Infrastructure Commission (INFCOM)

Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT)

Expert Team on Quality, Traceability and Calibration (ET-QTC)

Measurement Terminology

Part-1: Basic and Common Terms

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Content

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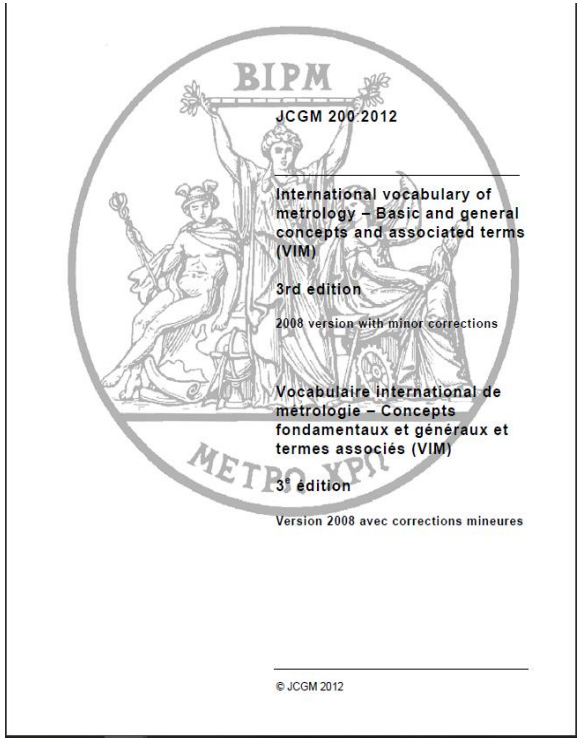
Why adopting a common terminology

- To better communicate within members of the same community
- To compare information among different communities
- To keep correct interpretation of measurement in time and across nations/languages
- For unique interpretation and use of terms
- For a correct link between terms and concepts
- For clear interpretation of recommendations, prescriptions and guides
- To avoid misunderstanding in evaluating measurements results
- To avoid cheating or fraud in tenders and specifications



VIM: The International Vocabulary of Metrology

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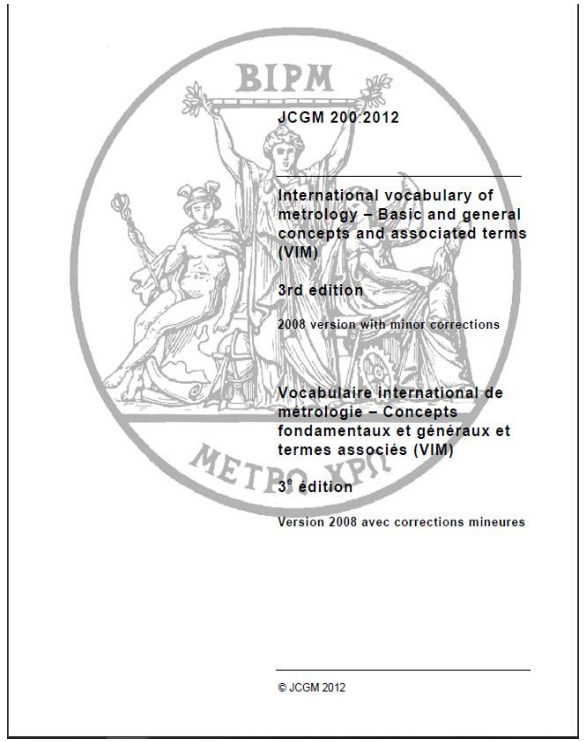
International Vocabulary of Metrology
Basic and General Concepts and Associated Terms

The VIM pertains to metrology, the “science of measurement and its application”. It also covers the basic principles governing quantities and units.»…

…«*this Vocabulary is intended to promote global harmonization of terminology used in metrology*.»…



VIM 3rd edition:
Free download at BIPM website

VIM 4th edition: Coming soon!

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…also to avoid common mistakes

Uncertainty

Parameter, associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand.

Accuracy

It is not a quantitative term. Do not write “Accuracy of 0.1 °C”. To keep correct interpretation of measurement in time and across nations/languages

Precision

The term precision is still ambiguous and leaves large misunderstanding. It is still frequently used to indicate instrumental resolution or sometimes sensibility and even uncertainty. If used in commercial processes (datasheets, tenders) it can also lead to fraude. Avoid the use of precision!

Error

Not to be used instead of “uncertainty”! It is a mistake or a wrong response of instrument which must be corrected.

Some terms

Measurand

Quantity intended to be measured.

Measurement

The process of experimentally obtaining one or more **quantity values** that can *reasonably* be attributed to a **quantity.**

Measurement Result

Set of **quantity values** being attributed to a **measurand** together with any other available relevant information.

Some terms

Measurand

It should be defined with sufficient completeness (see for example the air temperature…)

Measurement

Is the evaluation of an estimated ratio among the measured quantity and a **reference standard**.

Measurement Result

The result of a measurement is only an approximation or estimate of the value of the measurand and thus is complete only when accompanied by a statement of the **uncertainty** of that estimate.

The result of a measurement…

…is expressed using three components

value	uncertainty	unit
20.3	±0.1	°C

t_{air} = (20.3 ± 0.1) °C

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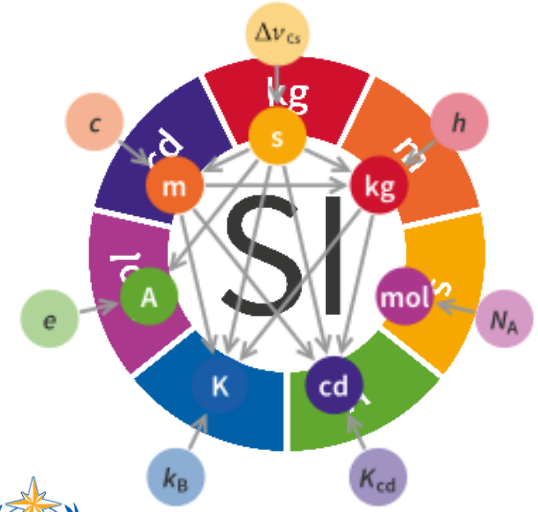
Measurement unit

Real scalar quantity, defined and adopted by convention*, with which any other quantity of the same kind can be compared to express the ratio of the two quantities as a number.

*Measurement units are designated by conventionally assigned names and symbols

System of Units (Système International - SI)

Defines the units, their names and symbols, the rules of use of prefixes



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Base quantity	Base unit	Base unit
Name	Name	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

BASE UNIT

measurement unit that is adopted by convention for a **base quantity**

In each **coherent system of units**, there is only one base unit for each base quantity.
EXAMPLE: In the **SI**, the metre is the base unit of length.

DERIVED UNIT

measurement unit for a **derived quantity**

EXAMPLE: The speed in metre per second, symbol m/s, and the centimetre per second, symbol cm/s, are derived units of speed in the **SI**. Pressure, surfaces, solar radiation….

Quantity

Property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference.

MEASUREMENT STANDARD - Etalon

Realization of the definition of a given **quantity**, with stated **quantity value** and associated **measurement uncertainty**, used as a reference.

NOTE 1: A “realization of the definition of a given quantity” can be provided by a measuring system, a material measure, or a reference material.

NOTE 2: A measurement standard is frequently used as a reference in establishing measured quantity values and associated measurement uncertainties for other quantities of the same kind, thereby establishing **metrological traceability** through calibration of other measurement standards, measuring instruments, or measuring systems.

EXAMPLE: 1 kg mass measurement standard with an associated standard measurement uncertainty of 50 µg.

INTERNATIONAL MEASUREMENT STANDARD

measurement standard recognized by signatories to an **international agreement** and intended to serve worldwide

NATIONAL MEASUREMENT STANDARD

measurement standard recognized by **national authority** to serve in a state or economy as the basis for assigning **quantity values** to other **measurement standards** for the **kind of quantity** concerned

PRIMARY STANDARD

measurement standard established using a **primary reference measurement procedure**, or created as an artifact, chosen by convention

EXAMPLE 4 Triple-point-of-water cell as a primary measurement standard of temperature.

SECONDARY STANDARD

measurement standard established through **calibration** with respect to a **primary measurement standard** for a **quantity** of the same **kind**

NOTE 1: Calibration may be obtained directly between a primary measurement standard and a secondary measurement standard, or involve an intermediate **measuring system** calibrated by the primary measurement standard and assigning a **measurement result** to the secondary measurement standard.

REFERENCE MEASUREMENT STANDARD
Reference standard

measurement standard designated for the **calibration** of other measurement standards for **quantities** of a given **kind** in a given organization or at a given location.

WORKING MEASUREMENT STANDARD
Working standard

measurement standard that is used **routinely to calibrate** or verify measuring instruments or measuring systems.

NOTE 1: A working measurement standard is usually calibrated with respect to a **reference measurement standard**.

TRAVELLING MEASUREMENT STANDARD
Travelling standard

measurement standard, sometimes of special construction, intended for transport between different locations

TRANSFER MEASUREMENT DEVICE
Transfer device

device used as an intermediary to compare **measurement standards**

NOTE: Sometimes, measurement standards are used as transfer devices.

Thank you.

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