

DRAFT INTERNATIONAL STANDARD

ISO/DIS 23247-1

ISO/TC 184/SC 4

Secretariat: ANSI

Voting begins on:
2020-07-27

Voting terminates on:
2020-10-19

Automation systems and integration — Digital Twin framework for manufacturing —

Part 1: Overview and general principles

ICS: 25.040.40; 35.240.50

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/DIS 23247-1](#)

<https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1>

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.



Reference number
ISO/DIS 23247-1:2020(E)

© ISO 2020

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO/DIS 23247-1](https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1)

<https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

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
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
3.1 General terms.....	2
3.2 Digital Twin for manufacturing specific terms.....	3
3.3 Abbreviated terms.....	4
4 Overview of Digital Twin for manufacturing	5
4.1 Concept of the Digital Twin.....	5
4.2 Digital Twin for manufacturing.....	5
4.3 Applications of the Digital Twin for manufacturing.....	6
4.3.1 Real time control.....	6
4.3.2 Off-line analytics.....	6
4.3.3 Predictive maintenance.....	6
4.3.4 Health check.....	6
4.3.5 Engineering design.....	6
4.4 Benefits of the Digital Twin for manufacturing.....	6
4.4.1 In-loop planning and validation.....	6
4.4.2 Production scheduling assurance.....	7
4.4.3 Enhanced understanding of manufacturing elements.....	7
4.4.4 Dynamic risk management.....	7
4.4.5 Part/assembly traceability.....	7
4.4.6 Process traceability.....	7
4.5 Observable manufacturing elements.....	7
4.5.1 Personnel.....	7
4.5.2 Equipment.....	8
4.5.3 Material.....	8
4.5.4 Process.....	8
4.5.5 Facility.....	8
4.5.6 Environment.....	8
4.5.7 Product.....	8
4.5.8 Supporting document.....	8
5 General principles of the Digital Twin framework for manufacturing	8
5.1 Overview.....	8
5.2 Standardization Scope of the Digital Twin framework for manufacturing.....	9
5.2.1 Limitations and boundaries.....	9
5.3 Requirements of the Digital Twin for manufacturing.....	9
5.3.1 General requirements.....	9
5.3.2 Digital Twin modelling requirements.....	10
5.3.3 Information exchange requirements.....	11
5.4 Hierarchical modelling of Digital Twin for manufacturing.....	11
Bibliography	12

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).

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).

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.

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.

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.

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

- Part 1: Overview and general principles

General principles and requirements for developing Digital Twins in manufacturing;

- Part 2: Reference architecture

Reference architecture with functional views;

- Part 3: Digital representation of manufacturing elements

List of basic information attributes for the observable manufacturing elements;

- Part 4: Information exchange

Technical requirements for information exchange between entities within the reference architecture.

The framework is targeted to all types of manufacturing including discrete and continuous manufacturing of parts, assemblies and material. The actual type of manufacturing supported by a particular implementation depends on the standards and technologies available to model the observable manufacturing elements.

Digital Twin use cases that conform to the framework will be detailed in a series of technical reports attached to this series. Preliminary outlines for three use cases are given in the Annex of Part 4.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/DIS 23247-1](https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1)

<https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1>

Automation systems and integration — Digital Twin framework for manufacturing —

Part 1: Overview and general principles

1 Scope

This part of ISO 23247 provides an overview and general principles of a Digital Twin for manufacturing.

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

The following are within the scope of this part of ISO 23247:

- scope statement for ISO 23247 as a whole;
- terms and definitions used throughout ISO 23247;
- overview and requirements of the Digital Twin framework for manufacturing.

The following are described in other parts of ISO 23247:

- reference architecture (Part 2); [ISO/DIS 23247-1](https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-c6a33248e130/iso-23247-1)
- digital representation of manufacturing elements (Part 3);
- information exchange requirements for Digital Twins (Part 4).

The following are outside the scope of ISO 23247, but will be identified as use cases in technical reports;

- selection of the manufacturing devices and other resources to be represented by Digital Twins;
- selection of the manufacturing processes to be represented by Digital Twins;
- selection of the manufacturing products to be represented by Digital Twins.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

3.1 General terms

3.1.1

actuator

device that provides a physical output in response to an input signal in a predetermined way

[SOURCE: ISO/IEC 29182-2]

3.1.2

control

purposeful action on or in a process to meet specified objectives

[SOURCE: IEV 351-42-19]

3.1.3

element

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

[SOURCE: ISO 14258:1998, 2.2.4]

3.1.4

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]

3.1.5

entity

thing (physical or non-physical) having a distinct existence

[SOURCE: ISO/IEC 15459-3:2014, 3.1]

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/DIS 23247-1](https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1)

<https://standards.iteh.ai/catalog/standards/sist/7df6fef2-6487-43da-9a48-eaba332a9ffc/iso-dis-23247-1>

3.1.6

Internet of Things

IoT

infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical and virtual world

[SOURCE: ISO/IEC 20924:2018]

3.1.7

management

direction, control, and coordination of work performed to develop a product or perform a service

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3064]

3.1.8

physical element

thing that has material existence in physical world

3.1.9

resource

any device, tool, and means, except raw material and final product components, at the disposal of the enterprise to produce goods or services

Note 1 to entry: Resources, as they are defined here, include human resources.

[SOURCE: ISO 15531-1:2004, 3.6.43. Note 1 has been modified. Note 2 has been deleted.]

3.1.10**sensor**

device that observes and measures a physical property of a natural phenomenon or man-made process and converts that measurement into a signal

[SOURCE: ISO/IEC 29182-2. Note 1 to entry has been deleted.]

3.1.11**task**

activities required to achieve a goal

Note 1 to entry: These activities can be physical and/or cognitive.

[SOURCE: ISO 9241-11:1998, 3.9]

3.2 Digital Twin for manufacturing specific terms**3.2.1****digital representation**

<manufacturing> data element representing a set of properties of an observable manufacturing element

[SOURCE: IIC:PUB:G8V2.1:PB:20180822, modified, physical element has been replaced to observable manufacturing element]

3.2.2**Digital Twin**

<manufacturing> fit for purpose digital representation of an observable manufacturing element with a means to enable convergence between the element and its digital representation at an appropriate rate of synchronisation

3.2.3**Digital Twin modelling**

procedure of creating a Digital Twin of an observable manufacturing element

3.2.4**manufacturing process**

structured set of activities or operations performed upon material to convert it from the raw material or a semi-finished state to a state of further completion

Note 1 to entry: Manufacturing processes may be arranged in process layout, product layout, cellular layout or fixed position layout. Manufacturing processes may be planned to support make-to-stock, make-to-order, assemble-to-order, etc., based on strategic use and placements of inventories.

[SOURCE: ISO 15531-1:2004, 3.6.25]

3.2.5**observable manufacturing element**

item that has an observable physical presence or operation in manufacturing.

Note 1 to entry: Observable manufacturing elements include personnel, equipment, material, process, facility, environment, product, and supporting document.

3.2.6**presentation**

manner in which information is displayed for use by a human

Note 1 to entry: Information can be presented audibly and visually.

[SOURCE: ASME Y14.47-2019, Note 1 to entry has been modified.]