



**International  
Standard**

**ISO 9849**

**Optics and optical instruments —  
Geodetic and surveying instruments  
— Vocabulary**

*Optique et instruments d'optique — Instruments géodésiques et  
d'observation — Vocabulaire*

**Fourth edition  
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CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
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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.

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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 6, *Geodetic and surveying instruments*.

This fourth edition cancels and replaces the third edition (ISO 9849:2017), which has been technically revised.

The main changes are as follows:

- definitions added for GPR, UAV, range camera, pole and marker;
- sub-categories added for GNSS, 3D laser scanner and graduated circle;
- editorial corrections.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document forms one of a series concerning geodetic and surveying instruments. It gives terms and definitions which may be used in the drafting of other International Standards and national standards in this field.

This document defines terms as they are used to describe geodetic and surveying instruments for geodetic work and their essential parts. It is intended for both the surveyor and the non-surveyor. The use of these definitions related to other fields may not be appropriate. Every reader is requested to use only these terms in the future so that, with time, a standard and acceptable terminology will come into common usage.

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# Optics and optical instruments — Geodetic and surveying instruments — Vocabulary

## 1 Scope

This document defines terms relating to geodetic and surveying instruments, such as distance meters, levels, theodolites, GNSS, total stations, laser scanners, airborne sensors and others, and their essential components and accessories which are used in measuring operations, such as land surveying, topographic surveying, construction surveying and engineering geodesy.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1 Types of geodetic instruments and related terms

#### 3.1.1

##### **alignment instrument**

device used to aim at intermediate points and to a reference target at the end of an alignment

Note 1 to entry: The device is usually equipped with a powerful magnifying *telescope* (3.2.38).

#### 3.1.1.1

##### **alignment laser**

*alignment instrument* (3.1.1) using a laser beam as reference line or reference plane instead of an optical line of sight

#### 3.1.1.1.1

##### **point laser**

##### **plumb laser**

##### **pipe laser**

*alignment laser* (3.1.1.1) which projects a single point on a surface using a reference line of a laser beam

#### 3.1.1.1.2

##### **line laser**

##### **laser marker**

##### **cone laser**

##### **cross-line laser**

*alignment laser* (3.1.1.1) which projects one or more lines or planes on a surface using a reference plane of a laser beam with a certain opening angle

Note 1 to entry: Instrument can be used for marking horizontal or vertical surfaces by a visible laser.

Note 2 to entry: A specific type of line laser for planar coverage is for example a *rotating laser* (3.1.16).

### 3.1.2

#### **barometer**

instrument for measuring atmospheric pressure

Note 1 to entry: Barometers can be used for the atmospheric reduction of electronically measured distances or as *barometric altimeters* (3.1.2.2).

#### 3.1.2.1

##### **aneroid barometer**

*barometer* (3.1.2) in which atmospheric pressure is balanced by some elastic elements as a method that does not involve liquid

#### 3.1.2.2

##### **barometric altimeter**

*barometer* (3.1.2) used for elevation measurement, in which case a read out is provided in metres

#### 3.1.2.3

##### **mercury barometer**

*barometer* (3.1.2) in which atmospheric pressure is balanced by the mass of a column of mercury

#### 3.1.2.4

##### **electronic barometer**

instrument for measuring atmospheric pressure by conversion of physical observation to electrical signals

### 3.1.3

#### **electro-optical distance meter**

#### **electronic distance meter**

#### **EDM**

instrument for measuring distances between the instrument and a reflective target, using various electro-optical techniques, visible light or infrared radiation as carrier waves

Note 1 to entry: The target can be a *reflector* (3.1.15) or any other surface.

Note 2 to entry: See also *total station* (3.1.20), *hand-held laser distance meter* (3.1.7), *terrestrial laser scanner* (3.1.8.1) and *laser tracker* (3.1.9).

#### 3.1.3.1

##### **phase shift distance meter**

*electro-optical distance meter* (3.1.3) which is based on the phase comparison of two modulation signals, one is the reference signal, the other the return signal from the reflective target

Note 1 to entry: The phase difference can be detected by various methods and is used to calculate the distance.

#### 3.1.3.2

##### **pulsed distance meter**

##### **time of flight distance meter**

*electro-optical distance meter* (3.1.3) which is based on measuring the time of flight between transmission and reception of the same pulse

### 3.1.4

#### **field controller**

#### **tablet**

#### **data collector**

device that controls a surveying instrument, such as *total station* (3.1.20), *GNSS receiver* (3.1.5.1), *3D laser scanner* (3.1.8) or *digital level* (3.1.10.2), by using on-board applications, recalls surveying data or other information and records and analyses measurement data of the instruments

**3.1.5****global navigation satellite system****GNSS**

system consisting of several satellites in different orbital planes, which allow absolute navigation solutions as well as high precise (e.g. differential) positioning and broadcasting of time due to the global coverage

Note 1 to entry: GNSS includes all operating global navigation systems by satellite.

EXAMPLE 1 Global positioning system (GPS) or navigational satellite timing and ranging – Global positioning system (NAVSTAR-GPS) – US Department of Defence navigation system based on the constellation of usually more than 24 satellites at an altitude of 20 200 km above earth's surface.

EXAMPLE 2 GLObal'naya NAVigationnaya Sputnikovaya Sistema (GLONASS) – Russia's global navigation satellite system based on the constellation of approximately 24 satellites at an altitude of 19 100 km above earth's surface.

EXAMPLE 3 Galileo – Global navigation satellite system organized by EU and European Space Agency. The system is planned to consist of 30 satellites at an altitude of 23 200 km above earth's surface.

EXAMPLE 4 BeiDou – Navigation satellite system (BDS) organized by China. More than 54 satellites in medium earth orbit (22 000 km above earth's surface) as well as in geosynchronous orbit (35 790 km above earth's surface) are used, where the latter include satellites in both geostationary orbit and in inclined geosynchronous orbit.

EXAMPLE 5 Quasi-Zenith Satellite System (QZSS) – Satellite navigation system operated by Japan. The system complements GPS, especially in the Asia-Pacific region, and consists of a constellation of typically 4 satellites in geostationary orbit as well as highly elliptical, quasi-zenith orbit (32 600 km to 38 950 km above earth's surface).

**3.1.5.1****GNSS receiver**

electronic device that receives and digitally processes the signals from GNSS satellites in order to provide position, velocity and time (of the receiver)

**3.1.5.2****differential GNSS****DGNSS**

processing application within mobile GNSS receivers, using difference techniques of GNSS observations and additional reference point or reference network GNSS observations

Note 1 to entry: In differential GNSS (DGNSS) applications, correction data and additional information from a known reference station are used by mobile rovers, enabling them to improve position accuracy.

**3.1.5.2.1****differential GPS****DGPS**

DGNSS ([3.1.5.2](#)) application using only observations from the GPS (Navstar satellite system) and additional reference point or reference network GPS observations

**3.1.5.2.2****differential BDS****DBDS**

DGNSS ([3.1.5.2](#)) application using only observations from the BDS (BeiDou navigation satellite system) and additional reference point or reference network BDS observations

**3.1.5.3****real-time kinematic****RTK**

real-time processing algorithm technique of mobile GNSS receivers using the carrier phase of GNSS observations for a positioning of the mobile GNSS receiver within a reference network in a low cm-level

Note 1 to entry: In real-time kinematic (RTK) application, measurements of the phase of the signal's carrier wave are used to provide real-time corrections. By a data link from the reference station to the rover station, the corrections are transmitted to enhance the precision of the position up to cm-level.