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Geographic information — Well-known text representation of coordinate reference systems

AMENDMENT 1

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This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics,* in collaboration with the Open Geospatial Consortium (OGC).

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Geographic information — Well-known text representation of coordinate reference systems

AMENDMENT 1

3.1.13

Replace definition with:

3.1.13
datum ensemble
group of multiple realizations of the same terrestrial or vertical reference system that, for approximate spatial referencing purposes, are not significantly different

EXAMPLE "WGS 84" as an undifferentiated group of realizations including WGS 84 (TRANSIT), WGS 84 (G730), WGS 84 (G873), WGS 84 (G1150), WGS 84 (G1674) and WGS 84 (G1762). At the surface of the Earth these have changed on average by 0.7 m between the TRANSIT and G730 realizations, a further 0.2 m between G730 and G873, 0.06 m between G873 and G1150, 0.2 m between G1150 and G1674 and 0.02 m between G1674 and G1762.

Note 1 to entry: Datasets referenced to the different realizations within a datum ensemble may be merged without coordinate transformation.

Note 2 to entry: 'Approximate' is for users to define but typically is in the order of under 1 decimetre but may be up to 2 metres.

[SOURCE: ISO 19111/Amd2:2023, 3.1.16]

3.1.14

Replace "[SOURCE: ISO 19111:2019, 3.1.8]" by "[SOURCE: ISO 19111:2019, 3.1.18]"

3.1.15

Replace "[SOURCE: ISO 19111:2019, 3.1.9]" by "[SOURCE: ISO 19111:2019, 3.1.19]"

3.1.25

Replace definition with:

3.1.25
geodetic coordinate reference system
two- or three-dimensional coordinate reference system based on a geodetic datum reference frame and having either a three-dimensional Cartesian or an ellipsoidal or a spherical coordinate system

Note 1 to entry: In this document a coordinate reference system based on a geodetic reference frame and having an ellipsoidal coordinate system is geographic.

[SOURCE: ISO 19111/Amd2:2023, 3.1.31]

3.1.45

Replace definition with:

3.1.45
spherical coordinate system
two- or three-dimensional coordinate system in Euclidean space in which position is specified by two angular coordinates and (in the three-dimensional case) one distance coordinate

Note 1 to entry: Not to be confused with an ellipsoidal coordinate system based on an ellipsoid 'degenerated' into a sphere.

[SOURCE: ISO 19111/Amd2:2023, 3.1.60]

3.2

In the entry for EPSG, replace www.epsg-registry.org with https://epsg.org.

6.3.1

Insert the following in the row above <left bracket>:

<at sign> ::= @ *!! ISO/IEC 10646:2012 character identifier U+0040*

6.3.4

Replace <wkt Latin text character> with the following:

<wkt Latin text character> ::= <simple Latin upper case letter> | <simple Latin lower case letter>
| <digit> | <underscore>
| <left bracket> | <right bracket> | <left paren> | <right paren>
| <left brace> | <right brace>
| <less than operator> | <equals operator>
| <greater than operator>
| <period> | <comma> | <colon> | <semicolon>
| <plus sign> | <minus sign> | <space> | <number sign>
| <percent> | <ampersand> | <quote> | <asterisk> | <circumflex>
| <solidus> | <reverse solidus> | <question mark> | <at sign>
| <vertical bar> | <degree symbol> | <doublequote symbol>

6.6

Insert the following in the row above angleUnit:

anchorEpoch <datum anchor epoch keyword> 8 and 10

Insert the following in the two rows above baseEngCRS:

axisMaxValue	<axis maximum value keyword>	7
axisMinValue	<axis minimum value keyword>	7

Insert the following in the row above derivedProjCRS:

definingTransformation	<defining transformation keyword>	8

Insert the following in the row above remark:

rangeMeaning	<axis value range meaning keyword>	7

7.5.1

Replace rows for spatial axis, temporalCountMeasure axis and ordinal-dateTime axis with the following:

<spatial axis>	::=	<axis keyword> <left delimiter> <axis nameAbbrev> <wkt separator> <axis direction> [<wkt separator> <axis order>] [<wkt separator> <spatial unit>] [<wkt separator> <axis range>] [{ <wkt separator> <identifier> }]... <right delimiter> *!! Axis unit and conversion factor mandatory. See 7.5.6.2.*
<temporalCountMeasure axis>	::=	<axis keyword> <left delimiter> <axis nameAbbrev> <wkt separator> <axis direction> [<wkt separator> <axis order>] [<wkt separator> <time unit>] [<wkt separator> <axis range>] [{ <wkt separator> <identifier> }]... <right delimiter> *!! Axis unit mandatory, conversion factor conditional. See 7.5.6.4*
<ordinal-dateTime axis>	::=	<axis keyword> <left delimiter> <axis nameAbbrev> <wkt separator> <axis direction> [<wkt separator> <axis order>] [<wkt separator> <axis range>] [{ <wkt separator> <identifier> }]... <right delimiter> *!! The attribute 'axis unit' is not required for an ordinal coordinate system or for a temporal dateTime coordinate system. See 7.5.6.3.*

Insert seven new rows between <axis direction> and <meridian>:

<axis range>	::=	<axis minimum value> | <axis maximum value> | { axis minimum value> <axis maximum value> } | { axis minimum value> <axis maximum value> <axis range meaning> }
<axis minimum value>	::=	<axis minimum value keyword> <left delimiter> <number> <right delimiter>
<axis minimum value keyword>	::=	AXISMINVALUE
<axis maximum value>	::=	< axis maximum value keyword> <left delimiter> <number> <right delimiter>
<axis maximum value keyword>	::=	AXISMAXVALUE
<axis range meaning>	::=	<axis range meaning keyword> <left delimiter> { exact | wraparound } <right delimiter>]
<axis range meaning keyword>	::=	RANGEMEANING

7.5.2, Table 3

Replace Table 3 with the following:

Table 3 — Permitted coordinate system type, dimension and coordinate data type by CRS

CRS type	Permitted CS type(s)	Dimension (number of axes)	Coordinate data type
geodetic derived geodetic	Cartesian spherical (ellipsoidal - read only: see 8.3)	3 2 or 3 (2 or 3)	
geographic derived geographic	ellipsoidal	2 or 3	
projected	Cartesian	2 or 3	
derived projected	affine Cartesian cylindrical ordinal polar spherical	2 or 3 2 or 3 3 1 or 2 or 3 2 2 or 3	(no constraint) (no constraint) (no constraint) integer (no constraint) (no constraint)
vertical derived vertical	vertical	1	
engineering derived engineering	affine Cartesian cylindrical linear ordinal polar spherical	2 or 3 2 or 3 3 1 1 or 2 or 3 2 2 or 3	(no constraint) (no constraint) (no constraint) (no constraint) integer (no constraint) (no constraint)
parametric derived parametric	parametric	1	

Table 3 *(continued)*

CRS type	Permitted CS type(s)	Dimension (number of axes)	Coordinate data type
temporal derived temporal	temporalDateTime	1	dateTime
	temporalCount	1	integer
	temporalMeasure	1	real

7.5.6.1

Remove last paragraph ("<axis unit> or <cs unit> may also specify the unit for implied map projection parameter values, as described in 9.3.").

7.5

Insert the following text as a new subclause 7.5.7. Renumber the original subclause 7.5.7 as 7.5.8 and renumber the subsequent subclauses as 7.5.8.1, 7.5.8.2, 7.5.8.3, 7.5.8.4 and 7.5.8.5, respectively.

7.5.7 Axis range

An axis may have optional attributes minimumValue, maximumValue and rangeMeaning. minimumValue and maxiumValue describe the minimum and maximum values normally allowed for this axis, in the unit for the axis. rangeMeaning indicates whether the axis value range specified through minimumValue and maximumValue allows 'wrap-around', for example longitudes modulus 360°. It may only be included when both minimumValue and maximumValue are included in the axis description, and then it is an optional attribute.

7.5.7.1 (7.5.8.1 following insertion of new subclause 7.5.7)

Insert a fourth example as follows:

EXAMPLE 4 2D Geocentric CS. Axis order is implied, <cs unit> is used, axes have name and abbreviation.

```
CS[spherical,2],
  AXIS["geocentric latitude (U)",north],
  AXIS["geocentric longitude (V)",east],
  ANGLEUNIT["degree",0.0174532925199433]
```

7.5.7.5 (7.5.8.5 following insertion of new subclause 7.5.7)

Insert the following text as a new subclause 7.5.8.6:

7.5.8.6 Coordinate systems with axis range constraint

EXAMPLE 1 3D spherical CS with longitude range constrained to be 0 through 360°. Axis order is explicit, <axis unit> is used, first two axes have name but no abbreviation.

```
CS[spherical,3],
   AXIS["latitude",north,ORDER[1],ANGLEUNIT["degree",0.0174532925199433]],
   AXIS["longitude",east,ORDER[2],ANGLEUNIT["degree",0.0174532925199433],
       AXISMINVALUE[0],AXISMAXVALUE[360]],
   AXIS["ellipsoidal height (h)",up,ORDER[3],LENGTHUNIT["metre",1.0]]
```

8.1

Replace definitions of <static geodetic crs>, <dynamic geodetic crs>, <static geographic crs> and <dynamic geographic crs> with the following:

<static geodetic crs> ::= <geodetic crs keyword> <left delimiter> <crs name>
<wkt separator>
{ <geodetic reference frame> | <geodetic datum ensemble> }
<wkt separator> <coordinate system>
[<wkt separator> <defining transformation ID>]...
<scope extent identifier remark> <right delimiter>

<dynamic geodetic crs> ::= <geodetic crs keyword> <left delimiter> <crs name>
<wkt separator> <dynamic crs>
<wkt separator> <geodetic reference frame>
<wkt separator> <coordinate system>
[<wkt separator> <defining transformation ID>]...
<scope extent identifier remark> <right delimiter>

<static geographic crs> ::= <geographic crs keyword> <left delimiter> <crs name>
<wkt separator>
{ <geodetic reference frame> | <geodetic datum ensemble> }
<wkt separator> <coordinate system>
[<wkt separator> <defining transformation ID>]...
<scope extent identifier remark> <right delimiter>

<dynamic geographic crs> ::= <geographic crs keyword> <left delimiter> <crs name>
<wkt separator> <dynamic crs>
<wkt separator> <geodetic reference frame>
<wkt separator> <coordinate system>
[<wkt separator> <defining transformation ID>]...
<scope extent identifier remark> <right delimiter>

Insert three rows after <dynamic geographic crs> as follows:

<defining transformation ID>	::=	<defining transformation keyword> <left delimiter> <defining transformation name> [<wkt separator> <identifier>] <right delimiter> *!! This information identifies the transformation that may define a geodetic CRS. A full description may be given separately; see Clause 17. A full description of the defining transformation shall not be embedded within the geodetic CRS WKT.*
<defining transformation keyword>	::=	DEFININGTRANSFORMATION
<defining transformation name>	::=	<quoted Latin text> *!! See 7.2*

8.2.3

Add the following text at the end of the second paragraph:

A dynamic reference frame may have a reference frame derived from it at a specified epoch. This epoch may be included in the description of the derived reference frame using *datum anchor epoch*. This is not to be confused with the epoch at which a static reference frame is aligned with another frame: that epoch information may be included in *datum anchor*.

Replace the definition of <geodetic reference frame> with the following:

<geodetic reference frame>	::=	<geodetic reference frame keyword> <left delimiter> <datum name> <wkt separator> <ellipsoid> [<wkt separator> <datum anchor>] [<wkt separator> <datum anchor epoch >] [{ <wkt separator> <identifier> }]... <right delimiter> [{ <wkt separator> <prime meridian> }]

Insert three rows after <datum anchor description> as follows:

<datum anchor epoch>	::=	<datum anchor epoch keyword> <left delimiter> <anchor epoch> <right delimiter>
<datum anchor epoch keyword>	::=	ANCHOREPOCH
<anchor epoch>	::=	<unsigned integer> [<period> [<unsigned integer>]] *!! See 6.3.2*

8.3

Replace first bullet,

"— a geodetic CRS to contain either a 3D Cartesian or a 3D spherical coordinate system, and"

with

"— a geodetic CRS to contain either a 3D Cartesian or a 2D or 3D spherical coordinate system, and"

8.4

After EXAMPLE 4 and text "Non-Latin1 characters may only be included within remarks (see 7.3.4).", add a fifth example as follows:

EXAMPLE 5 Static geodetic CRS with defining transformation:

```
GEODCRS["ETRF2000",
  DATUM["European Terrestrial Reference Frame 2000",
    ELLIPSOID["GRS 1980",6378137,298.257222101]
  ],
  CS[Cartesian,3],
    AXIS["(X)",geocentricX],
    AXIS["(Y)",geocentricY],
    AXIS["(Z)",geocentricZ],
    LENGTHUNIT["metre",1.0],
  DEFININGTRANSFORMATION["ITRF2000 to ETRF2000 (EUREF)",ID["EPSG",7940]],
ID["EPSG",7930]
]
```

9.5

Replace EXAMPLE 4 with the following:

EXAMPLE 4 3D Projected CRS: