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Foreword

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

This third edition cancels and replaces the second edition (ISO 9849:2000), which has been technically revised.

Introduction

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

Only terms relating to geodetic and surveying instruments for geodetic work and their essential parts are described in this document. It is intended for both the surveyor and the non-surveyor. 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.

Optics and optical instruments — Geodetic and surveying instruments — Vocabulary

1 Scope

This document defines terms relating to geodetic field instruments only, e.g. distance meters, levels, theodolites and others, and their essential component parts which are normally used in terrestrial measuring operations of ordnance survey, topographic survey, plane survey and engineering survey. Therefore, terms concerning fields such as the following are not mentioned, for example, photogrammetry, astronomy, hydrographic survey and industrial metrology.

Accessories which are not necessary for the functioning of the instruments are not dealt with. The terms are arranged in English alphabetical order.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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

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 meters

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) and *laser tracker* (3.1.9).

3.1.3.1
phase shift distance meter

electronic distance meter which is based on the 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 which is based on measuring the time of flight between transmission and reception of the same pulse

3.1.4
field-controller
device that controls surveying instruments (total station, GNSS receiver, terrestrial laser scanner and digital level) 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 – Satellite Navigation System operated by China. 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 is compatible with GPS.

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 from the 15 m nominal GNSS accuracy to about 10 cm and less.

3.1.5.3
differential GPS
DGPS
DGNSS application using only observations from the GPS (Navstar Satellite System) and additional reference point or reference network GPS observations

3.1.5.4
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.

3.1.6
gravimeter
gravity meter
gravity instrument
instrument for measuring the absolute gravity or the differences in the value of gravity

3.1.7
hand-held laser distance meter
electro-optical distance meter (3.1.3) which is used and held usually with the hands

Note 1 to entry: Usually, reflectorless EDM techniques are used.

3.1.8
terrestrial laser scanner
TLS
ground-based instrument using a scanning technology by a laser beam to produce detailed 3D data including intensity of complex structures and objects and geometries

3.1.9
laser tracker
portable coordinate measuring instrument based on laser interferometry techniques that enables to get high accuracy 3D data in real time by tracking a *reflector* (3.1.15) or *corner cube* (3.1.15.1)

3.1.10
level
instrument for measuring differences in height by establishing horizontal lines of sight, comprising as main components a *telescope* (3.2.38) which can be rotated on a *vertical axis* (3.2.44) and a facility for levelling the line of sight

Note 1 to entry: It can be additionally fitted with a horizontal *circle* (3.2.7) and/or a *parallel plate micrometer* (3.2.23). The reticule has sometimes stadia hairs for optical distance measurement.

Note 2 to entry: See also *spirit level* (3.2.16) and *tachymeter* (3.1.17).

3.1.10.1
automatic level
compensator level
self-levelling level
pendulum level
level which makes use of a *tilt compensator* (3.2.39) that ensures that the line of sight is horizontal once the operator has roughly levelled the instrument

3.1.10.2
digital level
level which electronically reads a sequence of code patterns on the *levelling staff* (3.1.11) by an image sensor

Note 1 to entry: These instruments usually include data recording capability. The automation removes the requirement for the operator to read a scale.

Note 2 to entry: The processing and the display of the results are taken by an integrated computer.

3.1.10.3
electronic level
inclinometer
tiltmeter
instrument which detects inclination or changes of inclination under the influence of gravity by the use of electronic sensors

3.1.10.4
tilting level
manual level
level which provides a tilting screw to establish a levelled line of sight

3.1.11
levelling staff
levelling rod
level rod
straight bar with a scale on a flat face

Note 1 to entry: The levelling staff can be made of, for example, metal, glass fibre or wood.

Note 2 to entry: The levelling staff is used to measure the vertical distance between a base point and the horizontal line of sight of a *level* (3.1.10).

3.1.11.1
digital levelling staff
bar code staff
levelling staff (3.1.11) for levelling with a *digital level* (3.1.10.2) having a specified code patterns on the flat face

3.1.11.2
invar levelling staff
precise levelling rod
invar rod
levelling staff (3.1.11) for precise levelling, having an invar strip with graduation lines or code patterns (bar code)

Note 1 to entry: Invar is a Fe-Ni alloy to ensure a low coefficient thermal expansion ($<10^{-6}$/°C).

3.1.12
optical plummet
instrument or device that realizes a visible line of sight in a vertical zenith or nadir direction

Note 1 to entry: The optical plummet can be levelled by liquid horizon, tubular levels or compensators.

Note 2 to entry: An optical plummet can also be a part of a geodetic instrument.

Note 3 to entry: It can be used for placing a mark on the ground or centring an instrument over a mark on the ground (nadir plummet) as well as for centring an instrument under a point (zenith plummet).

3.1.12.1
laser plummet
optical plummet (3.1.12) which uses a laser beam as a visual plumb line

3.1.12.2
optical precise plummet
optical plummet (3.1.12) comprising a telescope with high magnification and precise devices (e.g. bubbles, compensator) to precisely realize the vertical line of sight

3.1.13
optical square
pentaprism
device equipped with pentagonal prism for determination of orthogonal lines of sight

3.1.14
plane table
device used in surveying and related disciplines to provide a solid and level surface on which to make field drawings, charts and maps

Note 1 to entry: As a sighting instrument, usually, an alidade is used on the plane table.

Note 2 to entry: See also 3.2.27 for a description for a plane table as a part.

3.1.15
reflector
device at the target which reflects the light beam to an *electro-optical distance meter* (3.1.3) or to a tracker system

Note 1 to entry: These devices are, for example, glass prism reflectors, corner cube reflectors, acrylic reflectors, reflecting sheets.

Note 2 to entry: Reflectors are usually provided on a pole having a centring device. A 360° reflector device has multiple glass prisms which are measurable from any horizontal direction.

3.1.15.1
retroreflector
corner cube
device that reflects light back to the light source exactly along the same light direction

Note 1 to entry: These devices are, for example, glass prism reflectors, corner cube reflectors.

