Basic concepts in metrology
Part 1: General concepts

DIN 1319-1

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Grundlagen der Meßtechnik – Teil 1: Grundbegriffe

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

The DIN 1319 series of standards comprises the following parts:

Part 1 General concepts
Part 2 Terminology relating to the use of measuring instruments
Part 3 Evaluating measurements of a single measurand and expression of uncertainty
Part 4 Evaluating measurements of more than one measurand and expression of uncertainty

Foreword

This standard has been prepared jointly by the *Normenausschuß Einheiten und Formelgrößen* (Quantities and Units Standards Committee) and the *Normenausschuß Qualitätsmanagement, Statistik und Zertifizierungsgrundlagen* (Quality Management, Statistics and Certification Standards Committee), in cooperation with the *VDI/VDE-Gesellschaft Meß-und Automatisierungstechnik (GMA)* (VDI/VDE Society for Metrology and Automation Technology) and the *Deutsche Elektrotechnische Kommission im DIN und VDE* (German Electrotechnical Commission of DIN and VDE).

Users of this standard should take note of the alphabetical index of defined concepts at the end of the standard, as well as the list of symbols given in Annex B.

Contents

1 Scope and field of application

This standard defines general metrological concepts that are universally applicable, regardless of the quantity being measured. For concepts specific to one field, refer to the relevant standard or code of practice.

Continued on pages 2 to 29.

Translation by DIN-Sprachendienst.

In case of doubt, the German-language original should be consulted as the authoritative text.

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2 Concepts

Numbers in parentheses refer to the numbered clause in which the concept is defined. Words in bold are defined concepts listed in the alphabetical index. The German term is given in italics.

No.	Term	Definition	Remarks
1	**Basic concepts**		
1.1	**Measurand** *Meßgröße*	Physical quantity subject to measurement. NOTE 1: (Relevant to German original only.) NOTE 2: **(Measurable) quantity** is a more general term referring to the attribute of a phenomenon, body or substance that can be determined quantitatively. A **particular quantity** is a quantity describing a specific physical characteristic (see examples in Remark 1). NOTE 3: (Relevant to German original only.) NOTE 4: The **value (of a quantity)** is the magnitude of a quantity expressed as the product of a number and the unit of measurement (cf. DIN 1313 and DIN 1301-1).	1. Re NOTE 2: Examples of particular quantities include – the volume of a given body, – the electrical resistance of a copper wire specimen at a given temperature, – the activity concentration (average number of counts, or decay events, over a given time period) of a radioactive sample. When used in a general sense, the term 'measurand' refers to the physical quantity under measurement (e.g. mass, energy, thermodynamic temperature, luminous intensity). 2. The measurand is not always directly measured; it can also be indirectly determined by means of known physical or mathematical relationships between the various quantities under measurement. EXAMPLES: a) The measurand 'electrical resistance' is given by the ratio of the applied potential difference across a conductor to the current flowing through it (Ohm's law). b) The measurand can also be the mean of a series of results measured on the same object using the same measurement procedure. Examples include the mean diameter of a cylindrical workpiece or the mean number of counts measured over a specified time interval for a radioactive specimen. Most measurands in quantum physics are defined as means. 3. Measurands are generally dependent on several physical quantities and they are often time- or locus-dependent. 4. The components of vector quantities and tensor quantities are particular (scalar) quantities in and of themselves.
1.2	**Object of measurement** *Meßobjekt*	The object being measured in order to determine the value of the measurand.	1. Objects of measurement include physical bodies, phenomena or physical states. EXAMPLES: a) For the measurand 'volume of a given body', the object of measurement is a physical body. b) For the measurand 'radiant power of a given amount of electromagnetic radiation', the object of measurement is a phenomenon (i.e. radiation). c) For the measurand 'magnetic flux density', the object of measurement is a magnetic field (i.e. physical state).

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No.	Term	Definition	Remarks
1.3	**True value (of a quantity)** *Wahrer Wert* *(einer Meßgröße)*	Value consistent with the definition of a given particular quantity and that would be obtained by a perfect measurement (cf. [1], [2]). Translator's note. It should be noted that in [1] the terms 'value of a measurand (or quantity)' and 'true value of a measurand (or quantity)' are considered as being equivalent and use of the latter term is avoided.	1. The term 'true value' was originally used in statistical estimation methods. Such methods give an estimate of the result of measurement which is a possible value for the measurand, but not necessarily its true value. 2. The true value cannot be precisely known. Rather, it is an ideal value that is estimated based on previous measurements. Some exceptions are defined values (e.g. the angle of a full circle, the speed of light in a vacuum) and the determinable number of elements in a finite set. 3. A true value can only relate to a completely defined measurand. Since for all practical reasons it is not possible to fully define a measurand, the realized quantity (i.e. measured value) is normally not equivalent to the (idealized) true value. 4. If systematic errors can be ruled out and results are obtained under repeatability conditions, then the expected value is equivalent to the true value.
1.4	**Conventional true value** *Richtiger Wert* *(einer Meßgröße)*	Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose (from [2]). NOTE 1: Sometimes referred to as the **assigned value, best estimate** of the value, **conventional value** or **reference value** (from [2]). NOTE 2: The conventional true value for a material measure is determined by means of calibration and may deviate from the marked value.	1. EXAMPLE: For calibration purposes, it may be agreed that a measured value be specified as the conventional true value. 2. Since the actual difference between the conventional true value and the true value is normally disregarded, the former is determined, wherever possible, using measuring instruments and measurement standards having an error of indication that is smaller than the permissible error by at least a power of ten.
2	**Measurement**		
2.1	**Measurement** *Messung* *(Messen einer Meßgröße)*	Performing certain operations to determine the value of a quantity (measurand). NOTE 1: Measurement involves the evaluation of the measured values so that a complete statement of the results is possible (cf. 3.4 and 3.10). The re-evaluation of results or evaluation of results from a separate observation are not deemed as part of a measurement. NOTE 2: (Relevant to German original only.)	1. Although measurement primarily involves operations of a practical (i.e. experimental) nature, theoretical considerations may also be necessary. 2. A measurement normally serves to determine the value of a measurand as a unit multiplied by a number. However, in some cases the objective of a measurement is to establish whether or not the value of the measurand is larger or smaller than a multiple of that unit. Measurement may be part of an inspection (2.1.4), calibration (4.10), verification or examination (5.13) (see Explanatory notes). 3. The results of a measurement need not be evaluated immediately. Instead, they may be stored for later evaluation, or processed automatically.

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