OGP

OGP P6/11 Seismic bin grid data exchange format

Report No. 483-6
November 2012

This document will be accompanied by a User Guide (publication forthcoming), which contains further details and instruction on implementation of the OGP P6/11 format and examples of its use.

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Version	Publication History	Date
1.0	First Publication	November 2012

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1. Executive Summary

The P6/11 format for the exchange of seismic binning grids is recommended by the International Association of Oil & Gas Producers (OGP) Geomatics Committee for general use in the Upstream Oil and Gas industry.

P6/11 has been developed alongside the revisions to P1/11 and P2/11 to allow the new format to take advantage of the new features available within the common header utilised by 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 P6/11 file is ***filename.p611***. The 'p' can be upper or lower case. Header records will precede data records. Files without mandatory header and data records are considered invalid.

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 that 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. The other types of record will be specific to the format type depending on the value of the second character in the record identifier. 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 6.1).

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 13), 100 onwards defined by user
Second	Conditional Additional Parameter	Required for some record extensions (Table 13)
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 13. 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

3.1. 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,0,3,0: 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
```

5. Common Header: Reference System Definitions

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

1) Unit reference systems (section 6.1)
2) Time reference systems (section 6.2)
3) Coordinate reference systems including transformations between CRSs (section 6.3)

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 11can 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. 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
```

7. P6 Header: File Content Definitions

H6,0,0,0: File Contents Description

Field	Description	Data Type	Reference Code	Comments
5	"File Contents Description"	Text, LJ50		
6	Description	Text		
7	Any Other Details	Text		Optional

H6,0,1,0: File Processing Details

Field	Description	Data Type	Reference Code	Comments
5	"Processing Details"	Text, LJ50		
6	Details	Text		

Record can be repeated as required

H6,0,2,0: File Contents Attribute

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Text, LJ50		
6	Unique Attribute Number	Integer		
7	Attribute Value	Variant		
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

Extension Identifier	Description	Comments
1	Receiver Groups Per Shot	
2	Original File	Used when the file is converted from an original output file
100 onwards	User Defined	

Table 12: File Contents Attribute Reference Numbers

8. P6 Header: Position Record Type Definitions

H6,1,0,0: Bin Node Position Record Type Definitions

Field	Description	Data Type	Reference Code	Comments
5	"Bin Node Position Record Definition"	Text,LJ50		
6	Record Type Number	Integer	P6TYPEREF	
7	CRS 1 Number	Integer	CRSREF	
8	CRS 2 Number	Integer	CRSREF	
9	Number of Record Extension Fields Recorded Per Record	Integer		
10	Record Extension Field Definition	Record Extension Field text string		Optional Standard Record Extension Definition - see Table 5

Field 10 is repeated as required.

Each Position Record provides storage for the position referenced to two CRSs. It is expected that generally CRS #1 will be the bin grid CRS or a compound CRS encompassing the bin grid CRS, whereas CRS #2 will be the projected CRS or a compound CRS encompassing the projected CRS. However, this is not an absolute rule and the CRSs used can be defined in the logical way for the position data recorded.

Position Record Extension Field 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	Fold	
100 onwards	User Defined	

Table 13: Position Record Field Extensions

Position Record Definition Example

```
H6,1,0,0,Position Record Type Definition                  ,2,1,2,1,1,1;3;Water Depth;3
```

9. P6 Header: M6 Survey Perimeter Position Definition

H6,2,0,0: M6 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

```
H6,2,0,0,Survey Perimeter Definition…    ,1,Full Fold Boundary,2,1,3,Full Fold Coverage,0,
```

10. P6 Data Records: B6 Bin Node Position Record

B6: Bin Node Position Record

Field	Description	Data Type	Reference Code	Comments
1	"B6"	Text		
2	Record Version	Integer		0
3	Record Type Number	Integer	P6TYPEREF	
4	CRS 1 Coordinate 1	Variant		Format as defined for CRS 1 listed in H6,1,0,0
5	CRS 1 Coordinate 2	Variant		Format as defined for CRS 1 listed in H6,1,0,0
6	CRS 1 Coordinate 3	Variant		Format as defined for CRS 1 listed in H6,1,0,0
7	CRS 2 Coordinate 1	Variant		Format as defined for CRS 2 listed in H6,1,0,0
8	CRS 2 Coordinate 2	Variant		Format as defined for CRS 2 listed in H6,1,0,0
9	CRS 2 Coordinate 3	Variant		Format as defined for CRS 2 listed in H6,1,0,0
10	Record Extension Fields	Variant List		If defined in H6,1,0,0

Fields 4 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 listed in each record.

Bin Node Postion Record Example:

```
B6,0,1,17000.00,4308.00,,421552.71,6838594.02,,
B6,0,1,17000.00,4309.00,,421577.71,6838593.72,,
B6,0,1,17000.00,4310.00,,421602.71,6838593.41,,
```

11. P6 Data Records: M6 Survey Perimeter Position Record

M6: Survey Perimeter Positions

Field	Description	Data Type	Reference Code	Comments
1	"M6"	Text		
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 H6,2,0,0 and as defined in HC,1,6,1
8	CRS 1 Coordinate 2	Variant		Format for CRS 1 as listed in H6,2,0,0 and as defined in HC,1,6,1
9	CRS 1 Coordinate 3	Variant		Format for CRS 1 as listed in H6,2,0,0 and as defined in HC,1,6,1
10	CRS 2 Coordinate 1	Variant		Format for CRS 2 as listed in H6,2,0,0 and as defined in HC,1,6,1
11	CRS 2 Coordinate 2	Variant		Format for CRS 2 as listed in H6,2,0,0 and as defined in HC,1,6,1
12	CRS 2 Coordinate 3	Variant		Format for CRS 2 as listed in H6,2,0,0 and as defined in HC,1,6,1
13	Record Extension Fields	Additional Field List		The number of items must equal that given in the H6,2,0,0 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

```
M6,0,1,1,1,1,391194.94,4092809.86,,54.2344345434,-9.2344345434,,
M6,0,1,1,2,1,392747.34,4093232.60,,54.2655123423,-9.2435354534,,
M6,0,1,1,3,1,393576.45,4094267.73,,54.2834225677,-9.2578834354,,
M6,0,1,1,4,1,391243.56,4095786.14,,54.2535353553,-9.2367002431,,
M6,0,1,1,1, ,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
OBJREF	General Object Reference Number	Counter	HC,2,3,0	1 onwards
OBJREF[RX]	Seismic Receiver Number	Counter	HC,2,2,0	Is a subset of OBJREF
OBJNAME	Short Object Name	Text	HC,2,2,0 HC,2,3,0	
OBJTYPE	Object Type	Text, Fixed with Extension	Table	See table
OBJTYPEREF	Object Type Code	Fixed with extension	Table	See table

Table 14: Common Header Reference Codes

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

A.2. P6-Specific Reference Codes

Code	Name	Type	Defined in/First Reference To*	Range
P6TYPEREF	Record Type Number	Counter	H6,1,0,0	1 onwards
PERIMREF	Survey Perimeter Reference Number	Counter	H6,2,0,0	1 onwards

Table 15: P6 Specific Reference Codes

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

Appendix B: Coordinate Reference Systems

The coordinates used for bin grids are:

- The map grid coordinates, which provide a geodetic reference frame
- The bin grid coordinates, which provide a relative reference frame.

These reference frames are related by an affine transformation.

The map grid coordinates require the definition of the projected CRS including the geodetic datum, the reference ellipsoid, the coordinate system and the map projection. See the P6/11 User Guide for further details.

The bin grid description should comprise of:

- For bin grids where the I-axis is 90 degrees clockwise from the J-axis (when viewed from above the plane of the two bin grid axes):
  - EPSG engineering CRS code 5818, plus
  - An affine transformation using EPSG operation method 9666. The EPSG Dataset contains an example in Coordinate Transformation 15744.

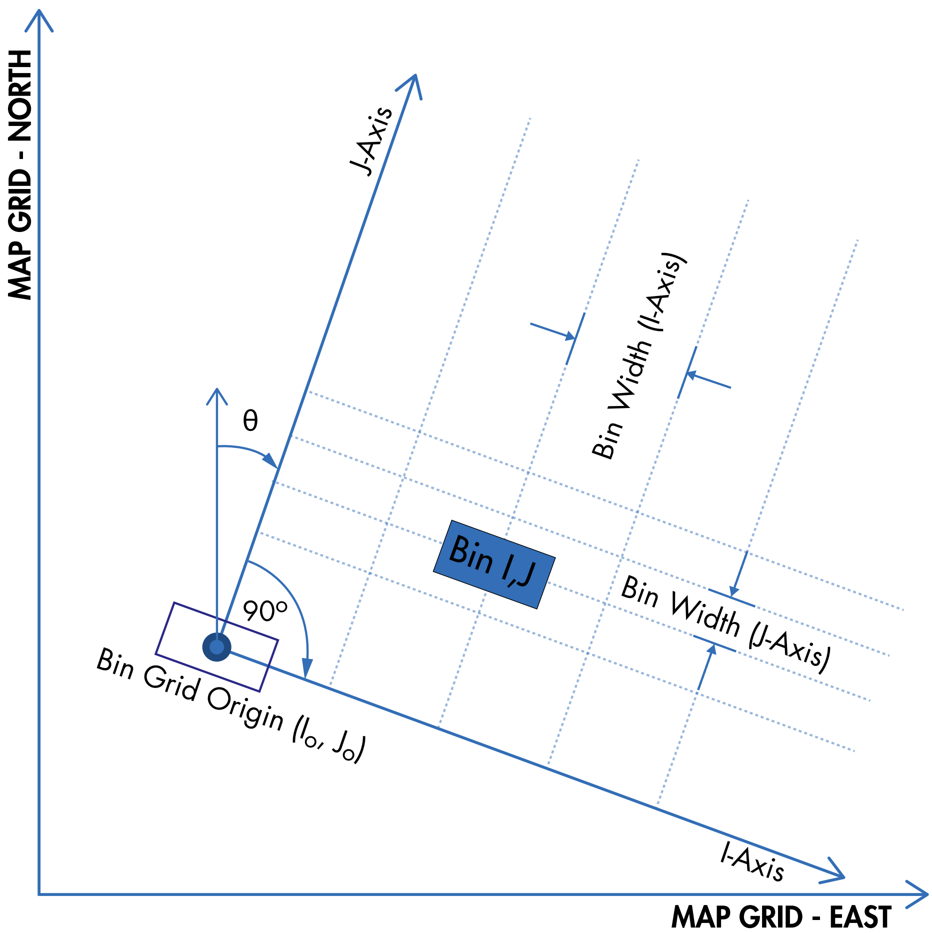

Figure 1: I-axis is 90 degrees clockwise from the J-axis when viewed from above the plane of the two bin grid axes.

- For bin grids where the I-axis is 90 degrees counter-clockwise from the J-axis (when viewed from above the plane of the two bin grid axes):
  - EPSG engineering CRS code 5859, plus
  - An affine transformation using EPSG operation method 1049. The EPSG Dataset contains an example in Coordinate Transformation 5860.

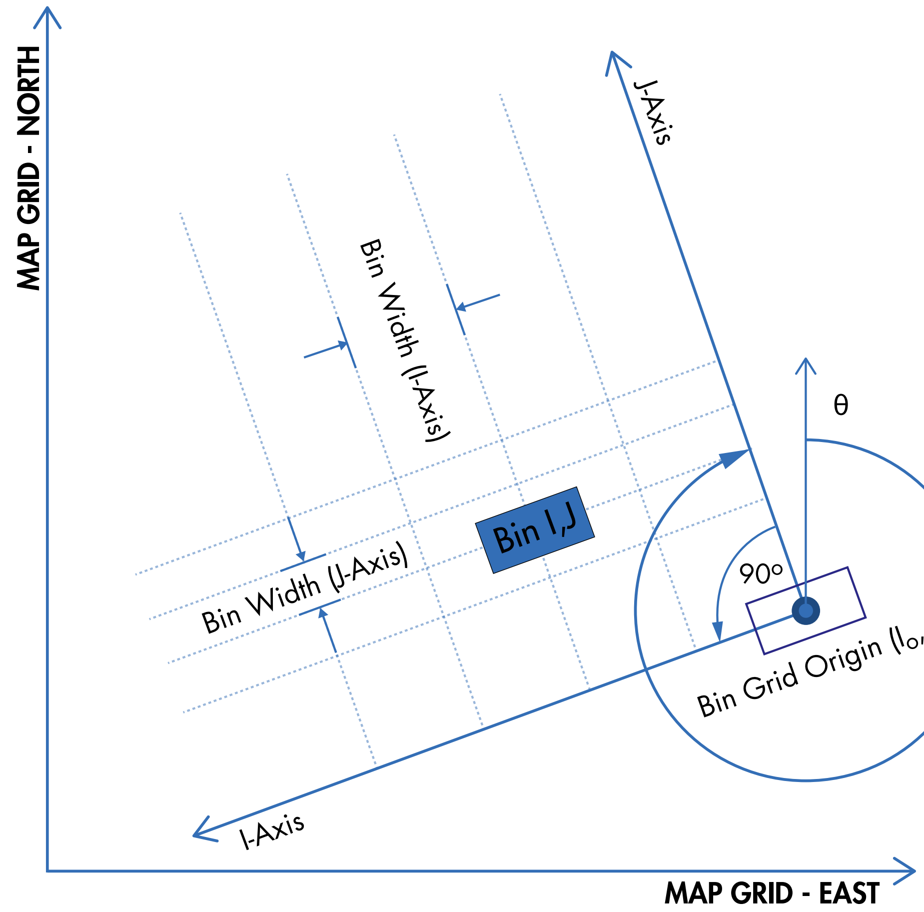

Figure 2: I-axis is 90 degrees counter-clockwise from the J-axis when viewed from above the plane of the two bin grid axes.

Note: **θ** is the Bin Grid Orientation in Figure 1 & 2

See the P6/11 User Guide for example records. For details of the affine transformation methods, see EPSG Guidance Note 7-2.

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