International Standard

ISO 17123-11

First edition
2025-07

Optics and optical instruments — Field procedures for testing geodetic and surveying instruments —

Part 11: GNSS instruments

Optique et instruments d'optique — Méthodes d'essai sur site des instruments géodésiques et d'observation —

Partie 11: Instruments GNSS

Reference number
ISO 17123-11:2025(en)

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Published in Switzerland

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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).

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

A list of all parts in the ISO 17123 series can be found on the ISO website.

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.

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Introduction

The ISO 17123 series specifies field procedures for adoption when determining and evaluating the uncertainty of measurement results obtained by geodetic instruments and their ancillary equipment, when used in building and surveying measuring tasks. Primarily, these tests are intended to be field verifications of suitability of a particular instrument for the immediate task. They are not proposed as tests for acceptance or performance evaluations that are more comprehensive in nature.

These field procedures have been developed specifically for in situ applications without the need for special ancillary equipment and are purposely designed to minimize atmospheric influences.

ISO 17123-8[1] provides a standard which exclusively covers Global Navigation Satellite System (GNSS) test procedures for real-time kinematic applications. Since the creation of ISO 17123-8[1], GNSS-based geodetic measurement and instrumentation techniques have evolved in many ways:

— in addition to the classical real-time kinematic measurement procedures on which ISO 17123-8[1] is based, other GNSS-based geodetic measurement procedures have become established;

— complementary to classical base-rover measurement arrangements and the instrument morphology by means of separation of antenna and receiver, which was widely used at the time, versatile integrated measurement instrument types are currently available;

— correction data services play an essential role in the analysis.

This document therefore has the following objectives:

— provision of GNSS field test procedures to achieve the highest possible reliability in the use of GNSS-based geodetic measurement techniques;

— far-reaching consideration of technological advancements both in instrument technology and morphology as well as in data streams;

— extensive independence from the accuracy class of the measuring equipment;

— consideration of the measuring equipment as a complete system;

— qualitative and quantitative multistage nature of the field test procedure in order to be able to meet different requirement profiles;

— inclusion of the user's expertise.

The implementation of these objectives is limited by the following framework conditions:

— a GNSS measuring instrument is not a measuring device in the narrower sense that can be tested independently of external infrastructure on its own as well as without target specifications. Instead, GNSS measuring instruments are subcomponents of an overall system;

— GNSS measuring instruments are perceived as black box systems. A large group of these systems is designed by the manufacturer in such a way that no, or only little, influence can be exerted on important instrument parameters;

— another group of GNSS measuring instruments follows an open-box strategy and allows a large number of parameter settings in the positioning algorithm, the changes of which have a direct influence on the determined position;

— GNSS-based measurement techniques are always based on an estimation algorithm, the result of which depends on a very large number of possible influencing factors;

— the quality of satellite geodetic measurements and the positional accuracies that can be achieved with them depend directly on the measurement conditions on site;

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— a metrologically correct, and at the same time, procedurally simple consideration of a multitude of the possible influencing factors on the achievable measurement accuracy is not possible according to the current state of the art, in contrast to other geodetic instruments and measurement principles.

The field test procedure presented in this document therefore focuses on the visualization of a three-dimensional coordinate, inherent to all GNSS measuring instruments, as the primary measurement result value, which is compared to a nominal value. It is a daily performance verification independent of this specific technique. More profound system verification requires the application of more specialized standards such as ISO 17123-8[1], which is not intended for high dynamic applications, e.g. autonomous driving, unmanned aerial vehicle (UAV) applications.

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Optics and optical instruments — Field procedures for testing geodetic and surveying instruments —

Part 11: GNSS instruments

1 Scope

This document specifies a field procedure for the verification that a given Global Navigation Satellite System (GNSS)-based system and measurement procedure meets a required measurement uncertainty at the location and time of interest.

The field procedure uses three-dimensional coordinates which are compared to reference coordinates. It is designed to be applicable to the technically versatile geodetic and surveying GNSS systems on the market and can be used for any kind of GNSS-based applications to determine coordinates. It is independent of the technology used in the GNSS measuring instrument, the satellite data streams, and any correction data used.

The procedure is applicable to GNSS instruments under operating condition in the field in such a way that the main parameters affecting the determination of coordinates are included in the result of the test. This document defines several delimitation criteria, which allows for versatile applicability. As a result, the verification procedure can be regularly performed in the field with limited economic impact.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9849, *Optics and optical instruments — Geodetic and surveying instruments — Vocabulary*

ISO 17123-1, *Optics and optical instruments — Field procedures for testing geodetic and surveying instruments — Part 1: Theory*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9849 and ISO 17123-1 and the following apply.

ISO and IEC maintain terminology 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
coordinate
one of a sequence of numbers designating the position of a point

Note 1 to entry: In a spatial *coordinate* (3.1) reference system, the *coordinate* (3.1) numbers are qualified by units.

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