

ISO/IEC TS 18661-4

Programming languages, their environments, and system software interfaces — Floating-point extensions for C —

Part 4: Supplementary functions

Langages de programmation, leurs environnements et interfaces du logiciel système — Extensions à virgule flottante pour C —

Partie 4: Fonctions supplémentaires

Second edition
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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology, Subcommittee SC 22, Programming languages, their environments and system software interfaces*.

This second edition cancels and replaces the first edition (ISO/IEC TS 18661-4:2015), which has been technically revised.

The main changes are as follows:

- The specification has been updated to extend ISO/IEC 9899:2024.
- The mathematical functions and constant rounding modes have been removed. These features are now incorporated into ISO/IEC 9899:2024.
- Functions to support the augmented arithmetic operations specified in IEEE 754-2019 have been added.
- New headers have been added, and all extensions to the `<math.h>` header have been removed.

A list of all parts in the ISO 18661 series can be found on the ISO website.

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The IEEE 754-1985 standard for binary floating-point arithmetic was motivated by an expanding diversity in floating-point data representation and arithmetic, which made writing reliable programs, debugging and moving programs between systems exceedingly difficult. Now the great majority of systems provide data formats and arithmetic operations according to IEEE 754. Corresponding versions of IEEE 754 and ISO/IEC 60559 have equivalent content.

Support for IEEE 754-1985 was added in ISO/IEC 9899:1999 (also referred to as C99), and ISO/IEC 9899:2018 is still based on IEEE 754-1985. However, IEEE 754 underwent a major revision in 2008 and a minor revision in 2019, which added several new features.

The purpose of the ISO/IEC 18661 series (first published 2014 through 2016) has been to specify C language support for the new features introduced into IEEE 754 since 1985. Most of the ISO/IEC 18661 series has been incorporated into ISO/IEC 9899:2024 (also referred to as C23 because major work on this revision was completed in 2023), which supports all required and most recommended features in IEEE 754-2019.

To supplement the IEEE 754 support in C23, this document specifies two C headers with functions corresponding to the reduction and augmented arithmetic operations recommended by IEEE 754, but not included in C23.

The reduction operations perform widely used vector computations involving sums and products, including scaled products. These operations are allowed to associate in any order, and to evaluate in any wider format.

The augmented arithmetic operations, added in IEEE 754-2019, are versions of operations commonly called `twoSum` and `twoProduct`. These operations can be used to implement arithmetic with extra precision, for example, for double-double format. In theory, they can also be used to implement efficient reproducible dot products.