

---

---

**Automation systems and  
integration — Digital twin framework  
for manufacturing —**

**Part 1:  
Overview and general principles**

*Systèmes d'automatisation industrielle et intégration — Cadre  
technique de jumeau numérique dans un contexte de fabrication —*

*Partie 1: Vue d'ensemble et principes généraux*



This document is a preview generated by EUS



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b>	<b>v</b>
<b>Introduction</b>	<b>vi</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms, definitions and abbreviated terms</b>	<b>1</b>
3.1 General terms	1
3.2 Terms related to digital twin for manufacturing	2
3.3 Abbreviated terms	3
<b>4 Overview of digital twin for manufacturing</b>	<b>3</b>
4.1 Concept of the digital twin for manufacturing	3
4.2 Applications of the digital twin for manufacturing	4
4.2.1 Real-time control	4
4.2.2 Off-line analytics	5
4.2.3 Predictive maintenance	5
4.2.4 Health check	5
4.2.5 Engineering design	5
4.2.6 Production control	5
4.2.7 Video surveillance	5
4.3 Benefits of the digital twin for manufacturing	5
4.3.1 In-loop planning and validation	5
4.3.2 Production scheduling assurance	5
4.3.3 Enhanced understanding of manufacturing elements	5
4.3.4 Dynamic risk management	6
4.3.5 Part/assembly traceability	6
4.3.6 Process traceability	6
4.4 Observable manufacturing elements	6
4.4.1 Personnel	6
4.4.2 Equipment	6
4.4.3 Material	6
4.4.4 Process	6
4.4.5 Facility	7
4.4.6 Environment	7
4.4.7 Product	7
4.4.8 Supporting document	7
<b>5 General principles of the digital twin framework for manufacturing</b>	<b>7</b>
5.1 Overview	7
5.2 Limitations and boundaries of the digital twin framework for manufacturing	7
5.3 Requirements of the digital twin for manufacturing	8
5.3.1 Accuracy	8
5.3.2 Communication	8
5.3.3 Data acquisition	8
5.3.4 Data analysis	8
5.3.5 Data integrity	8
5.3.6 Extensibility	8
5.3.7 Granularity	8
5.3.8 Identification	8
5.3.9 Management	8
5.3.10 Product life-cycle	8
5.3.11 Security	9
5.3.12 Simulation	9
5.3.13 Synchronization	9
5.3.14 Viewpoint	9

5.3.15	Hierarchical modelling of digital twin for manufacturing.....	9
5.4	High level outline for framework implementations.....	9
<b>Annex A (informative) Digital twins and the product life-cycle .....</b>		<b>10</b>
<b>Bibliography.....</b>		<b>12</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

A list of all parts in the ISO 23247 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The ISO 23247 series defines a framework to support the creation of digital twins of observable manufacturing elements including personnel, equipment, materials, manufacturing processes, facilities, environment, products, and supporting documents.

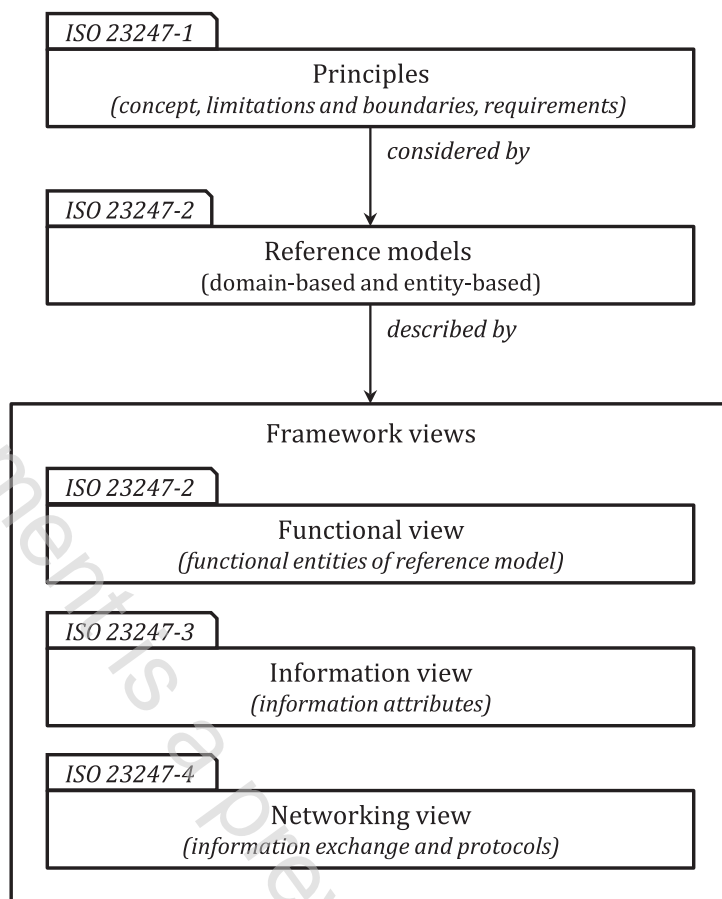
A digital twin assists with detecting anomalies in manufacturing processes to achieve functional objectives such as real-time control, predictive maintenance, in-process adaptation, Big Data analytics, and machine learning. A digital twin monitors its observable manufacturing element by constantly updating relevant operational and environmental data. The visibility into process and execution enabled by a digital twin enhances manufacturing operation and business cooperation.

The type of manufacturing supported by an implementation of the ISO 23247 framework depends on the standards and technologies available to model the observable manufacturing elements. Different manufacturing domains can use different data standards. As a framework, this document does not prescribe specific data formats and communication protocols.

The scopes of the four parts of this series are defined below:

- ISO 23247-1: General principles and requirements for developing digital twins in manufacturing;
- ISO 23247-2: Reference architecture with functional views;
- ISO 23247-3: List of basic information attributes for the observable manufacturing elements;
- ISO 23247-4: Technical requirements for information exchange between entities within the reference architecture.

[Figure 1](#) shows how the four parts of the series are related.



**Figure 1 — ISO 23247 series structure**

ISO 23247-4:2021, Annexes A to E, provide use cases that demonstrate the digital twin framework for manufacturing. The use cases are in the discrete manufacturing domain and the digital twins are modelled using the ISO 10303 series. In other domains, different standards and technologies can be used. For example, in the oil and gas industry, digital twins may be modelled using the ISO 15926 series, and for building and construction, digital twins may be modelled using the ISO 16739 series.





# Automation systems and integration — Digital twin framework for manufacturing —

## Part 1: Overview and general principles

### 1 Scope

This document provides an overview and general principles of a digital twin framework for manufacturing including:

- terms and definitions;
- requirements of the digital twin framework for manufacturing.

### 2 Normative references

There are no normative references in this document.

### 3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1 General terms

##### 3.1.1

##### **control**

purposeful action on or in a process to meet specified objectives

[SOURCE: IEC 60050:2013, 351-42-19, modified — The Notes to entry have been removed.]

##### 3.1.2

##### **element**

basic system part that has the characteristics of state, behaviour, and identification

[SOURCE: ISO 14258:1998, 2.2.4]

##### 3.1.3

##### **enterprise**

one or more organizations sharing a definite mission, goals, and objectives which provides an output such as a product or service

[SOURCE: IEC 62264-1:2013]