid
8	Start Point Number	Variant		Format as defined in H1,4,0,0
9	Start Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
10	Start Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
11	Start Point CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
12	Start Point CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
13	Start Point CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
14	Start Point CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
15	End Point Number	Variant		Format as defined in H1,4,0,0
16	End Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
17	End Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
18	End Point CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
19	End Point CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
20	End Point CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
21	End Point CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
22	Record Extension Fields	Additional Field List		The number of items must equal that given in the H1,4,0,0 record

Record can be repeated as required.

The Start Point Number and/or the End Point Number should be defined.

The position tuple in CRS 2 is mandatory for the first set of positions in each record, it is optional in the second and subsequent sets of positions, but optional fields must retain their field delimiters.

For lines with multiple segments, such as dog-leg lines, the Segment Number defines the segment to which a point belongs.

Example Preplot Straight Line Segment Definition

```
N1,0,1,1,6001,1001,1201
N1,2,1,1,1,25,1,1001,391194.94,4092809.86,,54.2344345434,-
       9.2344345434,,1201,393695.00,4097140.00,,53.2344345434,-8.2344345434,,
```

N1,3: Preplot Line: Arc Segment Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		N1
2	Record Identifier	Integer		3
3	Preplot Line Reference Number	Integer	PREPLOTREF	As defined in N1,0
4	Segment Number	Integer	PPSECREF	1 onwards
5	Point Number Increment	Variant		Format as defined in H1,4,0,0
6	Point Distance Interval	Variant		Units as defined in H1,4,0,0
7	Point Computation Method	Integer		0 = geographical 1 = grid
8	Start Point Number	Variant		Format as defined in H1,4,0,0
9	Start Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
10	Start Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
11	Start Point CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
12	Start Point CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
13	Start Point CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
14	Start Point CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
15	End Point Number	Variant		Format as defined in H1,4,0,0
16	End Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
17	End Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1

18	End Point CRS 1 Coordinate 3	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
19	End Point CRS 2 Coordinate 1	Variant	Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
20	End Point CRS 2 Coordinate 2	Variant	Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
21	End Point CRS 2 Coordinate 3	Variant	Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
22	Centre Point CRS 1 Coordinate 1	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
23	Centre Point CRS 1 Coordinate 2	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
24	Centre Point CRS 1 Coordinate 3	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
25	Angular Distance	Variant	The value of the angle from the Azimuth to first point to the Azimuth of the last point of the Arc, positive to clockwise. Units as defined in H1,4,0,0
26	Record Extension Fields	Additional Field List	The number of items must equal that given in the H1,4,0,0 record

Record can be repeated as required.

The angular distance value may be greater than 360 degrees if the arc represents a path greater than a circle.

The Start Point Number and/or the End Point Number should be defined.

The position tuple in CRS 2 is mandatory for the first set of positions in each record, it is optional in the second and subsequent sets of positions, but optional fields must retain their field delimiters.

For lines with multiple segments, the Segment Number defines the segment to which a point belongs.

Example Preplot Arc Segment Definition

```
N1,0,1,1,6001,1001,1201
N1,3,1,1,1,25,1,1001,391194.94,4092809.86,,54.2344345434,-
        9.2344345434,,1201,393695.00,4097140.00,,53.2344345434,-8.2344345434,,393495.00,4095140.00,,34.333,
```

N1,4: Preplot Line: Spiral Segment Record

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		N1
2	Record Identifier	Integer		4
3	Preplot Line Reference Number	Integer	PREPLOTREF	As defined in N1,0
4	Segment Number	Integer	PPSECREF	1 onwards
5	Point Number Increment	Variant		Format as defined in H1,4,0,0
6	Point Distance Interval	Variant		Units as defined in H1,4,0,0
7	Point Computation Method	Integer		0 = geographical 1 = grid
8	Start Point Number	Variant		Format as defined in H1,4,0,0
9	Start Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
10	Start Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
11	Start Point CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
12	Start Point CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
13	Start Point CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
14	Start Point CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
15	End Point Number	Variant		Format as defined in H1,4,0,0
16	End Point CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
17	End Point CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
18	End Point CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
19	End Point CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
20	End Point CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1
21	End Point CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a

22	Centre Point CRS 1 Coordinate 1	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
23	Centre Point CRS 1 Coordinate 2	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1
24	Centre Point CRS 1 Coordinate 3	Variant	Format for CRS 1 as listed in H1,4,0,0 and as defined in HC,1,6,1 Blank if n/a
25	Angular Distance	Variant	The value of the angle from the Azimuth to first point to the Azimuth of the last point of the Arc, positive to clockwise. Units as defined in H1,4,0,0
26	Radius Adjustment	Variant	For each circle described in this segment, the radius of the arc is increased (or decreased if the value is negative) by this value
27	Record Extension Fields	Additional Field List	The number of items must equal that given in the H1,4,0,0 record

The angular distance value may be greater than 360 degrees if the arc represents a path greater than a circle.

The Start Point Number and/or the End Point Number should be defined.

The position tuple in CRS 2 is mandatory for the first set of positions in each record, it is optional in the second and subsequent sets of positions, but optional fields must retain their field delimiters.

For lines with multiple segments the Segment Number defines the segment to which a point belongs.

Example Preplot Spiral Segment Definition

```
N1,0,1,1,6001,1001,1201
N1,4,1,1,1,25,1,1001,391194.94,4092809.86,,54.2344345434,-9.2344345434,,1201,393695.00,4097140.00,,53.2344345434,-
        8.2344345434,,393495.00,4095140.00,,34.333,500,
```

10.5. P1 Data Records: M1 Survey Perimeter Position Record

M1: Survey Perimeter Positions

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		M1
2	Record Version	Integer		0
3	Perimeter Number	Integer	PERIMREF	
4	Point Group Number	Integer		1 onwards
5	Point Number	Integer		1 onwards
6	Segment Computation Method to next point	Integer		1 =grid 2 = geodesic (~great circle) 3 = loxodrome / rhumb line 4 = parallel of latitude arc 5 = meridional arc
7	CRS 1 Coordinate 1	Variant		Format for CRS 1 as listed in H1,5,0,0 and as defined in HC,1,6,1
8	CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H1,5,0,0 and as defined in HC,1,6,1
9	CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H1,5,0,0 and as defined in HC,1,6,1 Blank if n/a
10	CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H1,5,0,0 and as defined in HC,1,6,1
11	CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H1,5,0,0 and as defined in HC,1,6,1
12	CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H1,5,0,0 and as defined in HC,1,6,1 Blank if n/a
13	Record Extension Fields	Additional Field List		The number of items must equal that given in the H1,5,0,0 record

Fields 5 onwards can be repeated as required.

The record can be repeated as required, with nodes in sequential order around the perimeter. The coordinates of the first node should be repeated at the end of the list as the (n+1)th node. No segment computation method should be given with the coordinates for the (n+1)th node.

The position tuple in CRS 2 is mandatory for the first set of positions in each record, it is optional in the second and subsequent sets of positions, but optional fields must retain their field delimiters.

The point group number is available to allow multiple areas to be defined as part of the same perimeter – thus the first discrete area is given a group number of 1, the second area is given a group number of 2 etc.

The Segment Computation Method defines the line computation from this position to the next.

Survey Perimeter Example

```
M1,0,1,1,1,1,391194.94,4092809.86,,54.2344345434,-9.2344345434,,
M1,0,1,1,2,1,392747.34,4093232.60,,54.2655123423,-9.2435354534,,
M1,0,1,1,3,1,393576.45,4094267.73,,54.2834225677,-9.2578834354,,
M1,0,1,1,4,1,391243.56,4095786.14,,54.2535353553,-9.2367002431,,

M1,0,1,1,1, ,391194.94,4092809.86,,54.2344345434,-9.2344345434,,
```

Appendix A: Tables of Fixed Values

A.1. Common Header Reference Codes

Code	Name	Type	Defined in/First Reference To*	Range
DATATYPEREF	Data Type Code	Fixed	Table 4	See Table
FORMATREF	Format Code	Fixed	Table 6	See Table
UNITREF	Unit Code	Counter	HC,1,1,0	1 onwards
TRSREF	TRS Number	Counter	HC,1,2,0	1 onwards
TIMEREF	Time Reference Code	Fixed	Table 8	See Table
CRSREF	CRS Number	Counter	HC,1,3,0	1 onwards
CRSTYPEREF	CRS Type Code	Fixed	Table 10	See Table
CSTYPEREF	Coordinate System Type Code	Fixed	Table 11	See Table
COTRANSREF	Coordinate Transformation Number	Counter	HC,1,7,0	1 onwards
PRODSYSREF	Recording System Reference Number	Counter	HC,2,1,0	1 onwards
PSATTREF	Production System Attribute Code	Fixed with extension	Table 12	See Table
AUXREF	Auxiliary Channel Number	Counter	HC,2,1,2	1 onwards
OBJREF	General Object Reference Number	Counter	HC,2,3,0	1 onwards
OBJREF[RX]	Seismic Receiver Reference Number	Counter	HC,2,2,0	Is a subset of OBJREF
OBJNAME	Object Short Name	Text	HC,2,2,0 HC,2,3,0	(User defined)
OBJTYPE	Object Type	Text. Fixed with extension	Table 14	See Table
OBJTYPEREF	Object Type Code	Fixed with extension	Table 14	See Table
OBJATTREF	Object Attribute Reference Code	Fixed with extension	Table 15	See Table
RXATTREF	Receiver Attribute Reference Code	Fixed	Table 13	See Table

Table 20: Common Header Reference Codes

** 'First Reference To' applies to codes that are counters*

A.2. P1-Specific Reference Codes

Code	Name	Type	Defined in/First reference to*	Range
P1TYPEREF	Record Type Number	Counter	H1,1,0,0	1 onwards
P1RXTYPEREF	Receiver Record Type Number	Counter	H1,2,0,0	1 onwards
ATTREF	File Contents Attribute Reference Number	Fixed with extension	Table 16	See Table
PREPLOTTYPEREF	Preplot Type Number	Counter	H1,4,0,0	1 onwards
PREPLOTREF	Preplot Line Number	Counter	N1,0	1 onwards
PPSECREF	Preplot Line Section Number	Counter	N1,1 N1,2 N1,3 N1,4	1 onwards
PERIMREF	Perimeter Number	Counter	H1,5,0,0	1 onwards

Table 21: P1 Specific Reference Codes

** 'First Reference To' applies to codes that are counters*

Appendix B: Minimum Requirements by Records Group

1) Minimum file content requirements by records group for new acquisition

Records Group	Records	New Marine Acquisition	New Land Acquisition	New TZ/OBC Acquisition
OGP Record	OGP	Mandatory	Mandatory	Mandatory
Survey Definition	HC,0,x,x	Mandatory	Mandatory	Mandatory
Reference Systems Summary Information	HC,1,0,0	Mandatory	Mandatory	Mandatory
Unit Reference Systems	HC,1,1,x	Mandatory	Mandatory	Mandatory
Time Reference Systems	HC,1,2,x	Mandatory	Mandatory	Mandatory
Coordinate Reference Systems	HC,1,3-9,x	Mandatory	Mandatory	Mandatory
Survey Configuration	HC,2,0,0	Mandatory	Mandatory	Mandatory
Production System Information	HC,2,1,x	Mandatory	Mandatory	Mandatory
Receiver Information	HC,2,2,x	Mandatory	Mandatory	Mandatory
Object Information	HC,2,3,x	Mandatory	Mandatory	Mandatory
Comments	CC,x,x,x	Optional	Optional	Optional
P1 Header: Content Definition	H1,0,x,x	Mandatory	Mandatory	Mandatory
P1 Header: Position Definitions	H1,1-2,x,x	Mandatory	Mandatory	Mandatory
Relation Definition + Records	H1,3,0,0 X1	Optional	Optional	Optional
Preplot Definition + Records	H1,4,0,0 N1	Optional	Optional	Optional
Perimeter Definition + Records	H1,5,0,0 M1	Recommended	Recommended	Recommended
P1 Data Records	S1,P1,R1	Mandatory	Mandatory	Mandatory
Quality Measures	Defined in File Header. Recorded in P1 posiition records	Mandatory	Mandatory	Mandatory

The "Records Group" column generally defines all relevant records in that group.

2) Minimum file content requirements by records group for legacy data

Records Group	Records	Conversion of Legacy Marine Data	Conversion of Legacy Land Data	Conversion of Legacy TZ/OBC Data
OGP Record	OGP	Mandatory	Mandatory	Mandatory
Survey Definition	HC,0,x,x	Mandatory	Mandatory	Mandatory
Reference Systems Summary Information	HC,1,0,0	Mandatory	Mandatory	Mandatory
Unit Reference Systems	HC,1,1,x	Mandatory	Mandatory	Mandatory
Time Reference Systems	HC,1,2,x	Mandatory	Mandatory	Mandatory
Coordinate Reference Systems	HC,1,3-9,x	Mandatory	Mandatory	Mandatory
Survey Configuration	HC,2,0,0	Mandatory	Mandatory	Mandatory
Production System Information	HC,2,1,x	Conditional Mandatory	Conditional Mandatory	Conditional Mandatory
Receiver Information	HC,2,2,x	Mandatory for HC,2,2,0	Mandatory for HC,2,2,0	Mandatory for HC,2,2,0
Object Information	HC,2,3,x	Mandatory	Mandatory	Mandatory
Comments	CC,x,x,x	Optional	Optional	Optional
P1 Header: Content Definition	H1,0,x,x	Mandatory	Mandatory	Mandatory
P1 Header: Position Definitions	H1,1-2,x,x	Mandatory	Mandatory	Mandatory
Relation Definition + Records	H1,3,0,0 X1	Optional	Optional	Optional
Preplot Definition + Records	H1,4,0,0 N1	(Not applicable)	(Not applicable)	(Not applicable)
Perimeter Definition + Records	H1,5,0,0, M1	Recommended	Recommended	Recommended
P1 Data Records	S1,P1,R1	Mandatory	Mandatory	Mandatory
Quality Measures	Defined in File Header. Recorded in P1 position records	Conditional Mandatory[1]	Conditional Mandatory[1]	Conditional Mandatory[1]

Conditional Mandatory = Mandatory if available in original data.

[1]*In some cases the quality measures may be subjective, based on the data conversion process.*

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