Guide 98-1

Guide to the expression of uncertainty in measurement —

Part 1: Introduction

Guide pour l'expression de l'incertitude de mesure —

Partie 1: Introduction

Second edition
2024-02

Reference number
ISO/IEC Guide 98-1:2024(en)

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Published in Switzerland

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This document was prepared by Working Group 1 of the Joint Committee for Guides in Metrology (as JCGM GUM-1:2023) and was adopted by the national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC Guide 98-1:2009), which has been technically revised.

The main changes are as follows:

— the document has been redrafted as an introduction to the revised ISO/IEC Guide 98 series;

— most conceptual and technical aspects have been removed.

A list of all parts in the ISO/IEC Guide 98 series can be found on the ISO and IEC websites.

Given that this document is identical in content to JCGM GUM-1:2023, the decimal symbol is a point on the line.

Annex ZZ has been appended to provide a list of corresponding ISO/IEC Guides and JCGM guidance documents for which equivalents are not given in the text.

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Joint Committee for Guides in Metrology

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Guide pour l'expression de l'incertitude de mesure — Partie 1: Introduction

JCGM GUM-1:2023

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Foreword

In 1997 a Joint Committee for Guides in Metrology (JCGM), chaired by the Director of the Bureau International des Poids et Mesures (BIPM), was created by the seven international organizations that had originally in 1993 prepared the 'Guide to the expression of uncertainty in measurement' and the 'International vocabulary of basic and general terms in metrology'. The JCGM assumed responsibility for these two documents from the Technical Advisory Group 4 of the International Organization for Standardization (ISO/TAG4).

The Joint Committee is formed by the BIPM with the International Electrotechnical Commission (IEC), the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC), the International Laboratory Accreditation Cooperation (ILAC), the International Organization for Standardization (ISO), the International Union of Pure and Applied Chemistry (IUPAC), the International Union of Pure and Applied Physics (IUPAP) and the International Organization of Legal Metrology (OIML).

JCGM has two Working Groups. Working Group 1, 'Expression of uncertainty in measurement', has the task to promote the use of the 'Guide to the expression of uncertainty in measurement' and to prepare documents for its broad application. Working Group 2, 'Working Group on International vocabulary of basic and general terms in metrology', has the task to revise and promote the use of the 'International vocabulary of basic and general terms in metrology' (the 'VIM').

In 2008 the JCGM made available a slightly revised version (mainly correcting minor errors) of the 'Guide to the expression of uncertainty in measurement', labelling the document 'JCGM 100:2008'.

In 2017 the JCGM rebranded the documents in its portfolio that have been produced by Working Group 1 or are to be developed by that Group. The whole suite of documents is now known as the 'Guide to the expression of uncertainty in measurement' or 'GUM', and is concerned with the evaluation and expression of measurement uncertainty, as well as its application in science, trade, health, safety and other societal activities.

This part of the suite introduces the processes involved and the subsequent parts in this suite giving specific guidance on these processes. This document replaces JCGM 104:2009.

This document has been prepared by Working Group 1 of the JCGM, and has benefited from detailed reviews undertaken by member organizations of the JCGM and National Metrology Institutes.

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Guide to the expression of uncertainty in measurement — Part 1: Introduction

1 Scope

The 'Guide to the expression of uncertainty in measurement' (GUM) establishes general rules for evaluating and expressing uncertainty in measurement from the shop floor to fundamental research. Therefore, the principles of this suite of documents are intended to be applicable to a broad spectrum of measurements and their applications. An overview of the parts of the GUM is given in table A.1 in Annex A.

NOTE Where the acronym GUM is used in this document, it refers to the suite of documents. An individual part of the GUM is referred to by its corresponding JCGM numbering (e.g., part 6 of the GUM is JCGM GUM-6:2020).

This document gives a rationale for evaluating, expressing and using measurement uncertainty (Clause 2). A brief introduction is given to measurement (Clause 3) and to the decisions involved when evaluating measurement uncertainty (Clause 4). In Clause 5, a brief description of the contents of the parts of the GUM is given. In each of these clauses, the relevant parts of the GUM are identified for further guidance.

2 Rationale

2.1 Measurement [12, Definition 2.1] is one of the most common processes in human activity. Measured values of quantities [12, Definition 2.10] are required for a diverse range of applications and, for each of these values, a statement is needed about its credibility. Such a statement is usually expressed in terms of measurement uncertainty [12, Definition 2.26]. The two components, the measured value and the associated uncertainty, together constitute the most common way of reporting a measurement result [12, Definition 2.9]. In cases where values for more than one quantity are provided by the measurement, a more elaborate statement of the uncertainty is often required (Clause 5.5; see also Clause 3.1).

2.2 Measurements are performed in many branches of society for widely different purposes. Many measurements performed on a daily basis, often in automated processes, concern trade and commerce. Reliable measurement results are also needed for making informed decisions in for example health, safety, weather forecasts, law enforcement and science. Measurements are performed by for example greengrocers, technicians, engineers, laboratory staff, health care professionals, scientists and individuals at home, in very different contexts.

2.3 Many measurements are made for the purpose of comparison of results with specifications. Such a comparison can be made for widely different purposes. This activity is generally known as conformity assessment [3, Definition 4.1] [10, Definition 3.3.1]; see also Clause 5.2.

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