

IOGP P6/11 Seismic bin grid data exchange format



Acknowledgements

Geomatics Committee

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OGP P6/11 Seismic bin grid data exchange format

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A P6/11 User Guide is due for issue in 2017, containing further details and instruction on implementation of the OGP P6/11 format and examples of its use. It is recommended that once issued, the User Guide be read in conjunction with this format description.

Format Version	Publication History	Date
1.0	First publication	November 2012
1.1	First revision	June 2017

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P6/11 changes between version 1.0 (November 2012) and version 1.1 (June 2017)

Global change:

Version 1.1: References to 'CRS 1', 'CRS 2', 'CRS 3' changed to 'CRS A', 'CRS B', 'CRS C' respectively

Record Code	Record Description	Introduced in Version:	Revised in Version:
Common Header			
OGP	File Identification Record	1.0	
HC,0,1,0	Project Name	1.0	
HC,0,3,0	Geographic Extent	1.0	
HC,0,4,0	Client	1.0	
HC,1,0,0	Reference Systems Summary Information	1.0	
HC,1,1,0	Units of Measure Definition	1.0	
HC,1,1,1	Example Unit Conversion	1.0	
HC,1,2,0	Time Reference System	1.0	1.1
HC,1,2,1	Example Time Conversions	1.0	1.1
HC,1,3,0	Coordinate Reference System Implicit Identification	1.0	
HC,1,4,0	Coordinate Reference System Details (Explicit Definition)	1.0	
HC,1,4,1	Compound CRS Horizontal CRS Identification	1.0	1.1
HC,1,4,2	Compound CRS Vertical CRS Identification	1.0	1.1
HC,1,4,3	Base Geographical CRS Details	1.0	1.1
HC,1,4,4	Geodetic Datum Details	1.0	1.1
HC,1,4,5	Prime Meridian Details	1.0	
HC,1,4,6	Ellipsoid Details	1.0	
HC,1,4,7	Vertical Datum Details	1.0	
HC,1,4,8	Engineering Datum Details	1.0	
HC,1,5,0	Map Projection Details	1.0	
HC,1,5,1	Projection Method Details	1.0	
HC,1,5,2	Projection Parameter Details	1.0	
HC,1,6,0	Coordinate System Details	1.0	
HC,1,6,1	Coordinate Axis Details	1.0	
HC,1,7,0	Coordinate Transformation Implicit Identification	1.0	
HC,1,8,0	Coordinate Transformation Name	1.0	

HC,1,8,1	Coordinate Transformation Details	1.0	
HC,1,8,2	Coordinate Transformation Method Details	1.0	
HC,1,8,3	Transformation Parameter File Details	1.0	
HC,1,8,4	Transformation Parameter Details	1.0	
HC,1,9,0	Example Point Conversion	1.0	
CC,1,0,0	Additional Information	1.0	
P6/11 Header			
H6,0,0,0	File Contents Description	1.0	
H6,0,1,0	File Processing Details	1.0	
H6,0,2,0	File Contents Attribute	1.0	
H6,1,0,0	Bin Node Position Record Type Definitions	1.0	
H6,2,0,0	M6 Survey Perimeter Definition	1.0	
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Table 13a	Bin Grid Attribute Reference Numbers	1.1	
Table 14	Common Header Reference Codes	1.0	1.1
Table 15	P6 Specific Reference Codes	1.0	

1. Executive Summary

The P6/11 format for the exchange of seismic bin grid data is recommended by the International Association of Oil & Gas Producers (IOGP) 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 utilized by these formats.

The extensible format of the P6/11 allows it to be used to record the history of a bin grid through time. A bin grid designed for 3D seismic acquisition is commonly modified in processing to optimise the data for interpretation. Re-processing of the seismic data often results in further geometric and/or geodetic modification of the bin grid. It is therefore recommended that the P6/11 is used to document and audit the development of a bin grid, starting from initial pre-plot, through acquisition and on to various stages of re-processing and/or merging with other bin grids.

The P6/11 is also recommended as a standard format for the exchange of bin grid loading data (the 'loading sheet'), supporting all variations of bin grid loading, including by complete listing of bin node coordinates.

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

The Chairman, Geomatics Committee
IOGP
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.

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 across 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 across 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

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 List

Table 3: Reserved Characters

Where use of reserved characters is unavoidable, for example to refer to a parameter name exactly as used by its source, an escape character sequence can be used.

Any character can be expressed as a \u followed by the 4 digit hexadecimal value written in uppercase. For example:

,	is escaped with	\u002C
;	is escaped with	\u003B
:	is escaped with	\u003A
&	is escaped with	\u0026

An escape character which does not start with \u00 is interpreted as the start of an UTF-8 character sequence.

2.4. Record Data Types [DATATYPEDEF]

Version history

<i>Item revised</i>	<i>Version 1.0</i>	<i>Version 1.1</i>
Code 5		Boolean data format

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	
5	Boolean	X	1	1 if True, 0 if False (Data format added in version 1.1)
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 as defined in an external source or normally to the relevant precision as defined by the precision inherent in the value recorded. It is acceptable to remove trailing decimal zero in the bulk data.

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** (as relevant). 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

The format has been designed to be extensible and to allow 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. To drive standardisation, Table 13 defines the identifier for commonly used record extensions to ensure that these values have the same code regardless of the system generating the data.
- 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. For extensions defined within this format document (with an identifier of less than 100), the description should contain the required description but will not be limited to it. So for instance, where the description is stated in the format document as "Water Depth", a description in the file of "Vessel Water Depth" or "Master Vessel Processed Water Depth" etc., as appropriate, is acceptable.

- The Data Units Code specifies, where relevant, the units of measure of the data value.

As an example, consider the logging of a GNSS position into the P2/11 format. The GNSS 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 unitless 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 (not relevant to P6/11)

These are described in sections 3 through 5.

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 6.

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 P6"
3	Format Code	Integer List	FORMATREF	See table 6 below
4	Format Version Number	Float		Format version (this document) 1.1
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 P1,1,1.1,1,2015:02:12,21:43:01,SPEC201001.P111,OilFinder Ltd
 OGP,OGP P6,6,1.1,1,2015:02:12,21:53:01,1001.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 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.

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
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		Blank if not 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,	lbf/in2	
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 difference, 2, 4,	0,	1,1000000,0,	parts per million,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,	m/s
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,	bin,	scale, 2, 4,	0,	1,	1,0,	seismic bin dimension,1024,EPSG Dataset	,	8.7.4,	1024	

Note that UNITREF 14 (parts per million) above is defined as a unit (quantity) type of scale difference, but referred to code EPSG::9202 as source. In the context in which scale difference in parts per million (the dS parameter in a 7-parameter transformation) is used in the Px/11 file it is a coordinate operation parameter. In the EPSG Dataset all units have a unit (or quantity) type of either length, angle, scale or time. Parts per million (ppm) in the EPSG dataset is assigned to the 'scale' unit (quantity) type. The unit (quantity) type is there as a check on having the correct SI base unit (length = meter, angle = radian, scale = unity, time = second). For parts per million, the unit type is scale so the factors B/C (fields 12 & 13) relate ppm to unity.

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 (Optional for P6/11)

Version history				
Item revised	Version 1.0	Version 1.1		
Record status	Mandatory	Optional		

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 (Required if Field 10 is set to 1)
12	Unit Code	Integer	UNITREF	

HC,1,2,1: Example Time Conversions (Optional for P6/11)

Version history		
Item revised	Version 1.0	Version 1.1
Record status	Mandatory	Optional

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,0,6
HC,1,2,0,Time Reference System,2,2,15.0,GPS,1,1980:01:06,5
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 does not preclude the full definition of all the coordinate reference system parameters in the header, simply referencing the EPSG codes is not acceptable.

In general, a CRS or a coordinate transformation is 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 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 supplied as 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, signs and units must be exactly as defined in that database, and in the case of transformations, this is regardless of the direction in which the transformation is applied in the field.

In the EPSG Dataset, there are geodetic entities containing the degree symbol (°). When an EPSG code is given it is a requirement of the P-Formats that the exact EPSG name for an entity should be used. The ascii code for this character falls outside the allowable range of 32 - 126. Therefore, when writing a Px/11 file this character should be escaped with \u00B0. However in examples in this document, to aid readability, the degree character is retained un-escaped.

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. In general, when describing or identifying a derived *geodetic* CRS, it is not necessary to document its base CRS or the conversion used in its derivation. However when the file specifies the explicit use of both base and related derived geodetic CRSs, for example where raw position is being logged in the base geodetic CRS (say WGS 84 geographic 3D) and being transformed through the derived CRS (WGS 84 geographic 2D), to ensure the EPSG structure is followed it is necessary to document both base and derived geodetic CRS and to document the correct 3D to 2D conversion between them using [HC,1,7,0] and [HC,1,8,n] records. In such circumstances it is permissible to regard [HC,1,7,0] and [HC,1,8,0] records as defining "coordinate operations", which are inclusive of coordinate conversions between base and derived CRSs. For parameterless coordinate conversions such as these, record [HC,1,8,4] is not required.

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
HC,1,3,0,CRS Number/EPSG Code/Name/Source...,5, ,WGS 84 / Block 29/10 (I=J+90°) bin grid, , , ,
The bin grid is defined through coordinate operation (COTRANSREF) number 3

```

Note: It is recommended to include the deriving geodetic datum in the name of the bin grid CRS (in the above example 'WGS 84').

In the case of a bin grid CRS, to aid human scrutiny it is recommended to include in 'Any Other Details' (field 12) mention of its associated operation, as this is an inherent part of its definition.

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/EPG Code/Type/Name...,1,32628,1,projected ,WGS 84 / UTM zone 28N
 HC,1,4,0,CRS Number/EPG Code/Type/Name...,5, ,6,engineering,WGS 84 / Block 29/10
 (I = J+90°) bin grid

HC,1,4,1: Compound CRS Horizontal CRS Identification**Version history**

Item revised	Version 1.0	Version 1.1
Field 8	Horizontal CRS Name	EPSG Horizontal CRS Code
Field 9		Horizontal CRS Name

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	EPSG Horizontal CRS Code	Integer		Blank if an EPSG-compliant database is not referenced (Field added in version 1.1)
9	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...,4,1,32628,WGS 84 / UTM zone 28N

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

Version history		
<i>Item revised</i>	<i>Version 1.0</i>	<i>Version 1.1</i>
Field 8	Vertical CRS Name	EPSG Vertical CRS Name
Field 9	Vertical CRS Name	

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	EPSG Vertical CRS Name	Integer		Blank if an EPSG-compliant database is not referenced (Field added in version 1.1)
9	Vertical CRS Name	Text		

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

Example

HC,1,4,2,Compound Vertical CRS...,4,3,5715,MSL depth

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

Version history		
<i>Item revised</i>	<i>Version 1.0</i>	<i>Version 1.1</i>
Field 9	Base Geographic CRS Name	

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
9	Base Geographic CRS Name	Text		(Field added in version 1.1)

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

Example

HC,1,4,3,Base Geographic CRS...,1,2,4326,WGS 84

HC,1,4,4: Geodetic Datum Details**Version history**

<i>Item revised</i>	<i>Version 1.0</i>	<i>Version 1.1</i>
Field 9		Realization Epoch

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
9	Realization Epoch	Date		If known YYYY:MM:DD (Field added in version 1.1)

Example

HC,1,4,4,Geodetic Datum...,1,6326,World Geodetic System 1984,1984:01:01

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 84,6378137,1,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...,5,9315,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

It may be necessary to incorporate reserved characters to replicate the EPSG name, for example Ellipsoidal 2D CS. Axes: latitude, longitude. Orientations: north, east. UoM: degree would be represented (using escape characters for the reserved characters) as Ellipsoidal 2D CS. Axes\u003A latitude\u002C longitude. Orientations\u003A north\u002C east. UoM\u003A degree

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,1,6,0,Coordinate System...,5,1033,Bin grid CS (I = J+90°). Axes\u003A I\u002C J,2,Cartesian,2
```

Note that certain reserved characters (colon & comma) have been replaced in the above example with escape character sequences. The degree symbol (°) should also be escaped (with \u00B0) but is retained here for clarity.

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 Axis Code if the Coordinate System EPSG Code is given ¹
9	Axis Name	Text		Use EPSG Axis Name if EPSG axis code given
10	Axis Orientation	Text		Use EPSG orientation if EPSG axis code given
11	Axis Abbreviation	Text		Use EPSG abbreviation if EPSG axis code given
12	Unit Code	Integer	UNITREF	
13	Units of Measure Name	Text		

1. Not to be confused with the EPSG Axis Name Code, or read from the GML representation of the Coordinate System.

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
HC,1,6,1,Coordinate System Axis 1...,5,1,1428,Bin grid I, J-axis plus 90°,I,20,bin
HC,1,6,1,Coordinate System Axis 2...,5,2,1429,Bin grid J,See associated operation,J,20,bin
```

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
HC,1,7,0,Transformation Number/EPSG Code/Name/Source ,3, ,ED50 / UTM zone 31N to ED50 / Block
    29/10 (I = J + 90°) bin grid, , , ,
```

Note: It is recommended to quote the full transformation name, from projected CRS to bin grid CRS (in the above example 'ED50 / UTM zone 31N to ED50 / Block 29/10 (I = J + 90°) bin grid').

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,1,8,0,Transformation Number/EPSG Code/Name...,3, ,ED50 / UTM zone 31N to ED50 / Block 29/10
    (I = J+90°) bin grid,0
HC,1,8,0,Transformation Number/EPSG Code/Name...,1,15593,geographic3D to geographic2D
    ,0
```

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		Use EPSG version if EPSG code given

Examples

This record defines the forward direction of the transformation by identifying the coordinate reference systems containing the Source and Target datums of the transformation. If referencing an EPSG-compliant database the forward direction is normally implicit in the transformation name. In the case of reversible transformations the forward direction defined here determines the signs of the transformation parameters listed in HC,1,8,4 records, regardless of the direction in which the transformation is actually applied. In the case of transformations between seismic bin grid and map grid, EPSG has defined the forward formula from map grid to bin grid.

```
HC,1,8,1,Source CRS/Target CRS/Version...,1,2,4230 ,ED50 ,3,4326,WGS 84
,EPG-Ger Nsea
HC,1,8,1,Source CRS/Target CRS/Version...,2,1,4979 ,WGS 84 ,3,4326,WGS 84
,
HC,1,8,1,Source CRS/Target CRS/Version...,3,4,23031,ED50 / UTM zone 31N,5, ,ED50 / Block 29/10 (I = J +
90°) bin grid,
```

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,1,8,2,Transformation Method...,2,9659,Geographic3D to 2D conversion ,1,0
HC,1,8,2,Transformation Method...,3,9666,P6 (I = J+90°) seismic bin grid transformation,1,10
```

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

```

The following example represents the parameters for a P6 ($I = J + 90^\circ$) bin grid transformation (Coordinate Operation Method 9666), source and target CRS as defined in record HC,1,8,1:

```

HC,1,8,4,Bin grid origin I...,3,8733, 1.0,20, bin,0
HC,1,8,4,Bin grid origin J...,3,8734, 1.0,20, bin,0
HC,1,8,4,Bin grid origin Easting...,3,8735, 456781.0, 1, metre,0
HC,1,8,4,Bin grid origin Northing...,3,8736,5836723.0, 1, metre,0
HC,1,8,4,Scale factor of bin grid...,3,8737, 0.99984, 4, unity,0
HC,1,8,4,Bin width on I-axis...,3,8738, 25.0, 1, metre,0
HC,1,8,4,Bin width on J-axis...,3,8739, 12.5, 1, metre,0
HC,1,8,4,Map grid bearing of bin grid J-axis...,3,8740, 20.0, 3,degree,0
HC,1,8,4,Bin node increment on I-axis...,3,8741, 1.0,20, bin,0
HC,1,8,4,Bin node increment on J-axis...,3,8742, 1.0,20, bin,0

```

5.3.5. Example Point Conversion

HC,1,9,0: Example Point Conversion

Mandatory (see note below table)

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.

In the case of a bin grid, example points are required to confirm that both coordinate reference system and grid parameters have been correctly set up. This needs at least five defined locations, four at the corners of the grid, and one at the centre, quoting the bin grid, map grid and the geographical coordinates. Two of these points must be on each of the I and J axes, from which the map grid bearing of the axes can be derived and checked, and the scale factor and bin parameters verified. Although these values will have been derived from the parameters themselves, they will provide a check against transcription errors in the parameters - for example typing errors or errors of sign. In situations where the bin grid has been converted or transformed, it is advisable to include more example points, for example to describe any curvature that has been introduced to the bin grid axes.

Example Point Conversions

```

HC,1,9,0,Example Point Conversion...,1,STN 1,1,674092.03,9716717.23,,2,
-2.561968694,133.565880528,
HC,1,9,0,Example Point Conversion...,2,STN 1,1,674092.03,9716717.23,,5,
1528.00 ,3757.00 ,

```

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.

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
```

Note that reserved characters may be used in comment records.

7. P6 Header: File Content Definitions

H6,0,0,0: File Contents Description

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

H6,0,1,0: File Processing Details

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

Record can be repeated as required

H6,0,2,0: File Contents Attribute

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 12
6	Unique Attribute Number	Integer	ATTREF	See Table 12
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
100 onwards	User Defined	User to provide Attribute Name in H6,0,2,0

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"	Description		
6	Record Type Number	Integer	P6TYPEREF	
7	CRS A Number	Integer	CRSREF	
8	CRS B 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.

Refer to Table 13 for format-defined record extension identifiers (as input to Field 10).

Each Position Record provides storage for the position referenced to two CRSs. It is expected that generally CRS A will be the bin grid CRS or a compound CRS encompassing the bin grid CRS, whereas CRS B 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.

Bin Node 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 Extension Field Data Identifiers

Position Record Definition Example

H6,1,0,0,Bin Node Position Record Definition,1,3,1,1,1,4;Water Depth;1

9. P6 Header: M6 Survey Perimeter Position Definition and Bin Grid Attributes

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 A Number	Integer	CRSREF	
9	CRS B 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.

Refer to Table 13 for format-defined record extension identifiers (as input to Field 13).

Example Survey Perimeter Definition

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

H6,3,0,0: Bin Grid Attributes

Mandatory for format-defined attributes 1 to 6 (bin grid axis definitions). Optional for other attributes.

Version history

Record introduced in Version 1.1

Field	Description	Data Type	Reference Code	Comments
5	Attribute Name	Description		See Table 13a
6	Unique Attribute Number	Integer	BINGRIDATTREF	See Table 13a
7	CRS Number	Integer	CRSREF	Bin Grid CRSREF
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		If not listed, the attribute value is assumed to be of text format
10	Attribute Unit Name	Text		If not listed, the attribute value is assumed to be of text format

Bin Grid Attribute Reference Numbers (BINGRIDATTREF)**Version history**

Code introduced in Version 1.1

BINGRIDATTREF Code	Description	Comments
1	I Axis Name	Line or Trace, Inline or Cross-line, etc
2	I Axis Description	
3	I Axis Direction/Orientation	In terms of projected CRS. If given should agree with HC,1,6,1 (field 10) for I axis of bin grid
4	J Axis Name	Line or Trace, Inline or Cross-line, etc
5	J Axis Description	
6	J Axis Direction/Orientation	In terms of projected CRS. If given should agree with HC,1,6,1 (field 10) for J axis of bin grid
100 onwards	User defined	User to provide Attribute Name in H6,3,0,0

Table 13a: Bin Grid Attribute Reference Numbers

Examples

```

H6,3,0,0,I Axis Name...           ,1,4,Line,,
H6,3,0,0,I Axis Description...    ,2,4,Axis with increasing line number,,
H6,3,0,0,I Axis Direction/Orientation... ,3,4,135.0,3,Degrees
H6,3,0,0,J Axis Name...           ,4,4,Trace,,
H6,3,0,0,J Axis Description...    ,5,4,Axis with increasing trace number,,
H6,3,0,0,J Axis Direction/Orientation... ,6,4,45.0,3,Degrees

```

10. P6 Data Records: B6 Bin Node Position Record

B6: Bin Node Position Record

Recommended for re-projected bin grids (see note below table)

Version history

Item revised	Version 1.0	Version 1.1
CRS B position tuple	Optional	Mandatory in all records

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		B6
2	Record Version	Integer		0
3	Record Type Number	Integer	P6TYPREF	
4	CRS A Coordinate 1	Variant		Format as defined for CRS A listed in H6,1,0,0
5	CRS A Coordinate 2	Variant		Format as defined for CRS A listed in H6,1,0,0
6	CRS A Coordinate 3	Variant		Format as defined for CRS A listed in H6,1,0,0
7	CRS B Coordinate 1	Variant		Format as defined for CRS B listed in H6,1,0,0
8	CRS B Coordinate 2	Variant		Format as defined for CRS B listed in H6,1,0,0
9	CRS B Coordinate 3	Variant		Format as defined for CRS B listed in H6,1,0,0
10	Record Extension Fields	Additional Field List		The number of items must equal that given in the H6,1,0,0 record

Fields 4 onwards can be repeated as required.

Record can be repeated as required.

Use of bin node position records:

A) For an original bin grid (that remains in the acquisition CRS) it is not necessary to export bin node positions because the matrix definition describes exactly the true positions of the bin centres.

B) A bin grid that has undergone a coordinate operation that does not distort the bin grid (e.g. change of origin, re-sampling etc) similarly does not need to be exported to a bin centres file.

C) For a bin grid that has undergone a distorting coordinate operation such as re-projection, that has resulted in irregular spacing of bin centres, non-rectilinear bin grid matrix, curved axes, or any combination of these, it is strongly recommended (E&P Operator or end client to confirm) to export to a P6/11 bin centres file for archive or exchange.

Bin Node Position 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

Recommended

Field	Description	Data Type	Reference Code	Comments
1	Record Identifier	Text		M6
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 A Coordinate 1	Variant		Format for CRS A as listed in H6,2,0,0 and as defined in HC,1,6,1
8	CRS A Coordinate 2	Variant		Format for CRS A as listed in H6,2,0,0 and as defined in HC,1,6,1
9	CRS A Coordinate 3	Variant		Format for CRS A as listed in H6,2,0,0 and as defined in HC,1,6,1
10	CRS B Coordinate 1	Variant		Format for CRS B as listed in H6,2,0,0 and as defined in HC,1,6,1
11	CRS B Coordinate 2	Variant		Format for CRS B as listed in H6,2,0,0 and as defined in HC,1,6,1
12	CRS B Coordinate 3	Variant		Format for CRS B 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 B 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 one position to the next. If the perimeter is given in the coordinates of 2 CRSs (eg map grid and bin grid), the segment computation method (and the resulting connection) refers to the perimeter defined by CRS A.

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 (relevant to P6/11)

Version history				
<i>Item revised</i>		<i>Version 1.0</i>	<i>Version 1.1</i>	
Code Name (OBJREF[RX])		Seismic Receiver Reference Number	Seismic Receiver Type Reference Number	
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 Type Reference Number	Counter	HC,2,2,0	Is a subset of OBJREF (Code name modified in version 1.1)
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
BINGRIDATTREF	Bin Grid Attribute Reference Number	Fixed	Table 13a	See Table

Table 1.5: 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:

- 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):
 - An engineering CRS (similar to code 5818 in the EPSG Dataset which is an example), plus
 - An affine transformation using EPSG operation method 9666. The EPSG Dataset contains an example in Coordinate Transformation 6918.

When adding a bin grid to an EPSG-compliant database, users should give the engineering CRS and the affine transformation their own unique codes, avoiding the reserved EPSG code range of 0-32767. Where this is not the case, the CRS and transformation can be defined without EPSG codes.

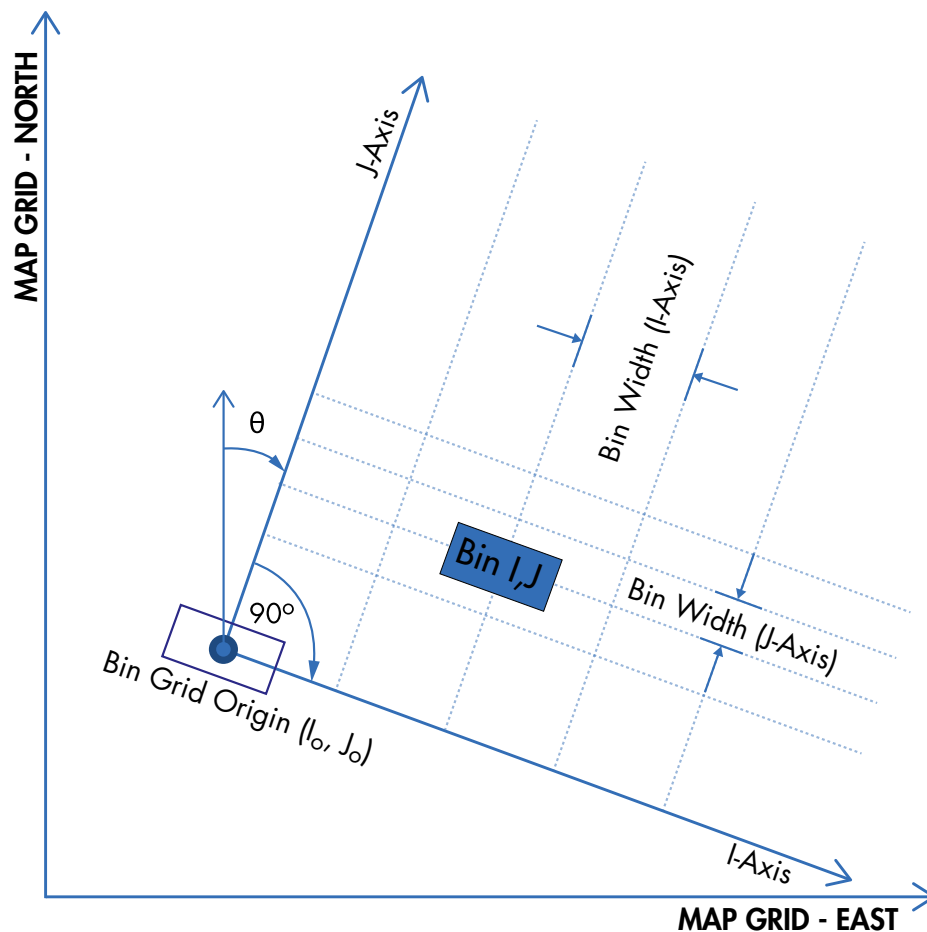


Figure 1: I-axis is 90 degrees clockwise from the J-axis when viewed from above the plane of the two bin grid axes.

- 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):
 - An engineering CRS (similar to code 5859 in the EPSG Dataset which is an example), plus
 - An affine transformation using EPSG operation method 1049. The EPSG Dataset contains an example in Coordinate Transformation 6919.

When adding a bin grid to an EPSG-compliant database, users should give the engineering CRS and the affine transformation their own unique codes, avoiding the reserved EPSG code range of 0-32767. Where this is not the case, the CRS and transformation can be defined without EPSG codes.



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

The P6/11 User Guide, due for issue in 2017, will have example records. For details of the affine transformation methods, see EPSG Guidance Note 7-2.

Appendix C: Bin Grid History

One of the benefits of the P6/11 format is the ability to track the history of a bin grid, from defining the preplot, through acquisition and on to various stages of re-processing, including merging with other surveys, which may include geodetic transformations and induce change of origin, change of orientation and/or re-sampling etc.

A bin grid CRS definition inherently includes both its engineering CRS and the coordinate operation (transformation) to its projected CRS. (See Note 5 to Table 9). If any parameter in the definition changes, a new bin grid CRS should be defined, and the P6/11 file updated accordingly. This principle is applied in the example that follows.

The example tracks the progress of a bin grid to demonstrate how its geometry and geodetic definition can be defined and recorded stage by stage throughout a seismic volume's development. Implicit in the example is that, prior to stage 1 there has been an iterative process between operator and seismic contractor to define the preplot (which can be done using the P6/11 exchange format). The example therefore starts from the acquisition phase. Note that the example uses extracts from the format rather than complete sets of mandatory records.

STAGE 1. 3D Seismic Survey Acquired by Operator 'A'

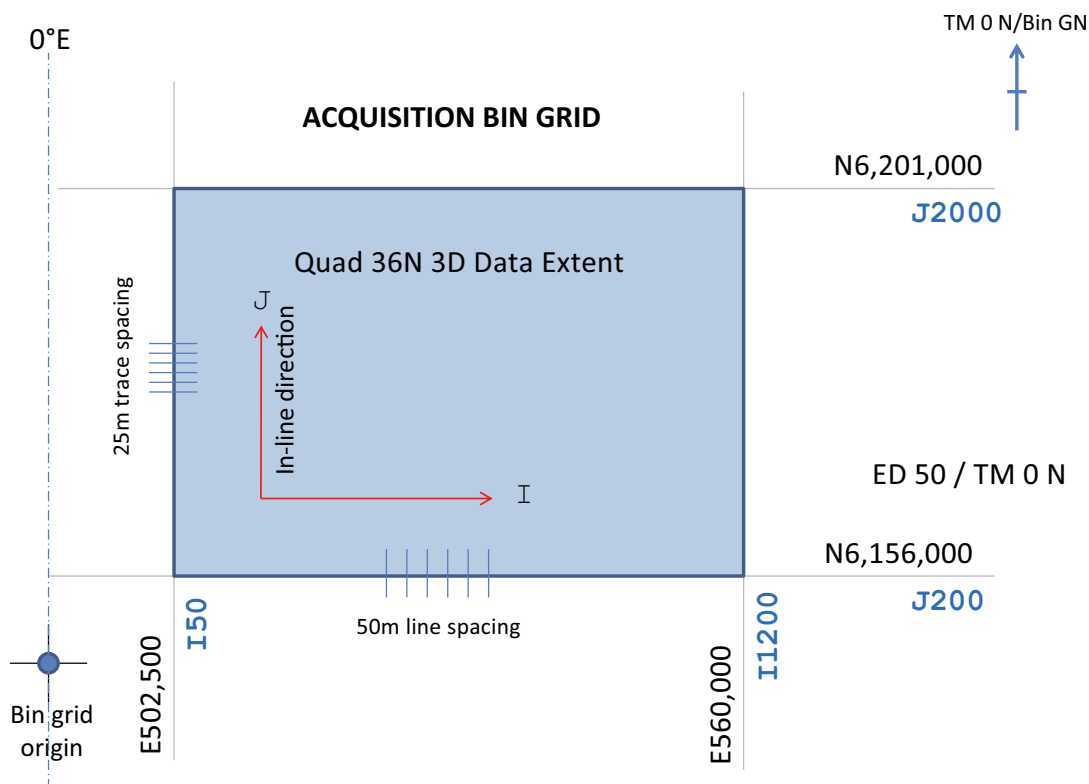


Figure 3: Parameters of original acquisition bin grid

The 3D survey is acquired on ED50/TM 0 N through real-time transformation from the field acquisition system (WGS 84), and delivered to Operator A as a rectilinear grid on the contractual CRS ED50 / TM 0 N map grid (EPSG::23090).

Location: UKCS North Sea
 Projected CRS: ED50 / TM 0 N (EPSG::23090)
 In-line direction: 0° (relative to Grid North on TM 0 N projection)
 Line spacing: 50.0 m
 Trace spacing: 25.0 m

P6/11 file:

OGP File Identification Record:

OGP, OGP P6, 6, 1.1, 1, 2016:01:04, 12:22:58, **Quad_36N_Acqn_bingrid.p611**, Seiseco_Acqn

Survey Summary:

HC, 0, 1, 0, Project Name..., UKCS1250, Quad 36N 3D, 2016:01:04,
 HC, 0, 3, 0, Geographic Extent..., 0.0, 1.0, 55.5, 56.0
 HC, 0, 4, 0, Client..., OPERATOR A Seismic Delivery

Reference Systems Summary:

HC, 1, 0, 0, Reference Systems Summary..., 7, 0, 4, 2

Coordinate Reference Systems:

HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 1, 4326, WGS 84, 8.3, 2013:11:29, EPSG,
 HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 2, 4230, ED50, 8.3, 2013:11:29, EPSG,
 HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 3, 23090, ED50 / TM 0
 N, 8.9.2, 2016:04:06, EPSG, Contractual field acquisition projected CRS and base
 projected CRS for bin grid CRS CRSREF 4

**HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 4, , ED50 / Quad 36N (I=J+90°) acqn bin
 grid,,, The bin grid is defined through coordinate operation (COTRANSREF)
 number 2. Used for acquisition**

Note: CRSREF 4 (in bold type above) is used for the acquisition bin grid, the explicit definition of which follows below...

HC, 1, 4, 0, CRS Number/EPG Code/Type/Name..., 4, , 6, engineering, ED50 / Quad 36N
 (I=J+90°) acqn bin grid
 HC, 1, 4, 8, Engineering Datum..., 4, 9315, Seismic bin grid datum
 CC, 1, 0, 0, The bin grid is defined through coordinate operation (**COTRANSREF**) number 2
 HC, 1, 6, 0, Coordinate System..., 4, 1033, Bin grid CS (I = J+90°). Axes\
 u003A I\ u002CJ., 2, Cartesian, 2
 HC, 1, 6, 1, Coordinate System Axis 1..., 4, 1, 1428, Bin grid I, J-axis plus
 90°, I, 7, bin
 HC, 1, 6, 1, Coordinate System Axis 2..., 4, 2, 1429, Bin grid J, See associated
 operation*, J, 7, bin

* COTRANSREF 2

Coordinate Transformations:

HC, 1, 7, 0, Transformation Number/EPG Code/Name/Source..., 1, 1311, ED50 to WGS 84
 (18), 8.3, 2013:11:29, EPSG, Used during acquisition
**HC, 1, 7, 0, Transformation Number/EPG Code/Name/Source..., 2, , ED50 / TM 0 N to ED50 /
 Quad 36N (I=J+90°) acqn bin grid,,,**

Note: COTRANSREF 2 (in bold type above) is used to transform between the map grid and acquisition bin grid, the explicit definition of which follows...

```

HC,1,8,0,Transformation Number/EPSS Code/Name...,2,,ED50 / TM 0 N to ED50 / Quad 36N
(I=J+90°) acqn bin grid,0
HC,1,8,1,Source CRS/Target CRS/Version...,2,3,23090,ED50 / TM 0 N,4,,ED50 /
Quad 36N (I=J+90°) acqn bin grid,
HC,1,8,2,Transformation Method...,2,9666,P6 (I = J+90°) seismic bin
grid transformation,1,10
HC,1,8,4,Bin grid origin I...,2,8733,0.0,7,bin,0
HC,1,8,4,Bin grid origin J...,2,8734,0.0,7,bin,0
HC,1,8,4,Bin grid origin Easting...,2,8735,500000.0,1,metre,0
HC,1,8,4,Bin grid origin Northing...,2,8736, 6151000.0,1,metre,0
HC,1,8,4,Scale factor of bin grid...,2,8737,1.0,4,unity,0
HC,1,8,4,Bin width on I-axis...,2,8738,50.0,1,metre,0
HC,1,8,4,Bin width on J-axis...,2,8739,25.0,1,metre,0
HC,1,8,4,Map grid bearing of bin grid J-axis...,2,8740,0.0,3,degree,0
HC,1,8,4,Bin node increment on I-axis...,2,8741,1.0,7,bin,0
HC,1,8,4,Bin node increment on J-axis...,2,8742,1.0,7,bin,0
CC,1,0,0,The transformation 2 defines Bin Grid CRS number 4

```

Example Point Conversion (e.g. a proposed well location)

```

HC,1,9,0,Example Point Conversion...,1,Well 36/1-
A,4,601.2,1000.8,,3,530060.0,6176020.0,,2,55.72775778,0.47859889,

```

For data exchange, parameter check points are required to confirm that coordinate reference systems and grid parameters have been correctly set up. This needs at least five defined locations, four at the corners of the grid, and one at the centre, quoting the bin grid, map grid and the geographical coordinates. Two of these points must be on each of the I and J axes, from which the map grid bearing of the axes can be derived and checked, and the scale factor and bin parameters verified. Although these values will have been derived from the parameters themselves, they will provide a check against transcription errors in the parameters - for example typing errors or errors of sign. In situations where the bin grid has been converted or transformed, it is advisable to include more example points, to adequately describe the resulting bin grid geometry.

```

HC,1,9,0,Example Point Conversion...,2,Parameter check
1,4,50.0,2000.0,,3,502500.0,6201000.0,,2,55.95312417,0.04003444,
HC,1,9,0,Example Point Conversion...,3,Parameter check
2,4,1200.0,2000.0,,3,560000.0,6201000.0,,2,55.94938583,0.96074889,
HC,1,9,0,Example Point Conversion...,4,Parameter check
3,4,1200.0,200.0,,3,560000.0,6156000.0,,2,55.54511917,0.95086528,
HC,1,9,0,Example Point Conversion...,5,Parameter check
4,4,50.0,200.0,,3,502500.0,6156000.0,,2,55.54880167,0.0396225,
HC,1,9,0,Example Point Conversion...,6,Parameter check
5,4,625.0,1100.0,,3,531250.0,6178500.0,,2,55.74996444,0.49782806,

```

File Content Definitions:

```

H6,0,0,0,File Contents Description...,Acquisition bin grid geometry and data extent
perimeter,Checked by onboard Survey Rep
H6,0,1,0,Processing Details...,Bin grid produced by CircumNav system

```

Survey Perimeter Definition:

```

H6,2,0,0,Survey Perimeter Definition...,1,Quad 36N 3D Data Extent,4,3,1,Data Extent,0,
M6,0,1,1,1,1, 50.0,2000.0,,502500.0,6201000.0,,
M6,0,1,1,2,1,1200.0,2000.0,,560000.0,6201000.0,,
M6,0,1,1,3,1,1200.0, 200.0,,560000.0,6156000.0,,
M6,0,1,1,4,1, 50.0, 200.0,,502500.0,6156000.0,,
M6,0,1,1,1,1, , 50.0,2000.0,,502500.0,6201000.0,,

```

It is a requirement of the format to define how the bin grid axes relate to field acquisition:

Bin Grid Axis Definitions:

The following bin grid attribute records define how the bin grid axes for the acquisition bin grid (CRSREF = 4) relate to field acquisition:

```
H6,3,0,0,I Axis Name... ,1,4,Line,,
H6,3,0,0,I Axis Description... ,2,4,Axis with increasing line number,,
H6,3,0,0,I Axis Direction/Orientation... ,3,4,90.0,3,Degrees
H6,3,0,0,J Axis Name... ,4,4,Trace,,
H6,3,0,0,J Axis Description... ,5,4,Axis with increasing trace number,,
H6,3,0,0,J Axis Direction/Orientation... ,6,4,0.0,3,Degrees
```

STAGE 2. Processed Bin Grid

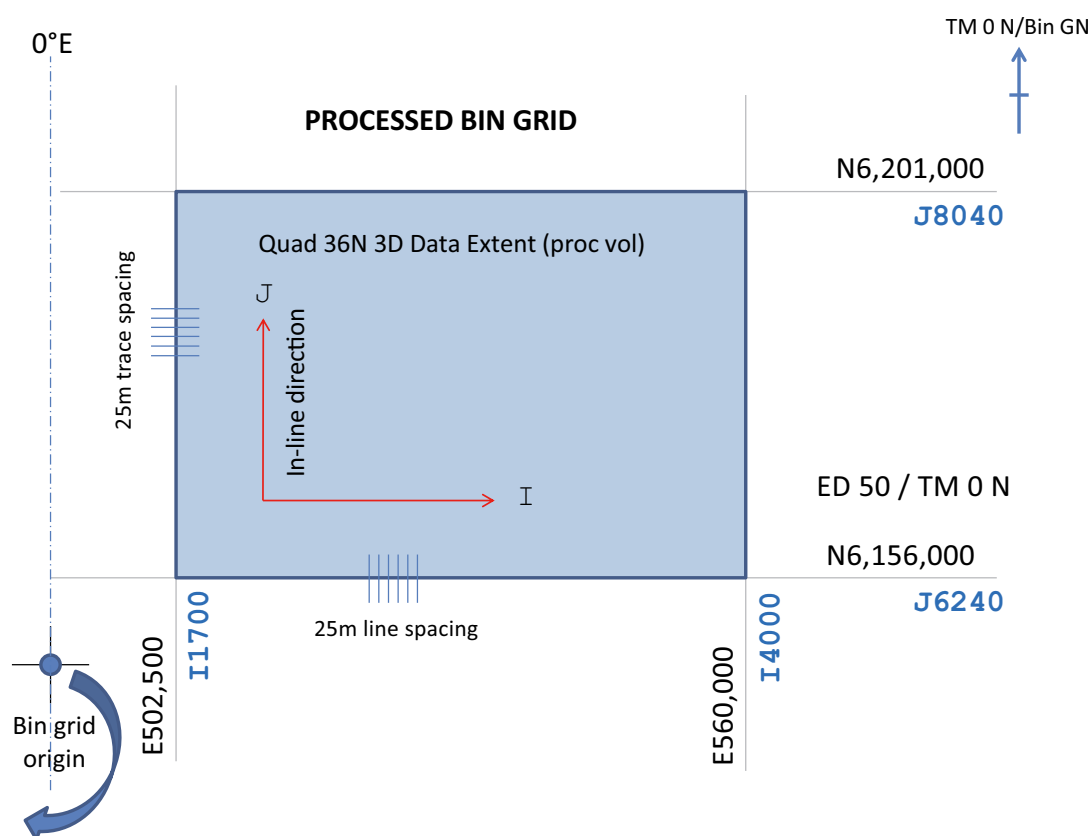


Figure 4: Parameters of processed bin grid

During processing the data is re-binned into square bins, and the bin grid origin is changed to retain positive bin numbering over a larger area in preparation for future mergers. The new bin grid has the following key parameters:

Projected CRS	ED50 / TM 0 N (EPSG::23090)
In-line direction:	0° (relative to Grid North on TM 0 N projection)
Line spacing:	25.0 m
Trace spacing:	25.0 m

P6/11 file:**OGP File Identification Record:**

OGP, OGP P6, 6, 1.1, 1, 2016:03:01, 15:22:00, **Quad_36N_Proc_bingrid.p611**, SeisCo_Proc

Reference Systems Summary:

HC, 1, 0, 0, Reference Systems Summary..., 7, 0, 5, 3

Coordinate Reference Systems:

.
.
HC, 1, 3, 0, CRS Number/EPSSG Code/Name/Source..., 4, , ED50 / Quad 36N (I=J+90°) acqn bin grid, , , , The bin grid is defined through coordinate operation (COTRANSREF) number 2. Used for acquisition
HC, 1, 3, 0, CRS Number/EPSSG Code/Name/Source..., 5, , ED50 / Quad 36N (I=J+90°) proc bin grid, , , , The bin grid is defined through coordinate operation (COTRANSREF) number 3. Used for first processing by Operator A

Note the addition of CRSREF 5 (in bold type above) to address the processed bin grid, the explicit definition of which follows...

HC, 1, 4, 0, CRS Number/EPSSG Code/Type/Name... , 5, , 6, engineering, ED50 / Quad 36N (I=J+90°) proc bin grid
HC, 1, 4, 8, Engineering Datum... , 5, 9315, Seismic bin grid datum
CC, 1, 0, 0, The bin grid is defined through coordinate operation (COTRANSREF) number 3
HC, 1, 6, 0, Coordinate System... , 5, 1033, Bin grid CS (I = J+90°). Axes\
u003A I\u002CJ., 2, Cartesian, 2
HC, 1, 6, 1, Coordinate System Axis 1... , 5, 1, 1428, Bin grid I, J-axis plus 90°, I, 7, bin
HC, 1, 6, 1, Coordinate System Axis 2... , 5, 2, 1429, Bin grid J, See associated operation*, J, 7, bin

*COTRANSREF 3

Coordinate Transformations:

HC, 1, 7, 0, Transformation Number/EPSSG Code/Name/Source..., 3, , ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) proc bin grid, , , ,

Note the addition of COTRANSREF 3 (in bold type above) is used to transform between the map grid and processed bin grid, the explicit definition of which follows...

HC, 1, 8, 0, Transformation Number/EPSSG Code/Name..., 3, , ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) proc bin grid, 0
HC, 1, 8, 1, Source CRS/Target CRS/Version... , 3, 3, 23090, ED50 / TM 0 N, 5, , ED50 / Quad 36N (I=J+90°) proc bin grid,
HC, 1, 8, 2, Transformation Method... , 3, 9666, P6 (I = J+90°) seismic bin grid transformation, 1, 10
HC, 1, 8, 4, Bin grid origin I... , 3, 8733, 0.0, 7, bin, 0
HC, 1, 8, 4, Bin grid origin J... , 3, 8734, 0.0, 7, bin, 0
HC, 1, 8, 4, Bin grid origin Easting... , 3, 8735, 460000.0, 1, metre, 0
HC, 1, 8, 4, Bin grid origin Northing... , 3, 8736, 6000000.0, 1, metre, 0
HC, 1, 8, 4, Scale factor of bin grid... , 3, 8737, 1.0, 4, unity, 0
HC, 1, 8, 4, Bin width on I-axis... , 3, 8738, 25.0, 1, metre, 0
HC, 1, 8, 4, Bin width on J-axis... , 3, 8739, 25.0, 1, metre, 0
HC, 1, 8, 4, Map grid bearing of bin grid J-axis... , 3, 8740, 0.0, 3, degree, 0
HC, 1, 8, 4, Bin node increment on I-axis... , 3, 8741, 1.0, 7, bin, 0
HC, 1, 8, 4, Bin node increment on J-axis... , 3, 8742, 1.0, 7, bin, 0
CC, 1, 0, 0, The transformation 3 defines Bin Grid CRS number 5

Example Point Conversion

HC, 1, 9, 0, Example Point Conversion..., 7, Well 36/1-
A, 5, 2802.4, 7040.8, , 3, 530060.0, 6176020.0, , 2, 55.72775778, 0.47859889,

Parameter check points (appended to existing check points):

```

HC,1,9,0,Example Point Conversion..., 8,Parameter check
    6,5,1700.0,8040.0,,3,502500.0,6201000.0,,2,55.95312417,0.04003444,
HC,1,9,0,Example Point Conversion..., 9,Parameter check
    7,5,4000.0,8040.0,,3,560000.0,6201000.0,,2,55.94938583,0.96074889,
HC,1,9,0,Example Point Conversion...,10,Parameter check
    8,5,4000.0,6240.0,,3,560000.0,6156000.0,,2,55.54511917,0.95086528,
HC,1,9,0,Example Point Conversion...,11,Parameter check
    9,5,1700.0,6240.0,,3,502500.0,6156000.0,,2,55.54880167,0.0396225,
HC,1,9,0,Example Point Conversion...,12,Parameter check
    10,5,2850.0,7140.0,,3,531250.0,6178500.0,,2,55.74996444,0.49782806,

```

File Content Definitions:

```

H6,0,0,0,File Contents Description...,Processed bin grid geometry and data extent
    perimeter,Checked in-house by Survey Dept
H6,0,1,0,Processing Details...,Bin grid produced by seismic processing system
H6,0,2,0,Original File...,2,Quad_36N_Acqn_bingrid.p611,,

```

Survey Perimeter Definition:

```

H6,2,0,0,Survey Perimeter Definition...,2,Quad 36N 3D Data Extent (proc
    vol),5,3,1,Data Extent,0,
M6,0,2,1,1,1,1700.0,8040.0,,502500.0,6201000.0,,
M6,0,2,1,2,1,4000.0,8040.0,,560000.0,6201000.0,,
M6,0,2,1,3,1,4000.0,6240.0,,560000.0,6156000.0,,
M6,0,2,1,4,1,1700.0,6240.0,,502500.0,6156000.0,,
M6,0,2,1,1,1,1700.0,8040.0,,502500.0,6201000.0,,

```

The first 4 M6 records above define the survey data extent and could be used as loading sheet coordinates for the processed volume.

Bin Grid Axis Definitions:

```

H6,3,0,0,I Axis Name...,1,5,Line,,
H6,3,0,0,I Axis Description...,2,5,Axis with increasing line number,,
H6,3,0,0,I Axis Direction/Orientation...,3,5,90.0,3,Degrees
H6,3,0,0,J Axis Name...,4,5,Trace,,
H6,3,0,0,J Axis Description...,5,5,Axis with increasing trace number,,
H6,3,0,0,J Axis Direction/Orientation...,6,5,0.0,3,Degrees

```

The P6/11 file of the processed bin grid (Quad_36N_Proc_bingrid.p611) is used as an exchange medium with partners in the concession.

STAGE 3. Partner 'B' (partner in concession) converts bin grid to in-house CRS

Partner 'B' wants to load the bin grid to a workstation project set up on a conventional UTM zone for UKCS North Sea work (zone 31N). This will involve referencing the bin grid to a projected CRS different from the one in which it was received. Such re-projection will introduce distortions to the regular and rectilinear bin grid. The method chosen to realise the bin grid after re-projection should be carefully considered in order to minimise the resulting distortion. In this appendix two variants are considered:

- 1) A rotated and re-scaled bin grid, which is rectilinear and regular in Partner B's CRS at the expense of the exact original bin centre positions (referred to as the implicit method in this appendix).
- 2) A converted grid re-projected bin-by-bin from the original bin grid, which preserves the exact original bin centre locations in Partner B's CRS at the expense of rectilinear and regular bin geometry (referred to as the explicit method in this appendix).

In the first variant, parameters are defined from which the re-projected grid can be generated as a matrix (implicit method). In the other, all bin centre coordinates are directly converted to the re-projected CRS (explicit method).

The first variant is more adapted to computer manipulation, but its downside is the resulting displacement of the implied re-projected bin centre coordinates. There are several techniques by which the defining parameters can be determined, but in almost all cases rectilinear bin grid axes and regularity of the bin grid dimensions cannot be preserved, and the process may be irreversible. Refer to Section 3 of the P6/11 User Guide for a detailed explanation of the different approaches.

In the second variant the bin centres are preserved at their exact real-world locations, but do not constitute a regular rectilinear grid in the re-projected CRS. A dataset of 'explicitly' generated bin centre coordinates may not be suited to manipulation by all 3D seismic workstations.

Each of the implicit methods requires seed data to be input. These can be pairs of coordinates at (3 or 4) corners of the bin grid, or bin grid parameters of origin, orientation and bin dimensions.

Partner 'B' works with a system that requires 4 corner points to be input, as I,J in bin grid and E,N in the original projected CRS (ED50 / TM 0 N), the positions of which it then optimizes in the target CRS (ED50 / UTM zone 31N) to create a rectilinear re-projected realisation of the bin grid, and implied bin positions.

The following B6 bin records generated from the exchanged P6/11 file could be used as the input data:

```
H6,1,0,0,Bin Node Position Record Definition...,1,5,3,,
B6,0,1,1700.0,8040.0,,502500.0,6201000.0,,
B6,0,1,4000.0,8040.0,,560000.0,6201000.0,,
B6,0,1,4000.0,6240.0,,560000.0,6156000.0,,
B6,0,1,1700.0,6240.0,,502500.0,6156000.0,,
```

In this example the conversion of the corner points to UTM zone 31N is done by the workstation application. From this input data the workstation will calculate affine transformation parameters that generate implied bin centre coordinates in UTM zone 31N. The resulting matrix will have an adjusted bin size with respect to the original (either directly or through application of a scale factor), be rotated with respect to both the TM 0 N and UTM zone 31 grid norths, and bin centres will be displaced from their true real-world positions.

It is important to appreciate that in this method and in any other similar implicit technique, the re-projected bin grid cannot both be rectilinear and describe the same points physically on the ground in both CRSs.

The converted bin grid relates to the UTM zone 31N map grid as shown in the following diagram:

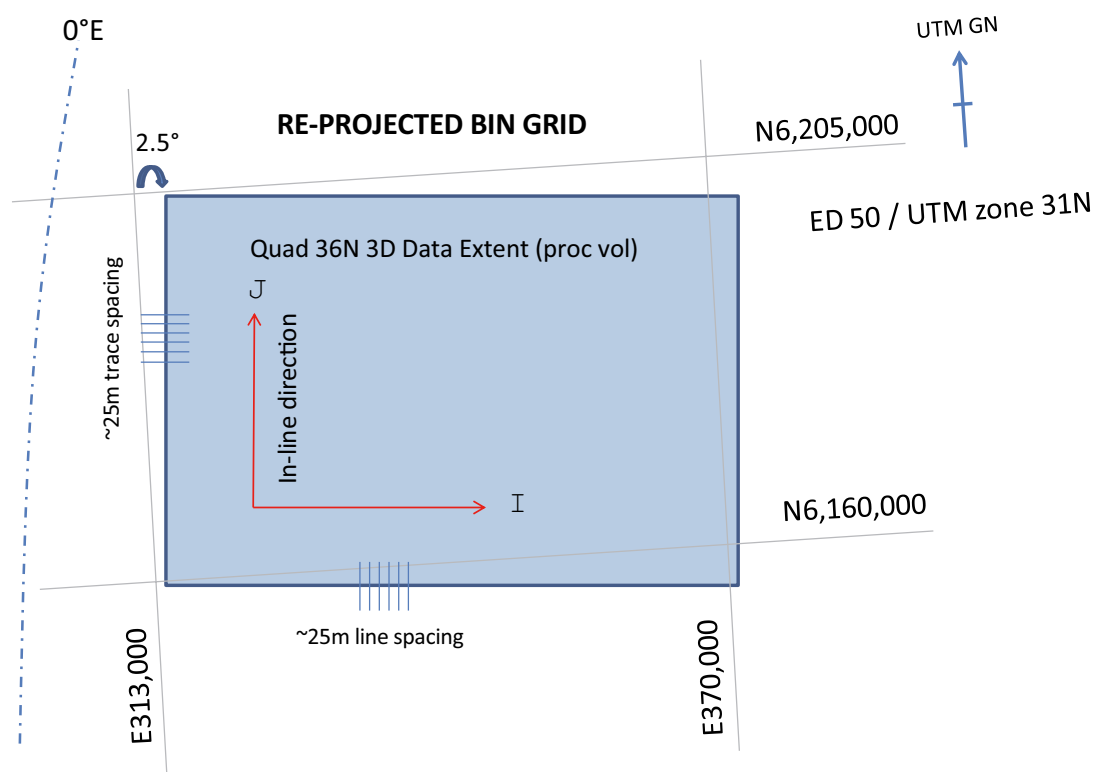


Figure 5: Processed bin grid optimised and converted to UTM zone 31N map grid

The exchanged bin grid has now been re-projected. It is critical to fully document this stage of the bin grid development. The parameters used in the re-projection, the original corner point coordinates and other relevant details must be appended to the P6/11 file to maintain the audit trail of the bin grid history. If the steps are not documented it may be impossible to recover the true real-world coordinates of the bin centres. The following records assume the workstation uses an affine transformation (EPSG method 9666) to convert between map and bin grids. This method locks in rectilinear axes but bin size and location will be perturbed.

P6/11 file:

OGP File Identification Record:

OGP,OGP P6,6,1.1,1,2016:04:01,14:50:30,Quad_36N_Proc_bingrid_UTM3E.p611,Partner B

Survey Summary:

HC,0,1,0,Project Name...,CNS 2016/1,Quad 36N 3D,2016:01:04,
 HC,0,3,0,Geographic Extent...,0.0,1.0,55.5,56.0
 HC,0,4,0,Client...,PARTNER B CNS team

Reference Systems Summary:

HC,1,0,0,Reference Systems Summary...,7,0,7,4

Coordinate Reference Systems:

```

.
.
HC,1,3,0,CRS Number/EPSSG Code/Name/Source...,4,,ED50 / Quad 36N (I=J+90°) acqn bin
  grid,,,, The bin grid is defined through coordinate operation (COTRANSREF)
  number 2. Used for acquisition
HC,1,3,0,CRS Number/EPSSG Code/Name/Source...,5,,ED50 / Quad 36N (I=J+90°) proc bin
  grid,,,, The bin grid is defined through coordinate operation (COTRANSREF)
  number 3. Used for first processing by Operator A
HC,1,3,0,CRS Number/EPSSG Code/Name/Source...,6,23031,ED50 / UTM zone 31N,
8.3,2013:11:29,EPSSG,This is the base projected CRS for bin grid CRSREF 7
HC,1,3,0,CRS Number/EPSSG Code/Name/Source...,7,,ED50 / Quad 36N (I=J+90°) proc
  bin grid reproj,,,,The bin grid is defined through coordinate operation
  (COTRANSREF) number 4
CC,1,0,0,Bin grid (CRSREF = 7) is a realisation of the processed bin grid (CRSREF =
  5) reprojected to ED50 / UTM zone 31N (CRSREF = 6) as a workstation defined
  4-point best fit optimisation
CC,1,0,0, CRSREF 6 is also used for export of bin node coordinates by Partner B in
  file Quad 36N Proc_bingrid_UTM3E_bin_centres.P611

```

Note the addition of CRSREF 6 & 7 (in bold type above) to address the realisation of the bin grid in Partner B's working CRS, and its export as a bin centres P6/11 file. The explicit definition of CRSREF 7 follows...

```

HC,1,4,0,CRS Number/EPSSG Code/Type/Name... ,7,,6,engineering,ED50 / Quad 36N
  (I=J+90°) proc bin grid reproj
HC,1,4,8,Engineering Datum... ,7,9315,Seismic bin grid datum
CC,1,0,0,The bin grid is defined through coordinate operation (COTRANSREF) number 4
HC,1,6,0,Coordinate System... ,7,1033,Bin grid CS (I = J+90°). Axes\
  u003A I\u002CJ.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1... ,7,1,1428,Bin grid I,J-axis plus
  90°,I,7,bin
HC,1,6,1,Coordinate System Axis 2... ,7,2,1429,Bin grid J,See associated
  operation*,J,7,bin

```

* COTRANSREF 4

Coordinate Transformations:

```

HC,1,7,0,Transformation Number/EPSSG Code/Name/Source...,4,,ED50 / UTM zone 31N to ED50
/ Quad 36N (I=J+90°) proc bin grid reproj,,,,

```

Note the addition of COTRANSREF 4 (in bold type above) used to transform the processed bin grid to Partner B's working CRS, the explicit definition of which follows...

```

HC,1,8,0,Transformation Number/EPSSG Code/Name...,4,,ED50 / UTM zone 31N to ED50 / Quad
  36N (I=J+90°) proc bin grid reproj,
HC,1,8,1,Source CRS/Target CRS/Version... ,4,6,23031,ED50 / UTM zone 31N,7,,ED50
  / Quad 36N (I=J+90°) proc bin grid reproj,
HC,1,8,2,Transformation Method... ,4,9666,P6 (I = J+90°) seismic bin
  grid transformation,1,10
HC,1,8,4,Bin grid origin I... ,4,8733,0.0,7,bin,0
HC,1,8,4,Bin grid origin J... ,4,8734,0.0,7,bin,0
HC,1,8,4,Bin grid origin Easting... ,4,8735,264018.172,1,metre,0
HC,1,8,4,Bin grid origin Northing... ,4,8736,6005922.726,1,metre,0
HC,1,8,4,Scale factor of bin grid... ,4,8737,1.0,4,unity,0
HC,1,8,4,Bin width on I-axis... ,4,8738,25.007,1,metre,0
HC,1,8,4,Bin width on J-axis... ,4,8739,25.007,1,metre,0
HC,1,8,4,Map grid bearing of bin grid J-axis... ,4,8740,2.48019694,3,degree,0
HC,1,8,4,Bin node increment on I-axis... ,4,8741,1.0,7,bin,0
HC,1,8,4,Bin node increment on J-axis... ,4,8742,1.0,7,bin,0
CC,1,0,0,The transformation 4 defines Bin Grid CRS number 7

```

Note the bin grid origin in E,N has been shifted 87m NW of its original position in the optimisation process.

Example Point Conversion

HC,1,9,0,Example Point Conversion...,13,Well 36/1-
 A,7,2802.462,7040.874,,3,530060.0,6176020.0,,
 2,55.72775778,0.47859889,,6,341653.0,6178796.23,

The example point is given in processed bin grid (reproj), original map grid, ED50 and new map grid terms. The slight adjustment in the I,J bin grid coordinates (compared with Stage 2) represents a displacement of 2.3 metres. Other methods of bin grid realisation could induce displacements of up to 100's of metres. This could lead to, for example, failed well objectives if a well was drilled without considering bin grid displacement.

Parameter check points (appended to existing check points):

CC,1,0,0,The following corner points (in CRSREF 5 and 3) were used to seed the workstation affine transformation COTRANSREF 4 (which have been independently converted below to ED50/UTM zone 31N)
 HC,1,9,0,Example Point Conversion...,14,Input corner 1,5,1700.0,8040.0,,3,502500.0, 62 01000.0,,6,315191.61,6204956.11,,2,55.95312417,0.04003444,
 HC,1,9,0,Example Point Conversion...,15,Input corner 2,5,4000.0,8040.0,,3,560000.0, 62 01000.0,,6,372653.96,6202461.18,,2,55.94938583,0.96074889,
 HC,1,9,0,Example Point Conversion...,16,Input corner 3,5,4000.0,6240.0,,3,560000.0, 61 56000.0,,6,370706.53,6157496.23,,2,55.54511917,0.95086528,
 HC,1,9,0,Example Point Conversion...,17,Input corner 4,5,1700.0,6240.0,,3,502500.0, 61 56000.0,,6,313243.22,6159979.24,,2,55.54880167,0.0396225,

These parameter check points are the corner coordinates of the bin grid, entered as I,J and E,N pairs for the workstation 4-point best fit optimisation process. They are given in Processed bin grid and TM 0 (the seed data), and UTM zone 31N and ED50 for complete spatial integrity.

File Content Definitions:

H6,0,0,0,File Contents Description...,Processed bin grid geometry and data extent perimeter,
 H6,0,1,0,Processing Details..., Bin grid projected to UTM zone 31N within workstation
 H6,0,2,0,Original File...,2,Quad_36N_Proc_bingrid.p611,,

Survey Perimeter Definition:

H6,2,0,0,Survey Perimeter Definition...,3,Quad 36N 3D Data Extent (proc vol) after re-projection to CRSREF 6 in workstation,7,6,1,Data Extent,0,
 M6,0,3,1,1,1,1700.02,8040.21,,315191.61,6204956.11,,
 M6,0,3,1,2,1,4000.04,8039.97,,372653.96,6202461.18,,
 M6,0,3,1,3,1,4000.05,6240.19,,370706.53,6157496.23,,
 M6,0,3,1,4,1,1700.02,6239.95,,313243.22,6159979.24,,
 M6,0,3,1,1,,1700.02,8040.21,,315191.61,6204956.11,,

Coordinates of the corner points generated from affine transformation:

H6,1,0,0,Bin Node Position Record Definition...,1,5,6,,
 B6,0,1,1700.0,8040.0,,315190.78,6204951.00,,
 B6,0,1,4000.0,8040.0,,372653.00,6202462.04,,
 B6,0,1,4000.0,6240.0,,370705.12,6157491.61,,
 B6,0,1,1700.0,6240.0,,313242.90,6159980.57,,

By comparing the seed data points in the HC,1,9,0 records above with the B6 node positions for the same corners it can be seen that the affine transformation has adjusted ('optimised') the input seed data to lock in rectilinear axes in the re-projected realisation of the bin grid. The differences are as follows:

Corner	Delta E (m)	Delta N (m)	Linear Displacement (m)
1 (NW)	-0.83	-5.11	5.18
2 (NE)	-0.96	0.86	1.29
3 (SE)	-1.41	-4.62	4.83
4 (SW)	-0.32	1.33	1.37

These are modest, and reflect the small size of the 3D area at a mid latitude location, minimal change of central meridian from 0° to 3°E, and the use of a 4-point optimised best fit method to approximate the re-projected bin grid. However, more severe re-projections are often applied to bin grids using less precise realisations of the grid (such as the skew parallelogram – see P6/11 User Guide), and the resulting displacements will grow accordingly.

To retain the true exact real-world positions of the bin nodes in the working CRS, it is necessary to preserve the data in another way. Good practice is to export the bin grid as explicit bin centres, containing all the bin coordinates directly converted from their ED50 / TM 0 N positions, and load these to the workstation as a reference dataset containing the true bin centre positions. This would represent the source data for any future exchange of the bin grid, or for 3D seismic applications that can handle non-rectilinear gridded data. The diagram below is a representation of the Processed bin grid converted in this way. Note that curvature is exaggerated:

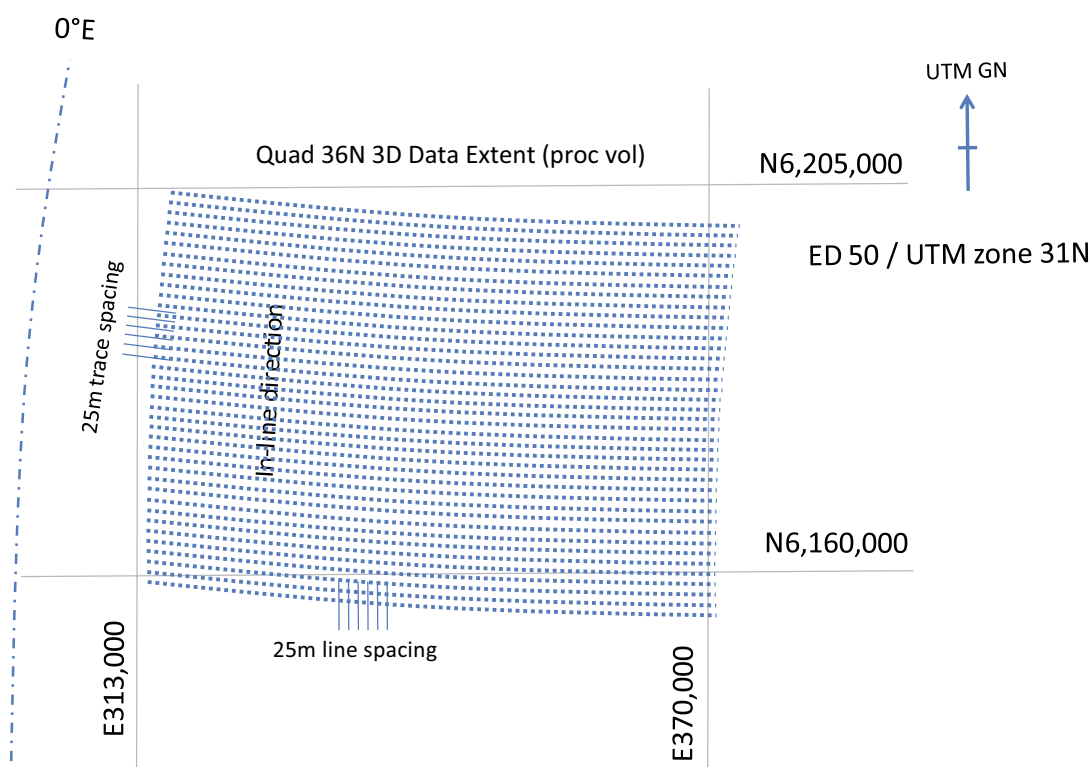


Figure 6: Processed bin grid re-projected bin-by-bin to UTM 31N map grid

B6 Bin Node Position Records:

It is strongly recommended that if the re-projected bin positions form a non-rectilinear or irregular grid, as is the case here, all bin node positions should be exported to a P6/11 bin centres file for further exchange:

P6/11 file:*OGP File Identification Record:*

OGP,OGP P6,6,1.1,1,2016:04:01,14:50:30,Quad_36N_Proc_bingrid_UTM3E_bin_centres.p611,
Partner B

Survey Summary:

HC,0,1,0,Project Name...,CNS 2016/1,Quad 36N 3D,2016:01:04,
HC,0,3,0,Geographic Extent...,0.0,1.0,55.5,56.0
HC,0,4,0,Client...,PARTNER B CNS team

Reference Systems Summary:

HC,1,0,0,Reference Systems Summary...,7,0,6,4

Coordinate Reference Systems:

.
.
HC,1,3,0,CRS Number/EPSP Code/Name/Source...,4,,ED50 / Quad 36N (I=J+90°) acqn bin
grid,,,The bin grid is defined through coordinate operation (COTRANSREF)
number 2. Used for acquisition
HC,1,3,0,CRS Number/EPSP Code/Name/Source...,5,,ED50 / Quad 36N (I=J+90°) proc bin
grid,,,The bin grid is defined through coordinate operation (COTRANSREF)
number 3. Used for first processing by Operator A
HC,1,3,0,CRS Number/EPSP Code/Name/Source...,6,23031,ED50 / UTM zone 31N,
8.3,2013:11:29,EPSP,Used for export of bin node coordinates in file 'Quad 36N
Proc_bingrid_UTM3E_bin_centres.p611'

Example Point Conversion

HC,1,9,0,Example Point Conversion...,1,Well 36/1-
A,5,2802.4,7040.8,,3,530060.0,6176020.0,,6,341653.0,6178796.23,

The re-projected bin centres do not define a rectilinear grid and as all bin node coordinates are written to the P6/11 there is no point in including parameter check points.

File Content Definitions:

H6,0,0,0,File Contents Description...,Processed bin grid node coordinates,
H6,0,1,0,Processing Details...,Bin grid nodes independently re-projected to
ED50 / UTM zone 31N
H6,0,2,0,Original File...,2,Quad_36N_Proc_bingrid.p611,,

Bin Node Position Record Type Definition:

H6,1,0,0,Bin Node Position Record Definition,1,5,6,0,

Bin Node Position records:

B6,0,1,1700.0,8040.0,,315191.61,6204956.11,,
B6,0,1,1701.0,8040.0,,315216.59,6204955.02,,
B6,0,1,1702.0,8040.0,,315241.58,6204953.94,,
B6,0,1,1703.0,8040.0,,315266.57,6204952.85,,
.
.
.
B6,0,1,3998.0,6240.0,,370656.57,6157498.39,,
B6,0,1,3999.0,6240.0,,370681.55,6157497.31,,
B6,0,1,4000.0,6240.0,,370706.53,6157496.23,,

STAGE 4. Bin grid merged with another resulting in geodetic transformation, change of origin and densification of cell size.

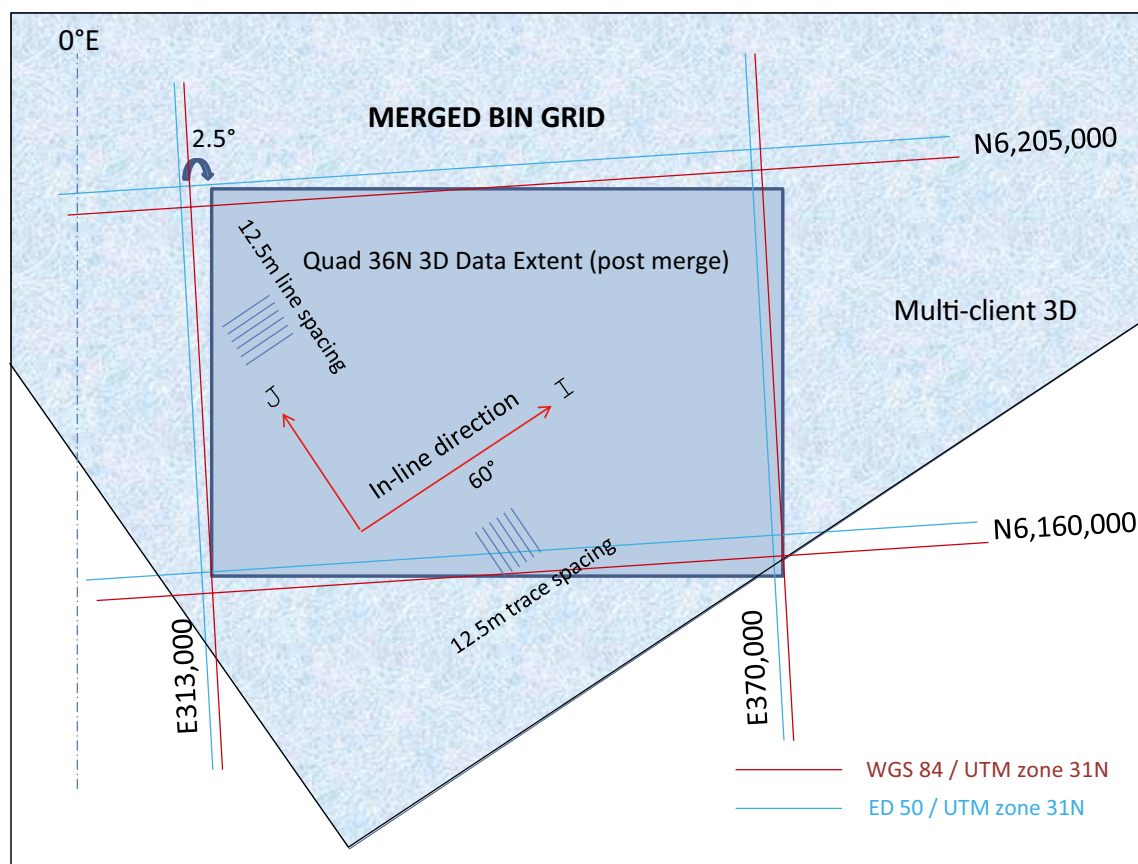


Figure 7: Processed bin grid re-binned and merged with data from another survey

Partner 'B' wishes to merge the new survey with another acquired through a multi-client arrangement, which overlaps but has different orientation, origin, and base geographic CRS. Data from the new survey is geodetically transformed to the CRS of the multi-client survey, and the data from both surveys is re-binned in a grid aligned to the multi-client dataset, with a new origin. The multi-client bin grid is on its original projected CRS therefore is rectilinear and regular. The increased data density in the area of overlap justifies re-sampling of the data to 12.5 metre bins.

The multi-client survey has the following parameters:

Projected CRS:	WGS 84 / UTM zone 31N	(EPSG::32631)
Inline direction:	330°	(relative to Grid North on UTM zone 31N projection)
Line spacing:	25.0 m	
Trace spacing:	25.0 m	

This is to be merged with the new survey which has the following parameters:

Projected CRS:	ED50 / UTM zone 31N	(EPSG::23031)
Data:	True real-world bin centre coordinates at 25m intervals from P6/11 bin centres file	

All traces (= bin centres) from the new survey are transformed to the CRS of the multi-client survey, combined with traces of the multi-client survey and re-binned in the revised bin grid.

P6/11 file:

OGP File Identification Record:

OGP, OGP P6, 6, 1.1, 1, 2016:05:01, 11:11:51, **Quad_36N_Revised_bingrid_WGS84/UTM3E post-merge.p611**, Partner B

Survey Summary:

HC, 0, 1, 0, Project Name..., CNS 2016/1, Quad 36N 3D, 2016:01:04,
 HC, 0, 3, 0, Geographic Extent..., 0.0, 1.0, 55.5, 56.0
 HC, 0, 4, 0, Client..., PARTNER B CNS team

Reference Systems Summary:

HC, 1, 0, 0, Reference Systems Summary..., 7, 0, 9, 5

Coordinate Reference Systems:

HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 1, 4326, WGS 84, 8.3, 2013:11:29, EPSG,

.

.

CC, 1, 0, 0, The following 2 CRSs are used by Partner B for the merged bin grid

HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 8, 32631, WGS84 / UTM zone 31N, 8.3, 2013:11:29, EPSG, This is the base projected CRS for bin grid CRSREF 9. Used for multi-client survey

HC, 1, 3, 0, CRS Number/EPG Code/Name/Source..., 9, , WGS 84 / Quad 36N (I=J+90°) bin grid merge, , , , Bin grid after merge of Quad 36N Proc_bingrid_UTM3E_bin_centres.P611 with multi-client survey P6/11. The bin grid is defined through coordinate operation (COTRANSREF) number 5

Note the addition of CRSREF 8 & 9 (in bold type above) to address the densified bin grid. The explicit definition of 9 follows...

.

.

HC, 1, 4, 0, CRS Number/EPG Code/Type/Name..., 9, , 6, engineering, WGS 84 / Quad 36N (I=J+90°) bin grid merge

HC, 1, 4, 8, Engineering Datum..., 9, 9315, Seismic bin grid datum

CC, 1, 0, 0, The bin grid is defined through coordinate operation (COTRANSREF) number 5

HC, 1, 6, 0, Coordinate System..., 9, 1033, Bin grid CS (I = J+90°). Axes\ u003A I\ u002C J., 2, Cartesian, 2

HC, 1, 6, 1, Coordinate System Axis 1..., 9, 1, 1428, Bin grid I, J-axis plus 90°, I, 7, bin

HC, 1, 6, 1, Coordinate System Axis 2..., 9, 2, 1429, Bin grid J, See associated operation*, J, 7, bin

* COTRANSREF 5

Coordinate Transformations:

HC, 1, 7, 0, Transformation Number/EPG Code/Name/Source..., 1, 1311, ED50 to WGS 84 (18), 8.3, 2013:11:29, EPSG, Used during acquisition

.

.

HC, 1, 7, 0, Transformation Number/EPG Code/Name/Source..., 5, , WGS 84 / UTM zone 31N to WGS 84 / Quad 36N (I=J+90°) bin grid merge, , , ,

COTRANSREF 1 is used for the geodetic transformation of the P6/11 bin centres file to WGS 84.

Note the addition of COTRANSREF 5 (in bold type above) used to transform between the projected CRS of the multi-client survey and merged bin grid, the explicit definition of which follows...

HC, 1, 8, 0, Transformation Number/EPG Code/Name..., 5, , WGS 84 / UTM zone 31N to WGS 84 / Quad 36N (I=J+90°) bin grid merge,

HC, 1, 8, 1, Source CRS/Target CRS/Version..., 5, 8, 32631, WGS 84 / UTM zone 31N, 9, , WGS 84 / Quad 36N (I=J+90°) bin grid merge,

HC, 1, 8, 2, Transformation Method..., 5, 9666, P6 (I = J+90°) seismic bin grid transformation, 1, 10

HC, 1, 8, 4, Bin grid origin I..., 5, 8733, 0.0, 7, bin, 0

HC, 1, 8, 4, Bin grid origin J..., 5, 8734, 0.0, 7, bin, 0

```

HC,1,8,4,Bin grid origin Easting...      ,5,8735,240000.0,1,metre,0
HC,1,8,4,Bin grid origin Northing...     ,5,8736,6050000.0,1,metre,0
HC,1,8,4,Scale factor of bin grid...     ,5,8737,1.0,4,unity,0
HC,1,8,4,Bin width on I-axis...          ,5,8738,12.5,1,metre,0
HC,1,8,4,Bin width on J-axis...          ,5,8739,12.5,1,metre,0
HC,1,8,4,Map grid bearing of bin grid J-axis... ,5,8740,330.0,3,degree,0
HC,1,8,4,Bin node increment on I-axis... ,5,8741,1.0,7,bin,0
HC,1,8,4,Bin node increment on J-axis... ,5,8742,1.0,7,bin,0
CC,1,0,0,The transformation 5 defines Bin Grid CRS number 9

```

Example Point Conversion

```

HC,1,9,0,Example Point Conversion...,18,Well 36/1-
    A,9,12179.791,4846.071,,6,341653.0,6178796.23,,8,341562.16,6178583.95,

```

(The example point is given in merged bin grid, Partner B North Sea CRS, and multi-client survey CRS terms).

Parameter check points (appended to existing check points):

```

HC,1,9,0,Example Point Conversion...,19,Parameter check
    11,9,11392.892,7716.921,,8,315100.92,6204743.70,,1,55.95240917,0.03849056,
HC,1,9,0,Example Point Conversion...,20,Parameter check
    12,9,15274.183,5245.585,,8,372562.97,6202248.76,,1,55.94868194,0.95922861,
HC,1,9,0,Example Point Conversion...,21,Parameter check
    13,9,13340.671,2208.235,,8,370615.53,6157284.05,,1,55.54440111,0.94935972,
HC,1,9,0,Example Point Conversion...,22,Parameter check
    14,9,9458.838,4678.784,,8,313152.53,6159767.06,,1,55.54807278,0.03809389,
HC,1,9,0,Example Point Conversion...,23,Parameter check
    15,9,12366.695,4962.348,,8,342858.73,6181010.83,,1,55.74924806,0.49630361,

```

File Content Definitions:

```

H6,0,0,0,File Contents Description...,Bin grid geometry and data extent perimeter
    post-merge,Checked in-house by Survey Dept
H6,0,1,0,Processing Details... ,Quad_36N_Proc_bingrid_UTM3E_bin_centres.p611
    transformed to WGS 84 / UTM zone 31N - merged with Multi-client trace data -
    re-binned on Multi-client survey bin grid
H6,0,2,0,Original File...      , 2,Quad_36N_Proc_bingrid_UTM3E_bin_centres.p611,,
H6,0,2,0,First Merged File... ,100,CNS_Multi-client_3D_2015.p611,,

```

Survey Perimeter Definition:

```

H6,2,0,0,Survey Perimeter Definition...,4,Quad 36N 3D Data Extent (post
    merge),9,8,1,Data Extent,0,
M6,0,4,1,1,1,11392.89,7716.92,,315100.92,6204743.70,,
M6,0,4,1,2,1,15274.18,5245.58,,372562.97,6202248.76,,
M6,0,4,1,3,1,13340.67,2208.24,,370615.53,6157284.05,,
M6,0,4,1,4,1, 9458.84,4678.78,,313152.53,6159767.06,,
M6,0,4,1,1,1, 11392.89,7716.92,,315100.92,6204743.70,,

```

As described at Stage 3, care should be exercised before accepting the 4 corner point coordinates as bin grid loading points.

Bin Grid Axis Definitions

```

H6,3,0,0,I Axis Name...          ,1,8,Line,,
H6,3,0,0,I Axis Description...    ,2,8,Axis with increasing line number,,
H6,3,0,0,I Axis Direction/Orientation... ,3,8,60.0,3,Degrees
H6,3,0,0,J Axis Name...          ,4,8,Trace,,
H6,3,0,0,J Axis Description...    ,5,8,Axis with increasing trace number,,
H6,3,0,0,J Axis Direction/Orientation... ,6,8,330.0,3,Degrees

```

The bin grid development to stage 4 is captured in the following P6/11 file. It is colour-coded to indicate how records from various stages of its development are appended to the file as an audit trail of the bin grid history.

Colour-coded P6/11 file for Stage 4:

Records from Stage 1: BLACK

Records from Stage 2: RED

Records from Stage 3: GREEN

Records from Stage 4: BLUE

```

OGP,OGP P6,6,1.1,1,2016:05:01,11:11:51,Quad_36N_Revised_bingrid_WGS84/UTM3E post-merge.p611,Partner B
HC,0,1,0,Project Name ,CNS 2016/1,Quad 36N 3D,2016:01:04,
HC,0,3,0,Geographic Extent ,0.0,1.0,55.5,56.0
HC,0,4,0,Client ,PARTNER B CNS team
HC,1,0,0,Reference Systems Summary ,7,0,9,5
HC,1,1,0,Unit of Measure ,1, metre ,length,2,,,,,SI base unit of length,9001,EPG
Dataset,7.6,9001
HC,1,1,0,Unit of Measure ,2, radian ,angle ,2,,,,,SI angular measure unit,9101,EPG
Dataset,7.6,9101
HC,1,1,0,Unit of Measure ,3, degree ,angle ,2,2,0,3.14159265358979,180,0,Measure of
plane angle,9102,EPG Dataset,7.6,9102
HC,1,1,0,Unit of Measure ,4, unity ,scale ,2,,,,,For unitless entities,9201,EPG
Dataset,7.6,9201
HC,1,1,0,Unit of Measure ,5, arc-second ,angle ,2,2,0,3.14159265358979,648000,0,1/3600 of
a degree,9104,EPG Dataset,7.6,9104
HC,1,1,0,Unit of Measure ,6, parts per million,scale ,2,4,0,1,1000000,0,parts per
million,9202,EPG Dataset,7.6,9202
HC,1,1,0,Unit of Measure ,7, bin ,scale ,2,4,0,1,1,0,seismic bin
dimension,1024,EPG Dataset,8.7.4,1024
HC,1,1,1,Example Unit Conversion ,1,2,1.0,3,57.295779513
HC,1,3,0,CRS Number/EPG Code/Name/Source ,1, 4326,WGS 84 , 8.3,2013:11:29,EPG,
HC,1,3,0,CRS Number/EPG Code/Name/Source ,2, 4230,ED50 , 8.3,2013:11:29,EPG,
HC,1,3,0,CRS Number/EPG Code/Name/Source ,3,23090,ED50 / TM 0 N
,8.9.2,2016:04:06,EPG,Contractual field acquisition projected CRS and base projected CRS for bin grid CRS CRSREF 4
HC,1,3,0,CRS Number/EPG Code/Name/Source ,4, ,ED50 / Quad 36N (I=J+90°) acqn bin grid,,,The bin grid is
defined through coordinate operation (COTRANSREF) number 2. Used for acquisition
HC,1,3,0,CRS Number/EPG Code/Name/Source ,5, ,ED50 / Quad 36N (I=J+90°) proc bin grid,,,The bin grid is
defined through coordinate operation (COTRANSREF) number 3. Used for first processing by Operator A
HC,1,3,0,CRS Number/EPG Code/Name/Source ,6,23031,ED50 / UTM zone 31N, 8.3,2013:11:29,EPG,This is the base
projected CRS for bin grid CRSREF 7
HC,1,3,0,CRS Number/EPG Code/Name/Source ,7, ,ED50 / Quad 36N (I=J+90°) proc bin grid reproj,,,The bin
grid is defined through coordinate operation (COTRANSREF) number 4

```

```

CC,1,0,0,Bin grid (CRSREF = 7) is a realisation of the processed bin grid (CRSREF = 5) reprojected to ED50 / UTM zone 31N (CRSREF
= 6) as a workstation defined 4-point best fit optimisation
CC,1,0,0,CRSREF 6 is also used for export of bin node coordinates by Partner B in file Quad 36N Proc_bingrid_UTM3E.p611
CC,1,0,0,The following 2 CRSs are used by Partner B for the merged bin grid
HC,1,3,0,CRS Number/EPG Code/Name/Source,8,32631,WGS 84 / UTM zone 31N,8.3,2013:11:29,EPG,This
is the base projected CRS for bin grid CRSREF 9. Used for multi-client survey
HC,1,3,0,CRS Number/EPG Code/Name/Source,9,,WGS 84 / Quad 36N (I=J+90°) bin grid merge,,,,Bin grid after
merge of Quad 36N Proc_bingrid_UTM3E.p611 with multi-client survey P6/11. The bin grid is defined through coordinate
operation (COTRANSREF) number 5
HC,1,4,0,CRS Number/EPG Code/Type/Name,1,4326,2,geographic 2D,WGS 84
HC,1,4,4,Geodetic Datum,1,6326,World Geodetic System 1984,1984:01:01
HC,1,4,5,Prime Meridian,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid,1,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System,1,6422,Ellipsoidal 2D CS. Axes\u003A latitude\u002C longitude.
Orientations\u003A north\u002C east. UoM\u003A degree,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1,1,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2,1,2,107,Geodetic longitude, east,Lon,3,degree
HC,1,4,0,CRS Number/EPG Code/Type/Name,2,4230,2,geographic 2D,ED50
HC,1,4,4,Geodetic Datum,2,6230,European Datum 1950,1950:01:01
HC,1,4,5,Prime Meridian,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid,2,7022,International 1924,6378388,1,metre,297
HC,1,6,0,Coordinate System,2,6422,Ellipsoidal 2D CS. Axes\u003A latitude\u002C longitude.
Orientations\u003A north\u002C east. UoM\u003A degree,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2,2,2,107,Geodetic longitude, east,Lon,3,degree
HC,1,4,0,CRS Number/EPG Code/Type/Name,3,23090,1,projected,ED50 / TM 0 N
HC,1,4,3,Base Geographic CRS,3,2,4230,ED50
HC,1,4,4,Geodetic Datum,3,6230,European Datum 1950,1950:01:01
HC,1,4,5,Prime Meridian,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid,3,7022,International 1924,6378388,1,metre,297
HC,1,5,0,Map Projection,3,16400,TM 0 N
HC,1,5,1,Projection Method,3,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin,3,8801,,0,3,degree
HC,1,5,2,Longitude of natural origin,3,8802,,0,3,degree
HC,1,5,2,Scale factor at natural origin,3,8805,0.9996,4,unity
HC,1,5,2,False easting,3,8806,500000,1,metre
HC,1,5,2,False northing,3,8807,,0,1,metre
HC,1,6,0,Coordinate System,3,4400,Cartesian 2D CS. Axes\u003A easting\u002C northing (E\u002CN).
Orientations\u003A east\u002C north. UoM\u003A m.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1,3,1,1,Easting ,east ,E,1,metre
HC,1,6,1,Coordinate System Axis 2,3,2,2,Northing,north,N,1,metre

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HC,1,4,0,CRS Number/EPSG Code/Type/Name      ,4,,6,engineering,ED50 / Quad 36N (I=J+90°) acqn bin grid
HC,1,4,8,Engineering Datum                    ,4,9315,Seismic bin grid datum
CC,1,0,0,The bin grid is defined through coordinate operation (COTRANSREF) number 2
HC,1,6,0,Coordinate System                    ,4,1033,Bin grid CS (I = J+90°). Axes\u003A I\u002CJ.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1             ,4,1,1428,Bin grid I,J-axis plus 90°      ,I,7,bin
HC,1,6,1,Coordinate System Axis 2            ,4,2,1429,Bin grid J,See associated operation,J,7,bin
HC,1,4,0,CRS Number/EPSG Code/Type/Name      ,5,,6,engineering,ED50 / Quad 36N (I=J+90°) proc bin grid
HC,1,4,8,Engineering Datum                    ,5,9315,Seismic bin grid datum
CC,1,0,0,The bin grid is defined through coordinate operation (COTRANSREF) number 3
HC,1,6,0,Coordinate System                    ,5,1033,Bin grid CS (I = J+90°). Axes\u003A I\u002CJ.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1             ,5,1,1428,Bin grid I,J-axis plus 90°      ,I,7,bin
HC,1,6,1,Coordinate System Axis 2            ,5,2,1429,Bin grid J,See associated operation,J,7,bin
HC,1,4,0,CRS Number/EPSG Code/Type/Name      ,6,23031,1,projected,ED50 / UTM zone 31N
HC,1,4,3,Base Geographic CRS                  ,6,2,4230,ED50
HC,1,4,4,Geodetic Datum                      ,6,6230,European Datum 1950,1950:01:01
HC,1,4,5,Prime Meridian                     ,6,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                           ,6,7022,International 1924,6378388,1,metre,297
HC,1,5,0,Map Projection                      ,6,16031,UTM zone 31N
HC,1,5,1,Projection Method                   ,6,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin           ,6,8801,      0,3,degree
HC,1,5,2,Longitude of natural origin          ,6,8802,      3,3,degree
HC,1,5,2,Scale factor at natural origin       ,6,8805,0.9996,4,unity
HC,1,5,2,False easting                      ,6,8806,500000,1,metre
HC,1,5,2,False northing                     ,6,8807,      0,1,metre
HC,1,6,0,Coordinate System                   ,6,4400,Cartesian 2D CS. Axes\u003A easting\u002C northing (E\u002CN).
      Orientations\u003A east\u002C north. UoM\u003A m.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1            ,6,1,1,Easting ,east ,E,1,metre
HC,1,6,1,Coordinate System Axis 2            ,6,2,2,Northing,north,N,1,metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name      ,7,,6,engineering,ED50 / Quad 36N (I=J+90°) proc bin grid reproj
HC,1,4,8,Engineering Datum                    ,7,9315,Seismic bin grid datum
CC,1,0,0,The bin grid is defined through coordinate operation (COTRANSREF) number 4
HC,1,6,0,Coordinate System                    ,7,1033,Bin grid CS (I = J+90°). Axes\u003A I\u002CJ.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1             ,7,1,1428,Bin grid I,J-axis plus 90°      ,I,7,bin
HC,1,6,1,Coordinate System Axis 2            ,7,2,1429,Bin grid J,See associated operation,J,7,bin
HC,1,4,0,CRS Number/EPSG Code/Type/Name      ,8,32631,1,projected,WGS 84 / UTM zone 31N
HC,1,4,3,Base Geographic CRS                  ,8,1,4326,WGS 84
HC,1,4,4,Geodetic Datum                      ,8,6326,World Geodetic System 1984,
HC,1,4,5,Prime Meridian                     ,8,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                           ,8,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,5,0,Map Projection                      ,8,16031,UTM zone 31N
HC,1,5,1,Projection Method                   ,8,9807,Transverse Mercator,5

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HC,1,5,2,Latitude of natural origin,8,8801,0,3,degree
HC,1,5,2,Longitude of natural origin,8,8802,3,3,degree
HC,1,5,2,Scale factor at natural origin,8,8805,0.9996,4,unity
HC,1,5,2,False easting,8,8806,500000,1,metre
HC,1,5,2,False northing,8,8807,0,1,metre
HC,1,6,0,Coordinate System,8,4400,Cartesian 2D CS. Axes\u003A easting\u002C northing (E\u002CN).
Orientations\u003A east\u002C north. UoM\u003A m.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1,8,1,1,Easting ,east ,E,1,metre
HC,1,6,1,Coordinate System Axis 2,8,2,2,Northing,north,N,1,metre
HC,1,4,0,CRS Number/EPSC Code/Type/Name,9,,6,engineering,WGS 84 / Quad 36N (I=J+90°) bin grid merge
HC,1,4,8,Engineering Datum,9,9315,Seismic bin grid datum
CC,1,0,0,The bin grid is defined through coordinate operation (COTRANSREF) number 5
HC,1,6,0,Coordinate System,9,1033,Bin grid CS (I = J+90°). Axes\u003A I\u002CJ.,2,Cartesian,2
HC,1,6,1,Coordinate System Axis 1,9,1,1428,Bin grid I,J-axis plus 90°,I,7,bin
HC,1,6,1,Coordinate System Axis 2,9,2,1429,Bin grid J,See associated operation,J,7,bin
HC,1,7,0,Transformation Number/EPSC Code/Name/Source acquisition,1,1311,ED50 to WGS 84 (18),8.3,2013:11:29,EPSC,Used during
HC,1,7,0,Transformation Number/EPSC Code/Name/Source,2,,ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) acqn bin grid,,,,
HC,1,7,0,Transformation Number/EPSC Code/Name/Source,3,,ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) proc bin grid,,,,
HC,1,7,0,Transformation Number/EPSC Code/Name/Source reproj,,,,,
HC,1,7,0,Transformation Number/EPSC Code/Name/Source merge,,,,,
HC,1,8,0,Transformation Number/EPSC Code/Name,1,1311,ED50 to WGS 84 (18),1
HC,1,8,1,Source CRS/Target CRS/Version,1,2,4230,ED50,1,4326,WGS 84,UKOOA-CO
HC,1,8,2,Transformation Method,1,9606,Position Vector transformation (geog2D domain),1,7
HC,1,8,4,X-axis translation,1,8605,-89.5,1,metre,1
HC,1,8,4,Y-axis translation,1,8606,-93.8,1,metre,1
HC,1,8,4,Z-axis translation,1,8607,-123.1,1,metre,1
HC,1,8,4,X-axis rotation,1,8608,0,5,arc-second,1
HC,1,8,4,Y-axis rotation,1,8609,0,5,arc-second,1
HC,1,8,4,Z-axis rotation,1,8610,-0.156,5,arc-second,1
HC,1,8,4,Scale difference,1,8611,1.2,6,parts per million,1
HC,1,8,0,Transformation Number/EPSC Code/Name,2,,ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) acqn bin grid,0
HC,1,8,1,Source CRS/Target CRS/Version,2,3,23090,ED50 / TM 0 N,4,,ED50 / Quad 36N (I=J+90°) acqn bin grid,
HC,1,8,2,Transformation Method,2,9666,P6 (I = J+90°) seismic bin grid transformation,1,10
HC,1,8,4,Bin grid origin I,2,8733,0.0,7,bin,0
HC,1,8,4,Bin grid origin J,2,8734,0.0,7,bin,0
HC,1,8,4,Bin grid origin Easting,2,8735,500000.0,1,metre,0
HC,1,8,4,Bin grid origin Northing,2,8736,6151000.0,1,metre,0
HC,1,8,4,Scale factor of bin grid,2,8737,1.0,4,unity,0

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HC,1,8,4,Bin width on I-axis           ,2,8738,      50.0,1,metre ,0
HC,1,8,4,Bin width on J-axis           ,2,8739,      25.0,1,metre ,0
HC,1,8,4,Map grid bearing of bin grid J-axis ,2,8740,      0.0,3,degree,0
HC,1,8,4,Bin node increment on I-axis   ,2,8741,      1.0,7,bin   ,0
HC,1,8,4,Bin node increment on J-axis   ,2,8742,      1.0,7,bin   ,0
CC,1,0,0,The transformation 2 defines Bin Grid CRS number 4
HC,1,8,0,Transformation Number/EPSG Code/Name ,3,,ED50 / TM 0 N to ED50 / Quad 36N (I=J+90°) proc bin grid,0
HC,1,8,1,Source CRS/Target CRS/Version ,3,3,23090,ED50 / TM 0 N,5,,ED50 / Quad 36N (I=J+90°) proc bin grid,
HC,1,8,2,Transformation Method ,3,9666,P6 (I = J+90°) seismic bin grid transformation,1,10
HC,1,8,4,Bin grid origin I ,3,8733,      0.0,7,bin   ,0
HC,1,8,4,Bin grid origin J ,3,8734,      0.0,7,bin   ,0
HC,1,8,4,Bin grid origin Easting ,3,8735, 460000.0,1,metre ,0
HC,1,8,4,Bin grid origin Northing ,3,8736, 6000000.0,1,metre ,0
HC,1,8,4,Scale factor of bin grid ,3,8737,      1.0,4,unity ,0
HC,1,8,4,Bin width on I-axis ,3,8738,      25.0,1,metre ,0
HC,1,8,4,Bin width on J-axis ,3,8739,      25.0,1,metre ,0
HC,1,8,4,Map grid bearing of bin grid J-axis ,3,8740,      0.0,3,degree,0
HC,1,8,4,Bin node increment on I-axis ,3,8741,      1.0,7,bin   ,0
HC,1,8,4,Bin node increment on J-axis ,3,8742,      1.0,7,bin   ,0
CC,1,0,0,The transformation 3 defines Bin Grid CRS number 5
HC,1,8,0,Transformation Number/EPSG Code/Name ,4,,ED50 / UTM zone 31N to ED50 / Quad 36N (I=J+90°) proc bin grid
reproj,
HC,1,8,1,Source CRS/Target CRS/Version ,4,6,23031,ED50 / UTM zone 31N,7,,ED50 / Quad 36N (I=J+90°) proc bin
grid reproj,
HC,1,8,2,Transformation Method ,4,9666,P6 (I = J+90°) seismic bin grid transformation,1,10
HC,1,8,4,Bin grid origin I ,4,8733,      0.0,7,bin   ,0
HC,1,8,4,Bin grid origin J ,4,8734,      0.0,7,bin   ,0
HC,1,8,4,Bin grid origin Easting ,4,8735, 264018.172,1,metre ,0
HC,1,8,4,Bin grid origin Northing ,4,8736, 6005922.726,1,metre ,0
HC,1,8,4,Scale factor of bin grid ,4,8737,      1.0,4,unity ,0
HC,1,8,4,Bin width on I-axis ,4,8738,      25.007,1,metre ,0
HC,1,8,4,Bin width on J-axis ,4,8739,      25.007,1,metre ,0
HC,1,8,4,Map grid bearing of bin grid J-axis ,4,8740,  2.4801969,3,degree,0
HC,1,8,4,Bin node increment on I-axis ,4,8741,      1.0,7,bin   ,0
HC,1,8,4,Bin node increment on J-axis ,4,8742,      1.0,7,bin   ,0
CC,1,0,0,The transformation 4 defines Bin Grid CRS number 7
HC,1,8,0,Transformation Number/EPSG Code/Name ,5,,WGS 84 / UTM zone 31N to WGS 84 / Quad 36N (I=J+90°) bin grid
merge,
HC,1,8,1,Source CRS/Target CRS/Version ,5,8,32631, WGS 84 / UTM zone 31N,9,, WGS 84 / Quad 36N (I=J+90°) bin
grid merge,
HC,1,8,2,Transformation Method ,5,9666,P6 (I = J+90°) seismic bin grid transformation,1,10

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HC,1,8,4,Bin grid origin I,5,8733,0.0,7,bin,0
HC,1,8,4,Bin grid origin J,5,8734,0.0,7,bin,0
HC,1,8,4,Bin grid origin Easting,5,8735,240000.0,1,metre,0
HC,1,8,4,Bin grid origin Northing,5,8736,6050000.0,1,metre,0
HC,1,8,4,Scale factor of bin grid,5,8737,1.0,4,unity,0
HC,1,8,4,Bin width on I-axis,5,8738,12.5,1,metre,0
HC,1,8,4,Bin width on J-axis,5,8739,12.5,1,metre,0
HC,1,8,4,Map grid bearing of bin grid J-axis,5,8740,330.0,3,degree,0
HC,1,8,4,Bin node increment on I-axis,5,8741,1.0,7,bin,0
HC,1,8,4,Bin node increment on J-axis,5,8742,1.0,7,bin,0
CC,1,0,0,The transformation 5 defines Bin Grid CRS number 9
HC,1,9,0,Example Point Conversion,1,Well 36/1-A,4,601.20,1000.80,,3,530060.0,6176020.0,,2,55.72775778,0.47859889,
HC,1,9,0,Example Point Conversion,7,Well 36/1-A,5,2802.40,7040.80,,3,530060.0,6176020.0,,2,55.72775778,0.47859889,
HC,1,9,0,Example Point Conversion,13,Well 36/1-A,7,2802.462,7040.874,,3,530060.0,6176020.0,,2,55.72775778,0.47859889,,6,341653.0,6178796.23,
HC,1,9,0,Example Point Conversion,18,Well 36/1-A,9,12179.791,4846.071,,6,341653.0,6178796.23,,8,341562.16,6178583.95,
CC,1,0,0,The following parameter check points should be used to confirm grid parameters have been correctly set up for CRS Quad 36N (I=J+90°) bin grid merge
HC,1,9,0,Example Point Conversion,19,Parameter check 11,9,11392.892,7716.921,,8,315100.92,6204743.70,,1,55.95240917,0.03849055,
HC,1,9,0,Example Point Conversion,20,Parameter check 12,9,15274.183,5245.585,,8,372562.97,6202248.76,,1,55.94868194,0.95922861,
HC,1,9,0,Example Point Conversion,21,Parameter check 13,9,13340.671,2208.235,,8,370615.53,6157284.05,,1,55.54440111,0.94935972,
HC,1,9,0,Example Point Conversion,22,Parameter check 14,9,9458.838,4678.784,,8,313152.53,6159767.06,,1,55.54807278,0.03809389,
HC,1,9,0,Example Point Conversion,23,Parameter check 15,9,12366.695,4962.348,,8,342858.73,6181010.83,,1,55.74924806,0.49630361,
H6,0,0,0,File Contents Description,Bin grid geometry and data extent perimeter post-merge,Checked in-house by Survey Dept
H6,0,1,0,Processing Details,Quad_36N_Proc_bingrid_UTM3E_bin_centres.p611 transformed to WGS 84 / re-binned on Multi-client survey bin grid
H6,0,2,0,Original File,2,Quad_36N_Proc_bingrid_UTM3E_bin_centres.p611,,
H6,0,2,0,First Merged File,100,CNS_Multi-client_3D_2015.p611,,
H6,2,0,0,Survey Perimeter Definition,1,Quad 36N 3D Data Extent,3,4,1,Data Extent,0,
H6,2,0,0,Survey Perimeter Definition,2,Quad 36N 3D Data Extent (proc vol),3,5,1,Data Extent,0,
H6,2,0,0,Survey Perimeter Definition,3,Quad 36N 3D Data Extent (proc vol) after re-projection to CRSREF 6 in workstation,6,7,1,Data Extent,0,

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H6,2,0,0,Survey Perimeter Definition                                ,4,Quad 36N 3D Data Extent (post merge),8,9,1,Data Extent,0,
CC,1,0,0,The following bin grid attribute records define how the bin grid axes relate to field acquisition of Multi-client survey
H6,3,0,0,I Axis Name                                              ,1,8,Line,,
H6,3,0,0,I Axis Description                                       ,2,8,Axis with increasing line number,,
H6,3,0,0,I Axis Direction/Orientation                             ,3,8,90.0,3,Degrees
H6,3,0,0,J Axis Name                                              ,4,8,Trace,,
H6,3,0,0,J Axis Description                                       ,5,8,Axis with increasing trace number,,
H6,3,0,0,J Axis Direction/Orientation                             ,6,8,0.0,3,Degrees
CC,1,0,0,Survey perimeter records follow
M6,0,1,1,1,1,502500.00,6201000.00,, 50.00,2000.00,,
M6,0,1,1,2,1,560000.00,6201000.00,,1200.00,2000.00,,
M6,0,1,1,3,1,560000.00,6156000.00,,1200.00, 200.00,,
M6,0,1,1,4,1,502500.00,6156000.00,, 50.00, 200.00,,
M6,0,1,1,1, ,502500.00,6201000.00,, 50.00,2000.00,,
M6,0,2,1,1,1,502500.00,6201000.00,,1700.00,8040.00,,
M6,0,2,1,2,1,560000.00,6201000.00,,4000.00,8040.00,,
M6,0,2,1,3,1,560000.00,6156000.00,,4000.00,6240.00,,
M6,0,2,1,4,1,502500.00,6156000.00,,1700.00,6240.00,,
M6,0,2,1,1, ,502500.00,6201000.00,,1700.00,8040.00,,
M6,0,3,1,1,1,315191.61,6204956.11,,1700.02,8040.21,,
M6,0,3,1,2,1,372653.96,6202461.18,,4000.04,8039.97,,
M6,0,3,1,3,1,370706.53,6157496.23,,4000.05,6240.19,,
M6,0,3,1,4,1,313243.22,6159979.24,,1700.02,6239.95,,
M6,0,3,1,1, ,315191.61,6204956.11,,1700.02,8040.21,,
M6,0,4,1,1,1,315100.92,6204743.70,,11392.89,7716.92,,
M6,0,4,1,2,1,372562.97,6202248.76,,15274.18,5245.58,,
M6,0,4,1,3,1,370615.53,6157284.04,,13340.67,2208.24,,
M6,0,4,1,4,1,313152.53,6159767.06,, 9458.84,4678.78,,
M6,0,4,1,1, ,315100.92,6204743.70,,11392.89,7716.92,,

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Appendix D: Minimum Requirements by Records Group

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

Records Group	Records	Original Bin Grid	Re-Projected Bin Grid
OGP Record	OGP	Mandatory	Mandatory
Survey Definition	HC,0,x,x	Mandatory	Mandatory
Reference Systems Summary Information	HC,1,0,0	Mandatory	Mandatory
Unit Reference Systems	HC,1,1,x	Mandatory	Mandatory
Time Reference Systems	HC,1,2,x	Optional	Optional
Coordinate Reference Systems	HC,1,3-8,x	Defined within the format for individual records	Defined within the format for individual records
Example Point Conversions	HC,1,9,0	Mandatory to confirm bin grid geometry	Mandatory to confirm bin grid geometry
Comment Records	CC,x,x,x	Optional	Optional
File Contents Description	H6,0,0,0	Mandatory	Mandatory
File Processing Details	H6,0,1,0	Mandatory	Mandatory
File Contents Attributes	H6,0,2,0	Optional	Optional
Bin Node Position Record Type Definitions	H6,1,0,0	Mandatory if B6 Bin Node Position Records included in file	Mandatory if B6 Bin Node Position Records included in file
M6 Survey Perimeter Definition	H6,2,0,0	Mandatory if M6 Perimeter Records included in file	Mandatory if M6 Perimeter Records included in file
Bin Grid Attributes	H6,3,0,0	Mandatory for format-defined attributes 1-6	Mandatory for format-defined attributes 1-6
B6: Bin Node Position Records	B6	Not required if bin grid is in its original acquisition CRS	Strongly Recommended (E&P Operator or end client to confirm) if re-projected bin grid is non-rectilinear or irregular
M6: Survey Perimeter Positions	M6	Recommended	Recommended

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The P6/11 format for the exchange of seismic binning grids is recommended by the International Association of Oil & Gas Producers (IOGP) 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 utilized by these formats.

A P6/11 User Guide is due for issue in 2017, containing further details and instruction on implementation of the OGP P6/11 format and examples of its use. It is recommended that once issued, the User Guide be read in conjunction with this format description.