

SLOVENSKI STANDARD

SIST ISO 19162:2017

01-junij-2017

Geografske informacije - Koordinatni referenčni sistemi, podani kot tekst

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

iTeh STANDARD PREVIEW

Information géographique -- Représentation textuelle bien lisible de systèmes de référence par coordonnées ([standards.iteh.ai](https://standards.iteh.ai/standard/sist-iso-19162-2017))

Ta slovenski standard je istoveten z: [SIST ISO 19162:2015](https://standards.iteh.ai/standard/sist-iso-19162-2017)

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971f1b/sist-iso-19162-2017>

ICS:

07.040	Astronomija. Geodezija. Geografija	Astronomy. Geodesy. Geography
35.240.70	Uporabniške rešitve IT v znanosti	IT applications in science

SIST ISO 19162:2017

en,fr,de

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST ISO 19162:2017](#)

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971f1b/sist-iso-19162-2017>

INTERNATIONAL
STANDARD

ISO
19162

First edition
2015-08-15

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

Information géographique — Représentation textuelle bien lisible de systèmes de référence par coordonnées

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST ISO 19162:2017](#)

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971fb/sist-iso-19162-2017>



Reference number
ISO 19162:2015(E)

© ISO 2015

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST ISO 19162:2017](#)

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971fb/sist-iso-19162-2017>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2015, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Forewordvii
Introduction.....	viii
1 Scope.....	1
2 Conformance requirements	1
3 Normative references.....	2
4 Definitions and abbreviations	2
4.1 Definitions	2
4.2 Abbreviations.....	8
5 Backus-Naur Form notation and syntax	8
6 WKT string form	9
6.1 Overview.....	9
6.2 Encoding	9
6.3 Characters used in WKT	9
6.3.1 Basic characters.....	9
6.3.2 Numbers iTech STANDARD PREVIEW (standards.itech.ai)	11
6.3.3 Date and time	11
6.3.4 CRS WKT characters	12
6.3.5 Double quote.....	13
6.4 Delimiter	13
6.5 Case sensitivity	13
6.6 Reserved keywords.....	13
6.7 Backward compatibility	15
7 WKT representation of common attributes	15
7.1 Introduction.....	15
7.2 Name	15
7.3 Scope, extent, identifier and remark	15
7.3.1 Introduction.....	15
7.3.2 Scope	16
7.3.3 Extent.....	16
7.3.4 Identifier	18
7.3.5 Remark.....	19
7.4 Unit and unit conversion factor	20
7.5 Coordinate system	21
7.5.1 Syntax	21
7.5.2 Coordinate system type and dimension	22
7.5.3 Axis name and abbreviation.....	23
7.5.4 Axis direction	24
7.5.5 Axis order	25
7.5.6 Axis unit and coordinate system unit	25
7.5.7 Examples of WKT describing coordinate systems.....	26
8 WKT representation of geodetic coordinate reference systems.....	28
8.1 Overview.....	28
8.2 Geodetic datum	28
8.2.1 Ellipsoid.....	28
8.2.2 Prime meridian.....	29
8.2.3 Datum.....	30
8.3 Coordinate systems for geodetic CRSS	31
8.4 Examples of WKT describing a geodetic CRS	31

9	WKT representation of projected CRSs	32
9.1	Overview	32
9.2	Base CRS	32
9.2.1	General.....	32
9.2.2	Ellipsoidal CS unit	33
9.3	Map projection	33
9.3.1	Introduction	33
9.3.2	Map projection name and identifier	34
9.3.3	Map projection method	34
9.3.4	Map projection parameter.....	35
9.4	Coordinate systems for projected CRSs.....	35
9.5	Examples of WKT describing a projected CRS	35
10	WKT representation of vertical CRSs.....	36
10.1	Overview	36
10.2	Vertical datum	37
10.3	Vertical coordinate system	37
10.4	Example of WKT describing a vertical CRS.....	37
11	WKT representation of engineering CRSs	37
11.1	Overview	37
11.2	Engineering datum	38
11.3	Coordinate systems for engineering CRSs	38
11.4	Examples of WKT describing an engineering CRS.....	38
12	WKT representation of image CRSs	39
12.1	Overview	39
12.2	Image datum.....	39
12.3	Coordinate systems for image CRSs.....	40
13	WKT representation of parametric CRSs	40
13.1	Overview	40
13.2	Parametric datum.....	40
13.3	Parametric coordinate system.....	40
13.4	Example of WKT describing a parametric CRS.....	41
14	WKT representation of temporal CRSs	41
14.1	Overview	41
14.2	Temporal datum	41
14.3	Temporal coordinate system.....	41
14.4	Example of WKT describing a temporal CRS	41
15	WKT representation of derived CRSs.....	42
15.1	Overview	42
15.2	Derived CRS conversion	42
15.2.1	Introduction	42
15.2.2	Derived CRS conversion method	43
15.2.3	Derived CRS conversion parameter	43
15.2.4	Derived CRS conversion parameter file	44
15.2.5	Derived CRS conversion example	44
15.3	Derived CRS of type geodetic	44
15.3.1	Representation.....	44
15.3.2	Example of WKT describing a derived geodetic CRS.....	45
15.4	Derived CRS of type vertical.....	45
15.5	Derived CRS of type engineering.....	46
15.5.1	Representation.....	46
15.5.2	Examples of WKT describing a derived engineering CRS	47
15.6	Derived CRS of type parametric	48
15.7	Derived CRS of type temporal	48
16	WKT representation of compound coordinate reference systems	49
16.1	Overview	49
16.2	Examples of WKT describing a compound CRS	50

17	WKT representation of coordinate operations	51
17.1	Coordinate operations	51
17.2	Coordinate operation components	51
17.2.1	Source and target CRS	51
17.2.2	Coordinate operation name and identifier	51
17.2.3	Coordinate operation method	52
17.2.4	Coordinate operation parameter	52
17.2.5	Coordinate operation parameter file	53
17.2.6	Interpolation CRS	53
17.2.7	Coordinate operation accuracy	53
17.2.8	Other coordinate operation attributes	53
17.3	Examples of WKT describing a coordinate operation	54
18	WKT representation of CRS and coordinate operation couples	55
18.1	Bound CRS	55
18.2	Bound CRS components	56
18.2.1	Abridged coordinate transformation	56
18.2.2	Coordinate operation method in abridged coordinate transformations	56
18.2.3	Abridged coordinate transformation parameter	57
18.2.4	Coordinate operation parameter file	57
18.3	Examples of WKT describing a Bound CRS	58
Annex A (normative) Abstract test suite		59
A.1	Conformance of a WKT string describing a geodetic CRS	59
A.2	Conformance of a WKT string describing a projected CRS	59
A.3	Conformance of a WKT string describing a vertical CRS	60
A.4	Conformance of a WKT string describing an engineering CRS	60
A.5	Conformance of a WKT string describing an image CRS	61
A.6	Conformance of a WKT string describing a parametric CRS	61
A.7	Conformance of a WKT string describing a temporal CRS	62
A.8	Conformance of a WKT string describing a derived CRS	62
A.9	Conformance of a WKT string describing a compound CRS	63
A.10	Conformance of a WKT string describing a coordinate operation	63
A.11	Conformance of a WKT string describing a Bound CRS	64
Annex B (informative) Recommended practice for implementation		65
B.1	Introduction	65
B.2	Keywords	65
B.2.1	Keyword case sensitivity	65
B.2.2	Alternative keywords	65
B.2.3	Handling of unrecognised keywords	65
B.3	Characters	65
B.3.1	Handling of unrecognised characters	65
B.3.2	String length	65
B.4	White space	66
B.4.1	Insertion of white space	66
B.4.2	Parsing of white space outside of quoted text	66
B.4.3	Parsing of white space within quoted text	66
B.5	Identifiers	66
B.5.1	Use of identifier	66
B.5.2	Using names to interpret identity	66
B.6	Numbers	67
B.6.1	Precision	67
B.6.2	Defining parameters for a sphere	67
B.6.3	Implied units	67
B.7	Attribute order	67
B.8	Version of CRS WKT	67
Annex C (informative) Mapping of concepts from previous versions of CRS WKT		68
C.1	BNF	68
C.2	Backward compatibility of CRS common attributes	68
C.2.1	Name	68

ISO 19162:2015(E)

C.2.2	ID (Authority)	68
C.3	Backward compatibility of coordinate reference system components	69
C.3.1	Ellipsoid	69
C.3.2	Prime meridian	69
C.3.3	Datum	69
C.3.4	Map projection	70
C.3.5	Coordinate system	71
C.4	Backward compatibility of coordinate reference systems	72
C.4.1	Geodetic CRS	72
C.4.2	Projected CRS	73
C.4.3	Vertical CRS and engineering (local) CRS	73
C.4.4	Compound CRS	74
C.4.5	Fitted CS	74
C.5	Backward compatibility of coordinate operations	74
C.6	Mapping of tokens and keywords from previous versions of CRS WKT to this International Standard	75
Annex D	(informative) Triaxial ellipsoid	79
Annex E	(informative) Identifiers for coordinate operation methods and parameters	80
E.1	Introduction	80
E.2	Map projection methods	81
E.3	Map projection parameters	81
E.4	Coordinate transformation methods	83
E.5	Coordinate transformation parameters	83
Bibliography	85

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST ISO 19162:2017](#)

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971fb/sist-iso-19162-2017>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

THE STANDARD PREVIEW

(standards.itel.ai)

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: http://www.iso.org/iso/iso_technical_barriers_to_trade.htm

The committee responsible for this document is ISO/TC 211, jointly with the Open Geospatial Consortium (OGC).

Introduction

Well-known Text (WKT) offers a compact machine- and human-readable representation of geometric objects. WKT may also be used for succinctly describing the critical elements of coordinate reference system (CRS) definitions.

WKT was described in the Open Geospatial Consortium implementation specifications 99-036 through 06-103r4 and International Standard ISO 19125-1:2004, "Geographic information – Simple feature access – Part 1: Common architecture". The WKT representation of coordinate reference systems was subsequently extended in Open Geospatial Consortium implementation specification 01-009 "Coordinate Transformation Services" and this extension was later adopted in the Open Geospatial Consortium GeoAPI 3.0 implementation standard 09-083r3 and GeoPackage 1.0 implementation standard 12-128r10. The WKT representation of coordinate reference systems as defined in ISO 19125-1:2004 and OGC specification 01-009 is inconsistent with the terminology and technical provisions of ISO 19111:2007 and OGC Abstract Specification topic 2 (08-015r2), "Geographic information – Spatial referencing by coordinates".

This International Standard provides an updated version of WKT representation of coordinate reference systems that follows the provisions of ISO 19111:2007 and ISO 19111-2:2009. It extends earlier WKT to allow for the description of coordinate operations. This International Standard defines the structure and content of well-known text strings. It does not prescribe how implementations should read or write these strings.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST ISO 19162:2017](#)
<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971fb/sist-iso-19162-2017>

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

1 Scope

This International Standard defines the structure and content of a text string implementation of the abstract model for coordinate reference systems described in ISO 19111:2007 and ISO 19111-2:2009. The string defines frequently needed types of coordinate reference systems and coordinate operations in a self-contained form that is easily readable by machines and by humans. The essence is its simplicity; as a consequence there are some constraints upon the more open content allowed in ISO 19111:2007. To retain simplicity in the well-known text (WKT) description of coordinate reference systems and coordinate operations, the scope of this International Standard excludes parameter grouping and pass-through coordinate operations. The text string provides a means for humans and machines to correctly and unambiguously interpret and utilise a coordinate reference system definition with look-ups or cross references only to define coordinate operation mathematics. Because it omits metadata about the source of the data and may omit metadata about the applicability of the information, the WKT string is not suitable for the storage of definitions of coordinate reference systems or coordinate operations.

THE STANDARD PREVIEW

(standards.iteh.ai)

2 Conformance requirements

This International Standard defines eleven classes of conformance (see Annex A) in three groups:

- 1) Any WKT string claiming conformance of coordinate reference system definition shall satisfy the requirements in Annex A as shown in Table 1.

Table 1 — Conformance requirements for coordinate reference systems

Coordinate reference system type	Conformance requirements given in
geodetic	A.1
projected	A.2
vertical	A.3
engineering	A.4
image	A.5
parametric	A.6
temporal	A.7
derived geodetic derived vertical derived engineering derived parametric derived temporal	A.8
compound	A.9

ISO 19162:2015(E)

- 2) Any WKT string claiming conformance of coordinate operation definition shall satisfy the requirements given in A.10.
- 3) Any WKT string claiming conformance of coordinate transformation bound to a coordinate reference system definition shall satisfy the requirements given in A.11.

Conformance is applicable to the WKT string. Recommended practices for implementations writing or reading coordinate reference system WKT strings are given in Annex B.

3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8601:2004, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO/IEC 9075-1:2011, *Information technology — Database languages — SQL — Part 1: Framework (SQL/Framework)*

ISO/IEC 9075-2:2011, *Information technology — Database languages — SQL — Part 2: Foundation (SQL/Foundation)*

ISO/IEC 10646:2012, *Information technology — Universal Coded Character Set (UCS)*

ISO 19111:2007, *Geographic information — Spatial referencing by coordinates*

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-47039e022222>

ISO 19111-2:2009, *Geographic information — Spatial referencing by coordinates — Part 2: Extension for parametric values*

4 Definitions and abbreviations

4.1 Definitions

For the purposes of this document, the following terms and definitions apply.

4.1.1

affine coordinate system

coordinate system (4.1.8) in Euclidean space with straight axes that are not necessarily mutually perpendicular

[SOURCE: ISO 19111:2007, 4.1]

4.1.2

bearing

horizontal angle at a point relative to a specified direction

Note 1 to entry: The direction is usually specified to be north. In some communities the term bearing refers specifically to grid north and directions relative to true north are then termed ‘azimuth’; in other communities a bearing refers specifically to true north. In this International Standard bearing is used for any specified reference direction. The angle may be reckoned positive clockwise or positive counter-clockwise depending upon the application.

4.1.3**Cartesian coordinate system**

coordinate system (4.1.8) which gives the position of points relative to n mutually perpendicular axes that each has zero curvature

Note 1 to entry: n is 2 or 3 for the purposes of this International Standard.

4.1.4**compound coordinate reference system**

coordinate reference system (4.1.7) using at least two independent coordinate reference systems

Note 1 to entry: Coordinate reference systems are independent of each other if coordinate values in one cannot be converted or transformed into coordinate values in the other.

[SOURCE: ISO 19111:2007, 4.3]

4.1.5**coordinate conversion**

coordinate operation (4.1.6) in which both *coordinate reference systems* (4.1.7) are based on the same *datum* (4.1.11)

EXAMPLE Conversion from an ellipsoidal coordinate reference system based on the WGS 84 datum to a Cartesian coordinate reference system also based on the WGS 84 datum, or change of units such as from radians to degrees or feet to metres.

Note 1 to entry: A coordinate conversion uses parameters which have specified values that are not determined empirically.

[SOURCE: ISO 19111:2007, 4.6] **The STANDARD PREVIEW (standards.iteh.ai)**

4.1.6

[SIST ISO 19162:2017](#)

coordinate operation

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-0709a71f0a22?language=en-US&version=2017-02-20T10:10:10Z>-
change of coordinates, based on a ~~one-to-one relationship~~, from one *coordinate reference system* (4.1.7) to another

Note 1 to entry: Supertype of *coordinate transformation* (4.1.9) and *coordinate conversion* (4.1.5).

[SOURCE: ISO 19111:2007, 4.7]

4.1.7**coordinate reference system**

coordinate system (4.1.8) that is related to an object by a *datum* (4.1.11)

Note 1 to entry: For *geodetic* and *vertical datums* (4.1.19, 4.1.39), the object will be the Earth.

[SOURCE: ISO 19111:2007, 4.8]

4.1.8**coordinate system**

set of mathematical rules for specifying how coordinates are to be assigned to points

[SOURCE: ISO 19111:2007, 4.10]

4.1.9**coordinate transformation**

coordinate operation (4.1.6) in which the two *coordinate reference systems* (4.1.7) are based on different *datums* (4.1.11)

ISO 19162:2015(E)

Note 1 to entry: A coordinate transformation uses parameters which are derived empirically by a set of points with known coordinates in both coordinate reference systems.

[SOURCE: ISO 19111:2007, 4.11]

4.1.10**cylindrical coordinate system**

three-dimensional coordinate system (4.1.8) with two distance and one angular coordinates

[SOURCE: ISO 19111:2007, 4.13]

4.1.11**datum**

parameter or set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system (4.1.8)

[SOURCE: ISO 19111:2007, 4.14]

4.1.12**ellipsoid**

surface formed by the rotation of an ellipse about a main axis

Note 1 to entry: In this International Standard, ellipsoids are always oblate, meaning that the axis of rotation is always the minor axis.

[SOURCE: ISO 19111:2007, 4.17]

The STANDARD PREVIEW (standards.iteh.ai)

4.1.13**ellipsoidal coordinate system**

geodetic coordinate system

coordinate system (4.1.8) in which position is specified by geodetic latitude (4.1.20), geodetic longitude (4.1.21) and (in the three-dimensional case) ellipsoidal height (4.1.14)

<https://standards.iteh.ai/standards/sist-iso-19162-2017/e4709d971f1b/sist-iso-19162-2017>

[SOURCE: ISO 19111:2007, 4.18]

4.1.14**ellipsoidal height**

geodetic height

h

distance of a point from the ellipsoid (4.1.12) measured along the perpendicular from the ellipsoid to this point, positive if upwards or outside of the ellipsoid

Note 1 to entry: Only used as part of a three-dimensional ellipsoidal coordinate system (4.1.13) and never on its own.

[SOURCE: ISO 19111:2007, 4.19]

4.1.15**engineering coordinate reference system**

coordinate reference system (4.1.7) based on an engineering datum (4.1.16)

EXAMPLES Local engineering and architectural grids; coordinate reference system local to a ship or an orbiting spacecraft.

[SOURCE: ISO 19111:2007, 4.20]

4.1.16**engineering datum**

local datum

datum (4.1.11) describing the relationship of a coordinate system (4.1.8) to a local reference

Note 1 to entry: Engineering datum excludes both *geodetic* and *vertical datums* (4.1.19, 4.1.39).

EXAMPLE A system for identifying relative positions within a few kilometres of the reference point.

[SOURCE: ISO 19111:2007, 4.21]

4.1.17

flattening

f

ratio of the difference between the *semi-major axis* (a) (4.1.32) and *semi-minor axis* (b) (4.1.33) of an *ellipsoid* (4.1.12) to the semi-major axis; $f = (a - b)/a$

Note 1 to entry: Sometimes inverse flattening $1/f = a/(a-b)$ is given instead; $1/f$ is also known as reciprocal flattening.

[SOURCE: ISO 19111:2007, 4.22, modified – The first occurrence of the words “semi-major” have been expanded to “semi-major axis”.]

4.1.18

geodetic coordinate reference system

coordinate reference system (4.1.7) based on a *geodetic datum* (4.1.19)

[SOURCE: ISO 19111:2007, 4.23]

4.1.19

geodetic datum

datum (4.1.11) describing the relationship of a two- or three-dimensional *coordinate system* (4.1.8) to the Earth

ITL STANDARD PREVIEW
(standards.iteh.ai)

[SOURCE: ISO 19111:2007, 4.24]

4.1.20

geodetic latitude

ellipsoidal latitude

φ

angle from the equatorial plane to the perpendicular to the *ellipsoid* (4.1.12) through a given point, northwards treated as positive

[SOURCE: ISO 19111:2007, 4.25]

SIST ISO 19162:2017

<https://standards.iteh.ai/catalog/standards/sist/b86ad3fb-320b-43f8-a2c3-e4709d971fb/sist-iso-19162-2017>

4.1.21

geodetic longitude

ellipsoidal longitude

λ

angle from the *prime meridian* (4.1.30) plane to the meridian plane of a given point, eastward treated as positive

[SOURCE: ISO 19111:2007, 4.26]

4.1.22

image coordinate reference system

coordinate reference system (4.1.7) based on an *image datum* (4.1.23)

[SOURCE: ISO 19111:2007, 4.30]

4.1.23

image datum

engineering datum (4.1.16) which defines the relationship of a *coordinate system* (4.1.8) to an image

[SOURCE: ISO 19111:2007, 4.31]