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A meta-modelling analysis approach to smart manufacturing reference models

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A META-MODELLING ANALYSIS APPROACH TO SMART MANUFACTURING REFERENCE MODELS

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IEC TR 63319 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation in cooperation with ISO technical committee 184: Automation systems and integration. It is a Technical Report.

It is published as a dual logo standard.

The text of this Technical Report is based on the following documents:

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Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

In this document, meta-model concepts are described in Clause 6 and are identified as **italic*, that is, starting with an asterisk followed by the concept name in italic.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

This corrected version of IEC TR 63319:2025 incorporates the following correction:

– update to points 1 to 9 of the foreword.

INTRODUCTION

The term "manufacturing" refers to a range of human activities, from handicraft to high tech, and is commonly applied to industrial production, in which raw materials and parts are transformed into products on small to large scale by a series of interconnected processes. In today's manufacturing landscape, manufacturing is no longer characterized as a set of serial processes, but instead as a highly complex set of processes interacting on different time scales, coordinated by a set of supervisory processes to dynamically respond to changing conditions in demands, supply, environment, energy, and other human caused or natural disruptive events.

The purpose of smart manufacturing is to accommodate those disruptive events, while supporting the introduction of new technologies and methods in a coordinated manner across a varied set of customers, suppliers and stakeholders at various stages in the value chain.

Both the IEC SMB and ISO TMB recognized the changing dynamics of manufacturing and the potential opportunities and benefits of developing a reference model for smart manufacturing for both the developers and the users of standards.

The objective of Smart Manufacturing Reference Model(s) (SMRMs) is the development of one or more than one unifying reference model of smart manufacturing to harmonize existing reference models for smart manufacturing. Objective details are described in Annex A.

The plan is to deliver the following outputs:

1) TR (Technical Report) A meta-modelling analysis approach to smart manufacturing reference models (this document);
2) IS (International Standard) Unified reference model for smart manufacturing (URMSM). (IEC 63339:2024, "*Unified reference model for smart manufacturing*" was developed concurrently; it was published on 2024-10-10).

A META-MODELLING ANALYSIS APPROACH TO SMART MANUFACTURING REFERENCE MODELS

1 Scope

This document uses a meta-modelling approach to identify commonalities among ten smart manufacturing reference models. Each reference model is placed into the context of the meta-model to facilitate analysis of both common and distinct features. Major smart manufacturing reference model topics are identified, and the reference models compared within each topic.

As part of the meta-modelling approach development, a collection of models differing in extent of abstraction characterizes the evolution of a particular smart manufacturing system from the meta-model through a unifying smart manufacturing reference model and successively less abstract domain models to a model for system implementation.

This document presents a range of issues and challenges for further work to specify a high-level smart manufacturing reference model that unifies the concepts and practices identified using the meta-model approach analysis of the smart manufacturing reference models.

2 Normative references

There are no normative references in this document.