SIST

# SLOVENSKI STANDARD
# SIST EN ISO 19111:2008

**01-junij-2008**

**Nadomeǧļ a:**

**SIST EN ISO 19111:2005**

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**Geografske informacije - Lociranje s koordinatami (ISO 19111:2007)**

Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

Geoinformation - Koordinatenreferenzsysteme (ISO 19111:2007)



Information géographique - Systeme de références spatiales par coordonnées (ISO 19111:2007)



**Ta slovenski standard je istoveten z: EN ISO 19111:2007**

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

**SIST EN ISO 19111:2008** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN ISO 19111

July 2007

ICS 35.240.70

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English Version

## Geographic information - Spatial referencing by coordinates (ISO 19111:2007)

Information géographique - Système de références spatiales par coordonnées (ISO 19111:2007)

Geoinformation - Raumbezug durch Koordinaten (ISO 19111:2007)

This European Standard was approved by CEN on 30 June 2007.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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# Foreword

This document (EN ISO 19111:2007) has been prepared by Technical Committee ISO/TC 211 "Geographic information/Geomatics" in collaboration with Technical Committee CEN/TC 287 "Geographic Information", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2008, and conflicting national standards shall be withdrawn at the latest by January 2008.

This document supersedes EN ISO 19111:2005.

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## Endorsement notice

The text of ISO 19111:2007 has been approved by CEN as EN ISO 19111:2007 without any modifications.

# INTERNATIONAL STANDARD

# ISO 19111

Second edition
2007-07-01

## Geographic information — Spatial referencing by coordinates

*Information géographique — Système de références spatiales par coordonnées*



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# 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19111 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*, in close collaboration with the Open Geospatial Consortium (OGC).

This second edition cancels and replaces the first edition (ISO 19111:2003), which has been technically revised.



 

## Introduction

Geographic information contains spatial references which relate the features represented in the data to positions in the real world. Spatial references fall into two categories:

— those using coordinates;

— those based on geographic identifiers.

Spatial referencing by geographic identifiers is defined in ISO 19112 [4]. This International Standard describes the data elements, relationships and associated metadata required for spatial referencing by coordinates. It describes the elements that are necessary to fully define various types of coordinate systems and coordinate reference systems applicable to geographic information. The subset of elements required is partially dependent upon the type of coordinates. This International Standard also includes optional fields to allow for the inclusion of non-essential coordinate reference system information. The elements are intended to be both machine and human readable.

The traditional separation of horizontal and vertical position has resulted in coordinate reference systems that are horizontal (2D) and vertical (1D) in nature, as opposed to truly three-dimensional. It is established practice to define a three-dimensional position by combining the horizontal coordinates of a point with a height or depth from a different coordinate reference system. In this International Standard, this concept is defined as a compound coordinate reference system.



The concept of coordinates can be expanded from a strictly spatial context to include time. ISO 19108 describes temporal schema. Time can be added as a temporal coordinate reference system within a compound coordinate reference system. It is even possible to add two time-coordinates, provided the two coordinates describe different independent quantities.



EXAMPLE An example is the time/space position of a subsurface point of which the vertical coordinate is expressed as the two-way travel time of a sound signal in milliseconds, as is common in seismic imaging. A second time-coordinate indicates the time of observation, usually expressed in whole years.

Certain scientific communities use three-dimensional systems where horizontal position is combined with a non-spatial parameter. In these communities, the parameter is considered to be a third, vertical axis. The parameter, although varying monotonically with elevation or depth, does not necessarily vary in a simple manner; thus, conversion from the parameter to height or depth is non-trivial. The parameters concerned are normally absolute measurements and the datum is taken with reference to a direct physical measurement of the parameter. These non-spatial parameters are beyond the scope of this International Standard. However, the modelling constructs described within this International Standard can be applied through a profile specific to a community.

In addition to describing a coordinate reference system, this International Standard provides for the description of a coordinate transformation or a coordinate conversion between two different coordinate reference systems. With such information, spatial data referred to different coordinate reference systems can be related to one specified coordinate reference system. This facilitates spatial data integration. Alternatively, an audit trail of coordinate reference system manipulations can be maintained.

# Geographic information — Spatial referencing by coordinates

## 1 Scope

This International Standard defines the conceptual schema for the description of spatial referencing by coordinates, optionally extended to spatio-temporal referencing. It describes the minimum data required to define one-, two- and three-dimensional spatial coordinate reference systems with an extension to merged spatial-temporal reference systems. It allows additional descriptive information to be provided. It also describes the information required to change coordinates from one coordinate reference system to another.

In this International Standard, a coordinate reference system does not change with time. For coordinate reference systems defined on moving platforms such as cars, ships, aircraft and spacecraft, the transformation to an Earth-fixed coordinate reference system can include a time element.

This International Standard is applicable to producers and users of geographic information. Although it is applicable to digital geographic data, its principles can be extended to many other forms of geographic data such as maps, charts and text documents.



The schema described can be applied to the combination of horizontal position with a third non-spatial parameter which varies monotonically with height or depth. This extension to non-spatial data is beyond the scope of this International Standard but can be implemented through profiles.



## 2 Conformance requirements

This International Standard defines two classes of conformance, Class A for conformance of coordinate reference systems and Class B for coordinate operations between two coordinate reference systems. Any coordinate reference system claiming conformance to this International Standard shall satisfy the requirements given in A.1. Any coordinate operation claiming conformance to this International Standard shall satisfy the requirements given in A.2.

## 3 Normative references

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

ISO/TS 19103, *Geographic information — Conceptual schema language*

ISO 19108, *Geographic information — Temporal schema*

ISO 19115, *Geographic information — Metadata*

Normative reference to ISO 19115 is restricted as follows. In this International Standard, normative reference to ISO 19115 excludes the MD_CRS class and its component classes. ISO 19115 class MD_CRS and its component classes specify descriptions of coordinate reference systems elements. These elements are modelled in this International Standard.

NOTE The MD_CRS class and its component classes were deleted from ISO 19115:2003 through Technical Corrigendum 1:2006.

## 4 Terms and definitions

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

**4.1**
**affine coordinate system**
**coordinate system** in Euclidean space with straight axes that are not necessarily mutually perpendicular

**4.2**
**Cartesian coordinate system**
**coordinate system** which gives the position of points relative to $n$ mutually perpendicular axes

NOTE $n$ is 2 or 3 for the purposes of this International Standard.

**4.3**
**compound coordinate reference system**
**coordinate reference system** using at least two independent **coordinate reference systems**

NOTE Coordinate reference systems are independent of each other if coordinate values in one cannot be converted or transformed into coordinate values in the other.

**4.4**
**concatenated operation**
**coordinate operation** consisting of sequential application of multiple **coordinate operations**

**4.5**
**coordinate**
one of a **sequence** of $n$ numbers designating the position of a point in $n$-dimensional space



NOTE In a coordinate reference system, the coordinate numbers are qualified by units.



**4.6**
**coordinate conversion**
**coordinate operation** in which both **coordinate reference systems** are based on the same **datum**

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 meters.

NOTE A coordinate conversion uses parameters which have specified values that are not determined empirically.

**4.7**
**coordinate operation**
change of **coordinates**, based on a one-to-one relationship, from one **coordinate reference system** to another

NOTE Supertype of coordinate transformation and coordinate conversion.

**4.8**
**coordinate reference system**
**coordinate system** that is related to an object by a **datum**

NOTE For geodetic and vertical datums, the object will be the Earth.

**4.9**
**coordinate set**
collection of **coordinate tuples** related to the same **coordinate reference system**

 

**4.10**
**coordinate system**
set of mathematical rules for specifying how **coordinates** are to be assigned to points

**4.11**
**coordinate transformation**
**coordinate operation** in which the two **coordinate reference systems** are based on different **datums**

NOTE A coordinate transformation uses parameters which are derived empirically by a set of points with known coordinates in both coordinate reference systems.

**4.12**
**coordinate tuple**
**tuple** composed of a **sequence** of **coordinates**

NOTE The number of coordinates in the coordinate tuple equals the dimension of the coordinate system; the order of coordinates in the coordinate tuple is identical to the order of the axes of the coordinate system.

**4.13**
**cylindrical coordinate system**
three-dimensional **coordinate system** with two distance and one angular **coordinates**

**4.14**
**datum**
parameter or set of parameters that define the position of the origin, the scale, and the orientation of a **coordinate system**



**4.15**
**depth**
distance of a point from a chosen reference surface measured downward along a line perpendicular to that surface



NOTE A depth above the reference surface will have a negative value.

**4.16**
**easting**
*E*
distance in a **coordinate system**, eastwards (positive) or westwards (negative) from a north-south reference line

**4.17**
**ellipsoid**
surface formed by the rotation of an ellipse about a main axis

NOTE In this International Standard, ellipsoids are always oblate, meaning that the axis of rotation is always the minor axis.

**4.18**
**ellipsoidal coordinate system**
geodetic coordinate system
**coordinate system** in which position is specified by **geodetic latitude**, **geodetic longitude** and (in the three-dimensional case) **ellipsoidal height**

**4.19**
**ellipsoidal height**
geodetic height
*h*
distance of a point from the **ellipsoid** measured along the perpendicular from the **ellipsoid** to this point, positive if upwards or outside of the **ellipsoid**

NOTE Only used as part of a three-dimensional ellipsoidal coordinate system and never on its own.

**4.20**
**engineering coordinate reference system**
**coordinate reference system** based on an engineering datum

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

**4.21**
**engineering datum**
local datum
**datum** describing the relationship of a **coordinate system** to a local reference

NOTE Engineering datum excludes both geodetic and vertical datums.

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

**4.22**
**flattening**
$f$
ratio of the difference between the **semi-major** ($a$) and **semi-minor axis** ($b$) of an **ellipsoid** to the **semi-major axis**; $f = (a - b)/a$

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

**4.23**
**geodetic coordinate reference system**
**coordinate reference system** based on a geodetic datum



**4.24**
**geodetic datum**
**datum** describing the relationship of a two- or three-dimensional **coordinate system** to the Earth



**4.25**
**geodetic latitude**
ellipsoidal latitude
$\varphi$
angle from the equatorial plane to the perpendicular to the **ellipsoid** through a given point, northwards treated as positive

**4.26**
**geodetic longitude**
ellipsoidal longitude
$\lambda$
angle from the **prime meridian** plane to the **meridian** plane of a given point, eastward treated as positive

**4.27**
**geoid**
equipotential surface of the Earth's gravity field which is everywhere perpendicular to the direction of gravity and which best fits **mean sea level** either locally or globally

**4.28**
**gravity-related height**
$H$
**height** dependent on the Earth's gravity field

NOTE This refers to in particular orthometric height or normal height, which are both approximations of the distance of a point above the mean sea level.

**4.29**
**height**
$h$, $H$
distance of a point from a chosen reference surface measured upward along a line perpendicular to that surface

NOTE A height below the reference surface will have a negative value.

**4.30**
**image coordinate reference system**
**coordinate reference system** based on an image datum

**4.31**
**image datum**
**engineering datum** which defines the relationship of a **coordinate system** to an image

**4.32**
**linear coordinate system**
one-dimensional **coordinate system** in which a linear feature forms the axis

EXAMPLES Distances along a pipeline; depths down a deviated oil well bore.

**4.33**
**map projection**
**coordinate conversion** from an **ellipsoidal coordinate system** to a plane



**4.34**
**mean sea level**
average level of the surface of the sea over all stages of tide and seasonal variations



NOTE Mean sea level in a local context normally means mean sea level for the region calculated from observations at one or more points over a given period of time. Mean sea level in a global context differs from a global **geoid** by not more than 2 m.

**4.35**
**meridian**
intersection of an **ellipsoid** by a plane containing the shortest axis of the **ellipsoid**

NOTE This term is often used for the pole-to-pole arc rather than the complete closed figure.

**4.36**
**northing**
$N$
distance in a **coordinate system**, northwards (positive) or southwards (negative) from an east-west reference line

**4.37**
**polar coordinate system**
two-dimensional **coordinate system** in which position is specified by distance and direction from the origin

NOTE For the three-dimensional case, see **spherical coordinate system (4.44)**.

**4.38**
**prime meridian**
zero meridian
**meridian** from which the longitudes of other **meridians** are quantified