



DPC: 24/30463844 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 16 August 2024

Origin: International

Latest date for receipt of comments: 09 October 2024

Project No. 2022/02282

Responsible committee: CPW/172 Optics and Photonics

Interested committees:

Title: Draft BS ISO 17123-11 Optics and optical instruments - Field procedures for testing geodetic and surveying instruments.
Part 11: GNSS instruments.

Please notify admin.start@bsigroup.com if you are aware of any keywords that might assist in clarifying or identifying the standard or of the content of this standard:

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 09 October 2024

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

E-mail: admin.start@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 17123-11

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

ICS: 17.180.30

ISO/TC 172/SC 6

Secretariat: **SNV**

Voting begins on:
2024-08-16

Voting terminates on:
2024-11-08

This document is circulated as received from the committee secretariat.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENTS AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

Reference number
ISO/DIS 17123-11:2024(en)

Full document details: 24/30463844 DC

© ISO 2024  **Documents**
Document Sharing Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Foreword.....	v
Introduction	vi
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviations	4
4.1 Symbols.....	4
4.2 Abbreviations	4
5 Delimitation	5
5.1 Reason for delimitation	5
5.2 Qualitative delimitation by measurement uncertainty classes	5
5.3 Qualitative delimitation through multistage test procedure.....	5
5.4 Functional delimitation related to <i>GNSS measuring instrument (3.7)</i>	7
5.5 Qualitative delimitation through the test criterion.....	7
5.6 Qualitative delimitation in the consideration of influencing factors.....	8
6 GNSS field test procedure	9
6.1 Prerequisites for all procedure stages	9
6.2 Procedure stage 1: Simplified GNSS field test procedures	11
6.2.1 Objective and scope	11
6.2.2 Test procedure.....	11
6.2.3 Calculation and interpretation	11
6.3 Procedure stage 2: Full test procedure	12
6.3.1 Objective and scope	12
6.3.2 Supplementary requirements for the full test procedure	12
6.3.3 Test procedure.....	13
6.3.4 Calculation.....	14
6.3.5 Interpretation and cause indications.....	14
6.4 Procedure stage 3: Extended test procedure	17
7 Further recommendations in case of exceeding measurement errors	18
Annex A (informative) Procedure stage 3: Extended test procedure — Methodology of a test with isotropy or antenna property tests (example of antenna diagnostics).....	20
Annex B (informative) Examples of test procedures and their results	21
B.1 Example 1 — <i>GNSS measuring equipment (3.6)</i> for position determination in the metre range 21	
B.1.1 Example 1.1.....	21
B.1.2 Example 1.2.....	21
B.2 Example 2 — <i>GNSS measuring equipment (3.6)</i> for position determination in the centimetre range 22	

B.3	Example 3 — GNSS measuring equipment (3.6) for position determination in the centimetre range	23
B.3.1	Example 3.1 — Possible influence of <i>measuring point</i> (3.11) transfer	23
B.3.2	Example 3.2 — GNSS measuring equipment (3.6) for position determination in the centimetre range	24
Annex C (informative)	Establishment of a <i>reference point</i> (3.12) by long-term static GNSS measurement.....	27
Annex D (informative)	Exemplary assignment of applications to the measurement uncertainty classes.....	29

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 (see 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 (see www.iso.org/patents).

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee [or Project 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.

Introduction

The international standards series ISO 17123 “Optics and optical instruments — Field procedures for testing geodetic and surveying instruments” is of great importance in geodesy.

With ISO 17123-8:2015 “GNSS field measurement systems in real-time kinematic (RTK)”, a standard is available, which exclusively covers Global Navigation Satellite System (GNSS) test procedures for real-time kinematic applications. Since the creation of ISO 17123-8:2015, 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 17123-8:2015 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, which are realised, among other things, by various types of control point fields or satellite systems, are not taken into account in ISO 17123-8:2015.

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 to be tested;
- consideration of the measuring equipment to be tested as a complete system, consisting of instrument components, accessories, operating software and applications;
- 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. Rather, *GNSS measuring instruments* are subcomponents of an overall system. Further parts of this overall system are navigation satellites, data transfer technologies and streams, data processing procedures including the algorithms used for position determination as well as optional supplementary components, such as correction service providers with their associated instrumentation and their networking software;
- *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. Shadow and multipath effects are representative of these factors;
- 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 like ISO 17123-8:2015. The standard is not intended for high dynamic applications (e.g. autonomous driving, unmanned aerial vehicle (UAV) applications, etc.).

Identification of patent holders: the following text shall be included if patent rights have been identified.

The International Organization for Standardization (ISO) [and/or] International Electrotechnical Commission (IEC) draw[s] attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO [and/or] IEC take[s] no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO [and/or] IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO [and/or] IEC. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO [and/or] IEC shall not be held responsible for identifying any or all such patent rights.

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

Part 11: GNSS instruments

1 Scope

This part of ISO 17123 series 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. The 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.

The Scope clause is a mandatory element of the text. For rules on the drafting of the Scope, refer to the ISO/IEC Directives, Part 2:2018, Clause 14.

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/IEC GUIDE 98-1:2009, *Uncertainty of measurement - Part 1: Introduction to the expression of uncertainty in measurement*

ISO/IEC GUIDE 98-3:2008, *Uncertainty of measurement -- Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 7078:2020, *Buildings and civil engineering works — Procedures for setting out, measurement and surveying — Vocabulary*

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*

ISO 17123-8:2015, *Optics and optical instruments — Field procedures for testing geodetic and surveying instruments — Part 8: GNSS field measurement systems in real-time kinematic (RTK)*

ISO 19111:2019, *Geographic information — Referencing by coordinates*

ISO 80000-2:2019, *Quantities and units - Part 2: Mathematics*

3 Terms and definitions

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

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.

Note 2 to entry: Coordinate in this document means a three-dimensional measured value in a *coordinate system* (3.2) determined by a measurement.

Note 3 to entry: Without limiting generality, the form of expression of coordinates in this document is by the designation *E* (east), *N* (north), *H* (height).

[SOURCE: ISO 19111:2019, 3.1.5, Notes 2 and 3 to entry have been added]

3.2

coordinate system

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

Note 1 to entry: Coordinate system in this document is the three-dimensional *coordinate system* (3.2) in which the *GNSS measuring instrument* calculates and displays the measured variables.

[SOURCE: ISO 19111:2019, 3.1.11, Note 1 to entry has been added]

3.3

position component

two-dimensional sub-system of the GNSS three-dimensional *coordinate system* (3.2) comprising East and North *coordinate* (3.1)

Note 1 to entry: The GNSS *coordinate* (3.1) orthogonal to the *position component* (3.3) is the Height *coordinate* (3.1).

3.4

height component

one-dimensional sub-system of the GNSS three-dimensional *coordinate system* (3.2) comprising the Height *coordinate* (3.1)

Note 1 to entry: The *height component* (3.4) is the GNSS *coordinate* (3.1) perpendicular to the local GNSS geoid surface.