ISO/~~CD TR~~ **DTS** 23164~~:2023(E)~~

ISO/TC 184/SC 4~~/AG 3~~

Date: ~~2023-06-14~~2024-07-19

Automation systems and integration — Core ~~terminology~~**vocabulary** for industrial data

-

-

-

CD stage

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/DTS 23164
https://standards.iteh.ai/catalog/standards/iso/0709bfb9-405f-4eca-a425-b8f55e25ffd5/iso-dts-23164

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/DTS 23164
https://standards.iteh.ai/catalog/standards/iso/0709bfb9-405f-4eca-a425-b8f55e25ffd5/iso-dts-23164

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~~www.iso.org/directives).

~~Attention is drawn~~ISO draws attention to the possibility that ~~some of~~ the ~~elements~~implementation of this document may ~~be~~involve the ~~subject~~use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights~~.~~ in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. 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~~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*.

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~~www.iso.org/members.html.

Introduction

The ~~core terminology for industrial data~~the terms and definitions in this document are ~~equally~~ applicable to all ISO/TC 184/SC 4 standards. Depending upon the standard, these terms can be implemented as classes, relationships, properties or other types of model or ontology element. The core terms can be used in the documentation of the links between the different standardised data models, ontologies and software applications that need to work together to produce a digital twin for an industrial activity. The terms in the set can also help with data integrity by making sure we are talking about the same thing.

~~The core terms~~This document:

— provide a ~~terminology~~vocabulary that is not only understandable by ISO/TC 184/SC 4 experts, but also by domain engineers and by business decision makers;

NOTE 1   Many of the terms and definitions can already exist in the Oxford English Dictionary or in standards, but the definition of an integration layer requires their selection and so even these terms are included.

— enable the development of reference data that are equally applicable to all ISO/TC 184/SC 4 standards;

NOTE 2   Domain experts will produce detailed taxonomies that specialise generic items identified by terms in the set. The domain experts will not need detailed knowledge of any particular ISO/TC 184/SC 4 standard or of any particular top-level ontology.

— define an interface to reference data developed outside ISO/TC 184/SC 4, and thereby enable its use by all ISO/TC 184/SC 4 standards.

~~The core terminology for industrial data~~NOTE 3   This document is intended to be analogous in the industrial domain to the Dublin Core in the document management domain. The original Dublin Core metadata set consisted of only 15 terms. This initial set has since been expanded to 55 terms. ~~The core terminology for industrial data~~This document is of a similar size.

The role of the ~~core terminology for industrial data~~this document in the development of reference data libraries is shown informally in ~~Figure 1~~Figure 1.
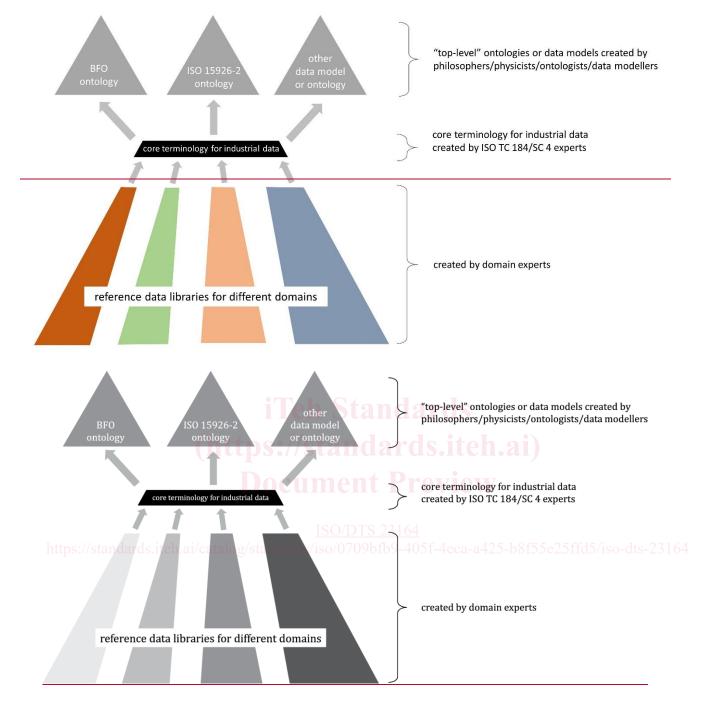
Figure 1 — Role of ~~the core terminology for industrial data~~<u>this document</u> in the development of reference data libraries

~~Comments on Figure 1~~:

A top-level ontology <u>in Figure 1</u> addresses generic issues such as the representation of whole-part relationships, change over time, and the distinction between actual objects, requirements and plans.

At present ~~ISO 10303~~<u>ISO 10303</u> does not contain a top-level ontology. However, the Integrated Resource data models can be regarded as containing an informal top-level ontology. ~~ISO 15926-2:2003~~<u>ISO 15926-2</u> is a top-level ontology.

The reference data libraries for different domains <u>in Figure 1</u> are shown as independent ~~in the figure.~~<u>.</u> In practice there are large overlaps. ~~The core terminology for industrial data will show~~<u>This document shows</u>

which reference data items are specialisations of the same generic item, and therefore ~~will~~ make the overlaps easier to manage.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

ISO/DTS 23164
https://standards.iteh.ai/catalog/standards/iso/0709bfb9-405f-4eca-a425-b8f55e25ffd5/iso-dts-23164

Core terminology for industrial data

1   1Scope

This document specifies a terminology for industrial data that defines generic terms for things that exist in more than one industrial domain.

The approach used to develop the content of this document and to define its scope is described in Annex A "Development methodology".

The guidance on groups of terms and their motivation is contained in Annex B "Guidance on groups of terms".

NOTE 1   The methodology followed in the development of ~~the terminology~~this document has been:

a)   define a thing about which industrial data is held using natural language;

b)   assign a preferred term consisting of one or more English language words to the thing.

Because the things and their definitions are primary with terms assigned to them, ~~the terminology could~~this document can also be called a "thesaurus".

NOTE 2   ~~Within the terminology~~In this document the preferred terms are unique. In some cases, ~~alternative~~admitted terms are also given, which are not necessarily unique.

NOTE 3   Where possible the terms are taken from international standards. ~~In such cases, the source is given.~~

NOTE 4   The terms can be used in the text definitions and descriptions of entities and attributes in industrial data models, and of classes and relationships in industrial ontologies. The terms can be used in the text definitions and descriptions of items within industrial data libraries for particular industrial domains.

Automation systems and integration — Core vocabulary for industrial data

1 Scope

This document specifies a vocabulary for industrial data that defines generic terms for things that exist in more than one industrial domain.

The following are within the scope of this document:

— definition of terms for generic types of industrial thing;

EXAMPLE 1   Definitions of the terms "material object", "artefact" and "product" are within the ~~terminology~~vocabulary.

— definition of terms relevant to assemblies, systems and their breakdown structures;

— definition of terms relevant to activities and participation in activities;

— definition of terms relevant to positions and roles in organizations;

— definition of terms relevant to behaviour, capability and function;

— definition of terms relevant to state and condition;

— definition of terms relevant to specifications, designs and plans;

— definition of terms relevant to versions, alternatives and configurations for specifications, designs and plans;

— definition of terms relevant to signals and other carriers of information and to devices that process signals and information;

— definition of terms relevant to physical quantities and properties.

The following are outside the scope of this document:

— definition of terms that are relevant to data themselves, rather than the things that data are about;

EXAMPLE 2   Definitions of the terms "data" and "information" are not within the ~~terminology~~vocabulary.

— definition of terms that are relevant to representations.

EXAMPLE 3   Definitions of the terms "representation" and "model" are not within the ~~terminology~~vocabulary.

2   ~~2~~Normative references

There are no normative references in this document.

3   ~~3~~Terms, definitions and abbreviated terms

3.1   ~~3.1~~   Terms and definitions

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

1

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~~https://www.iso.org/obp

— IEC Electropedia: available at ~~https://www.electropedia.org~~https://www.electropedia.org

~~NOTE In discussion clauses, examples and notes, **bold** font is used to indicate defined terms, and *italic* font is used for terms which can be defined in other terminologies.~~

3.2 ~~3.2 Discussion of~~ Terms related to particular and kind

~~3.2.1~~ 3.2.1 ~~Difference between particular and kind~~

~~Different data modelling and ontological approaches begin in different ways. Some begin with statements about **particular** things, and others begin with **kinds of** thing. Depending upon the approach an unqualified term can refer to a **particular** thing, to a **kind** of thing, or to either.~~

~~Consider the term **component**. Unqualified the term could refer to:~~

~~— a generic **kind** of **component**, such as a *pump*, *motor* or *valve*;~~

~~— a specific **kind** of **component**, such as a "Fred Bloggs and Co. model A-101" *pump*;~~

~~— a **particular component**, such as the *pump* with serial number "15/12345", manufactured by Fred Bloggs and Co. on 13th September 2015.~~

~~Where it is necessary to make it clear that a term refers to a **kind** of thing or to a **particular** thing, then the term can be prefixed by "kind of" or "particular".~~

~~Within the core terminology, an unqualified term refers to a **particular** thing.~~

~~3.2.2~~ 3.2.2 ~~Discussion of kind~~

~~A **kind** of thing can be defined in many ways.~~

~~NOTE 1 ISO/IEC 81346 contains the following text about "type":~~

~~A type is a class of objects having the same set of characteristics. Depending on the number of common characteristics (and whether they are qualitative or quantitative) a type can be from very generic to very specific. For example:~~

~~— Generic object types for example as described in IEC 81346-2 [....].~~

~~— Many kinds of products, for example motors, transformers, contactors or pneumatic cylinders are often designed as a range of sizes (e.g. frame sizes) with common characteristics. [....]~~

~~— Each product variant in a product series with fixed values for voltage, power etc. has normally an identifier [....] which identifies a class of presumably identical products.~~

~~[SOURCE ISO/IEC 81346-1:2009, 4.8]~~

~~Terms related to **kind** of are as follows:~~

~~— **specification**: A **particular** thing can comply with one or more **specifications**. A **specification** can require the following:~~

~~A **specification** can be defined by a customer as a requirement. A **specification** can be defined by a standard, and can be selected by a customer as a requirement. A **specification** can be defined by a supplier.~~

~~— specified values or ranges for the properties of a **particular** thing;~~

— the nature of the production process that created a **particular** thing, which can include specified value or ranges for its properties, and the inspection and testing regime.

— *commercial offering*: A *commercial offering* is an open offer to provide a **product** or **service**. The offer can state a price and perhaps conditions such as location.

A **particular** thing can be supplied in response to an acceptance of a *commercial offering*. A supplier can assert that a *commercial offering* complies with one or more **specifications**.

EXAMPLE   The sign at a petrol/gas station stating the price of petrol/gas at the station is a *commercial offering*. The price of a **product** on the shelf of a supermarket is a *commercial offering*. The price of the same thing at different petrol/gas stations or supermarkets can be different, so they are different *commercial offerings* of the same **product**.

NOTE 2 In some cases, the acceptance of a *commercial offering* can result in a contract to supply a **product** or **service** that meets some **specification**, at a price, and probably location. In other cases, a *commercial offering* is merely an item in a catalogue and further communication between customer and supplier maybe required to create a contract.

— *product range*: A *product range* is several similar **kinds of product**. Some statements are true for each **kind of product** in a range.

— **product design** (or product variant): A **product design** is a detailed definition of the form and properties of a **particular product**. A **product design** can include a detailed definition of the production **process**.

A single **product design** can be used for different *commercial offerings*. The different *commercial offerings* can be differently priced, and the customer may not be told that they are identical.

Different **product designs** can be used at different times for single *commercial offering*. A manufacturer can change its production **process** and produce a **product** that meets the same **specifications** in a different way. Occasionally this can lead to disputes between suppliers and customers.

NOTE 3 "Product definition" and "product specification" may be near synonyms. **Product design** is used for a **specification** that is complete enough to pass on to manufacturing or construction.

— *batch* (or lot): A number of **particular products** that are produced together or from the same source materials.

A *batch* as a whole is a **particular** thing. A *batch* can have **particular products** as **parts**.

— *effectivity*: An *effectivity* is the **part** of a production run associated with either a detailed **specification** for how the **products** should be produced, a detailed specification for the resulting **products**, or both.

Effectivity can add detail in addition to the **product design**, such as which *engineering change orders* apply. It can specify which **components** from which suppliers to use in an **assembly**, and other constraints on how a **product** is to be made that are not within the **product design**.

An *effectivity* as a whole can be regarded as a **particular** thing that has **particular products** as **parts**. Alternatively, an *effectivity* can be regarded as a more specialised **product specification**.

In ISO/TS 10303-1057:2014 "Application module: Effectivity", *effectivity* is defined as "the identification of a domain of applicability". ISO/TS 10303-1057:2014 allows an *effectivity* to be defined in different ways, including:

— dated effectivity: things made between a start and finish time;

— time interval effectivity: things made within a set time duration after an event;

— serial effectivity: things that have serial numbers within a range, possibly open ended;

3

— lot effectivity: things that are within a lot or batch.

Kind can be a number of **particular** things where:

— each complies with the same **specification**;

— each is supplied in response to acceptance of the same *commercial offering*;

— each is supplied in response to acceptance of a *commercial offering* within the same *product range*;

— each was made according to the same **product design**;

— each was made as part the same *batch*.

NOTE 4 **Particular material objects** from the same *batch* not have anything in common.

— each was made as part of the same *effectivity*.

NOTE 5 It is possible when considering *batches* and *effectivities* to think in terms of whole and **part** rather than **kind**. Nonetheless informally, a "1969 Ford Cortina" is often thought of as a **kind** of *motor car*.

3.3 ~~3.3~~ Terms for particular and kind

~~3.3.1~~
particular
individual
thing existing in space and time

EXAMPLE 1   The pump with serial number "X12345", which was supplied by Fred Bloggs and Co. to UGE Inc. on 2019-09-27, is a *particular* pump.

EXAMPLE 2   The computer file ~~http://www.uge.com/annual-report/2019.docx~~http://www.uge.com/annual-report/2019.docx is a *particular* computer file. It was created at a *particular* time and may be deleted in the future. It exists on a *particular* server somewhere.

Note 1 to entry: The term "individual" is used in ~~ISO/TS 10303-1164:2011, ISO 15926-2:2003,~~ISO/TS 10303-1164:2023, 4.3.1, and ~~ISO/IEC 81346-1:2009~~ISO 15926-2:2003, 3.1.6.

Note 2 to entry: IEC 81346-1:2022, 3.16 defines the term "product individual" with the same meaning as particular *product* (3.3.3).

Note 3 to entry: The term *particular* is used as a qualifier of another term.

Note ~~3~~ 4 to entry: ~~Within the core terminology~~ In this document, the term *particular* is not used on its own, except where the qualified term is understood.

Note ~~4~~ 5 to entry: "Realised" is a natural term where qualified term is *product*, (3.3.3), but less natural where the qualified term is *person*. (3.10.2).

~~Note 5 to entry: The term **particular** is defined in Arp et al., "Building Ontologies with Basic Formal Ontologies" [31] as follows:~~

~~An individual (nonrepeatable) denizen of reality (an instance of a universal); all particulars stand in the relation of instantiates to some universal; each particular occupies a unique spatiotemporal location.~~

Note 6 to entry: The term "individual" is used on its own in OWL to mean an object within the domain. In OWL DL (OWL statements following specified syntactic restrictions that are interpreted using the OWL 2 Direct Semantics) an OWL individual cannot also be an OWL class. In OWL-Full (which need not follow the above semantic restrictions and is interpreted using the OWL 2 RDF-Based Semantics) an OWL individual can also be an OWL class.

Note 7 to entry: ~~The term "individual" is used on its own in ISO/IEC 81346-1. The term is defined as follows:~~

~~An individual is one specimen of a type irrespective of where it is being used.~~

~~[SOURCE: ISO/IEC 81346-1:2009, 4.8]~~

~~ISO/IEC 81346 goes on to say:~~

~~Individuals are identified by serial numbers, related to the context of the production of the individuals or by inventory numbers related to the context of the organization using them.~~

~~Note 8 to entry:~~ The space and time within which a *particular* thing exists can be unknown.

Note ~~9~~ 8 to entry: Some ontological approaches describe plans for the future or scenarios in terms of *particular* things that exist in possible worlds. The ~~terminology~~vocabulary defined here neither prescribes nor precludes such approaches.

Note ~~10~~ 9 to entry: ~~ISO 10303~~ ISO 10303 allows a *particular* thing to be either actually existing or planned for the future. A *particular* thing that is actually existing is also called "realized".

Note 10 to entry: In ISO/TS 10303-~~1164 "Application module: Product as individual" defines "individual product" as:~~

~~existing or potential future artefact — an actual or planned product whose properties can only be known by observation or by derivation from observations~~

~~[SOURCE: ISO/TS 10303-1164:2011, 3.1.2.2]~~

~~The introduction to ISO/TS 10303-1293 "Application module: AP239 part definition information" says:~~

~~An actual product that has been made is represented by a Product_as_realized entity.~~

~~A product that is planned to be made is represented a Product_as_planned entity.~~

~~EXAMPLE 1: The front wheel on your car is an actual product — Product_as_realized.~~

~~EXAMPLE 2: The computer with the serial number "PN X0467-71281" is an actual product — Product_as_realized.~~

~~EXAMPLE 3: The plane, with tail number "GXY 8910", ordered by "Air 3000" that is just about to be manufactured is a predicted product — Product_as_planned.~~

~~[SOURCE: ISO/TS 10303-1293:2011, Clause Introduction]~~

In ~~ISO/TS 10303-4000:2022 "Core model"~~4000:2023 and in the Application Reference Model of ~~ISO 10303-242:2020 "Application protocol: Managed model-based 3D engineering",~~ISO 10303-242:2022, term "product" is replaced by "part" so that the following terms are used: "individual part", "planned individual part" and "realized individual part".

~~3.~~3.2.~~2~~
kind
class
type
things that have something in common

EXAMPLE 1   Pump is a *kind* of *material object*~~.~~ (3.3.2). Each *particular* (3.2.1)*material object* of this *kind* is intended to add mechanical energy to a fluid. This is a generic *kind* of *material object*.

EXAMPLE 2   The "Fred Bloggs and Co. model A-101 pump" is a *kind* of *material object*. Each *particular* pump of this *kind* has a rated power of 1 kW. There are many other quantitative properties possessed by each *particular* pump of this *kind*. This is a specific *kind* of *material object*.

Note 1 to entry: The term "class" is used in ~~ISO 15926-2:2003,~~ISO 15926-2:2003, 3.1.1, and ~~ISO/TS 10303-1070:2014.~~ISO/TS 10303-54:2005, 3.2.1.

Note 2 to entry: The ~~term~~terms "type" ~~is~~and "class" are used in ~~ISO/IEC 81346-1:2009.~~IEC 81346-1:2022, 3.17 and 3.20, with meanings which are both similar to *kind.*

Note ~~2~~ 3 to entry: The term *kind* is a qualifier of another term, usually in the form "kind of".

~~Within the core terminology~~ In this document, the term *kind* is not used on its own as a noun, except where the qualified term is understood.

Note ~~3~~ 4 to entry: Depending on the what all things of a *kind* have in common, a *kind* can be "generic" or "specific". A generic *kind* is one that is defined in sources used throughout industry, such as standards. A specific *kind* is often defined by an *organization* as part of a *specification*.

Note ~~4~~ 5 to entry: What things of the same *kind* have in common can be specified.

Note ~~5~~ 6 to entry: "Class" and "type" are possible synonyms for *kind*. "Class" is used in ~~ISO 15926-2:2003~~ISO 15926-2:2003, 3.1.1 with a meaning that is close to "set" in mathematics. ~~"Type" is used in ISO/IEC 81346-1:2009.~~ The uses of these terms in ontologies or data modelling languages is not necessarily consistent with the less formal use here.

Note ~~6~~ 7 to entry: ~~ISO/IEC 81346-1 says:~~

~~A type is a class of objects having the same set of characteristics. Depending upon the number of common characteristics (and if they are qualitative or quantitative) a type can be from very generic to very specific [....]~~

~~[|SOURCE: ISO/IEC 81346-1:2009, 4.8]~~

~~Note 7 to entry:~~ ISO 10303 mostly uses the term "class". The usage of this term is defined in ~~ISO/TS 10303-1070:2014 "Application module: Class". A~~ISO/TS 10303-1114:2019, 4.3.1 defines the entity Classification_assignment to be "the assignment of a Class to product or activity data for their classification ~~assignment entity asserts that a thing is a member of a class.~~".

Within ISO 10303, a "part" can be a *kind* of thing. ~~ISO/TS 10303-1022:2014 "Application module: Part and version identification"~~ISO/TS 10303-1022:2014, 3.1.2.2 defines a *part* to be "~~a collector of the definitional information of the versions of either a part or of a non-countable material~~discrete object that can come into existence as a consequence of a manufacturing process".

Within ISO 10303, a "concept" is a *kind* of thing. ~~ISO/TS 10303-1060:2004 "Application module:~~ISO/TS 10303-1060:2004, 4.1.2 defines the entity Product ~~concept identification" defines a *product*~~ concept to be "an identification of a set of similar products that were, are or will be proposed to customers".

Within ISO 10303 the term "type" is used in some circumstances. ~~ISO/TS 10303-1240:2004 "Application module:~~ISO/TS 10303-1240:2004, 4.2.2 defines the entity Organization ~~type" defines an *organization*~~ type to be a "recognized kind of organization". ~~ISO/TS 10303-1245:2004 "Application module:~~ISO/TS 10303-1245:2004, 4.3.1 defines the entity Type_of_person ~~says that~~ to be a "type of person ~~is identified by "a number of attributes", where "the attributes may include properties that are~~".

Terms related to ~~experience, qualifications or to physical attributes."~~

~~3.4~~3.3 3.4 ~~Discussion of~~ artefact, product and material object

~~3.4.1~~ 3.4.1 ~~Difference between artefact, material object and product~~

~~There are three related terms:~~

- ~~**artefact**: thing that is created by people;~~

- ~~**material object**: thing that is matter;~~