International Standard

ISO 29002

Industrial automation systems and integration — Exchange of characteristic data

Systèmes d'automatisation industrielle et intégration — Échange de données caractéristiques

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Foreword

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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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the 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.

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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*.

This document cancels and replaces ISO/TS 29002-4:2009, ISO/TS 29002-5:2009, ISO/TS 29002-6:2010, ISO/TS 29002-10:2009, ISO/TS 29002-20:2010 and ISO/TS 29002-31:2009, which have been technically revised.

The main changes are as follows:

— the contents of ISO/TS 29002-4:2009 have been incorporated into Clause 5, Annex A, Annex B and Annex C of this document. The conformance requirements are specified in Clause 11;

— the contents of ISO/TS 29002-5:2009 have been incorporated into Clause 6, Annex A, Annex B and Annex D of this document. The conformance requirements are specified in Clause 11;

— the contents of ISO/TS 29002-6:2010 have been incorporated into Clause 7, Annex A, Annex B, Annex C and Annex E of this document. The conformance requirements are specified in Clause 11;

— the contents of ISO/TS 29002-10:2009 have been incorporated into Clause 8, Annex A, Annex B, Annex F, Annex G and Annex H of this document. The conformance requirements are specified in Clause 11;

— the contents of ISO/TS 29002-20:2010 have been incorporated into Clause 9, Annex A, Annex B and Annex I of this document. The conformance requirements are specified in Clause 11;

— the contents of ISO/TS 29002-31:2009 have been incorporated into Clause 10, Annex A and Annex B of this document. The conformance requirements are specified in Clause 11;

— provisions have been modified to allow the use of new technologies for the exchange of characteristic data;

— the operation of the location service has been clarified;

— an alternative process in the absence of any location service has been added;

— minor updates have been made to the valid character set in the identification scheme to allow for more flexible implementation;

— an update has been made to allow references generated by another system [e.g. Universally Unique IDentifiers (UUIDs)] to be represented in the item code;

— the notation style of the figures has been modified to ensure consistency and readability.

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

Characteristic data are a valuable asset across the industrial sector. These data describe the products and services created, sold and used by organizations. Such data are most useful when organizations exchange and share the data without loss of meaning. Being useful specifically involves improving decision making regarding the described products and services.

Various international standards exist in the field of data that support exchange and sharing of characteristic data. This support is provided by each standard specifying a capability to represent characteristic data. The standards include the ISO 13399 series, the ISO 13584 series, the ISO 15926 series, the ISO 18101 series, the ISO 22745 series, the IEC 61360 series[23] including the IEC Common Data Dictionary[30] and the IEC 62656 series.[25]

While each standard serves a distinct purpose within the wide range of use cases in the industrial sector, the diversity also disrupts reuse of characteristic data across those use cases. Each standard does, however, recognize a consistent theme: a concept dictionary provides the common ground on which organizations can build coherent collections of characteristic data. Such dictionaries serve as a definitive, reusable external reference describing the concepts that give meaning to characteristic data.

Some standards label a concept dictionary as a product ontology, but the core capabilities are the same.

The ontology service specified in this document can be used to retrieve representation forms including a product ontology that conforms to ISO 13584-32 and an identification guide information that conforms to ISO/TS 22745-30.

This document establishes the foundation for building interoperability between standards that specify a capability to represent characteristic data. This foundation consists of elements including:

— conceptual information data models and exchange formats;

— a format for an identification scheme;

— an interface for retrieving information from a concept dictionary;

— capabilities for a location service, a terminology service and an ontology service;

— 20 schemas, in Extensible Markup Language (XML) and OpenAPI Specification (OAS) format (represented in JavaScript Object Notation (JSON) (see Annex B for instructions on how to download electronic versions of the schemas from the ISO website).

These elements can be used by organizations, either:

— as is, i.e. without any model-specific restrictions in combination with other standards including the ISO 13584 series and the ISO 22745 series; or

— according to special adaptations that are defined by the respective standard to tailor the use of a format or functionality to the specific requirements of that standard.

The data models, in particular, address the role of concepts in specifying the preferred common interpretation of terminological items. This common interpretation establishes the items as being semantically equivalent. These items are terms, abbreviations, definitions, graphical representations (images) and symbols. The models enable organizations to combine items from different sources and to collate coherent collections of characteristic data. These sources are typically ISO, IEC or other bodies that operate consensus-based processes to perform terminology work.

In setting up a concept dictionary, organizations do not need to repeat the effort of developing the source terminological items.

By establishing semantic equivalence, a concept dictionary can also function as a thesaurus. This function can integrate communities who either use colloquial terms or different natural languages.

The models also contain a concept equivalence relationship to support a further level of integration and data retrieval. This relationship allows organizations to identify the equivalence of concepts that are represented by pre-existing data records.

In this document, the model for a data dictionary and the format for an identification scheme each reflect the respective requirements for such objects in the ISO 8000 series for data quality, as illustrated by the data architecture in ISO 8000-1:2022, Figure 2.

By implementing this document, organizations will deliver the following benefits:

— even when they are familiar with a different term, users more readily identify the correct applicable concept when they are creating new data records, reducing the risk of creating duplicate records;

— improvement in the quality of characteristic data;

— no loss of meaning when exchanging characteristic data;

— possibility for different parties to continue using different preferred terms locally for the same concept;

— interoperability between computer systems that perform processing of characteristic data;

— interoperability across all phases of the data and product life cycles.

NOTE See Annex K for information on the role of data dictionary models in achieving semantic interoperability.

Industrial automation systems and integration — Exchange of characteristic data

1 Scope

This document provides a common resource that assists with the interoperability of characteristic data between various industrial data standards, such as the ISO 13399 series, the ISO 13584 series, the ISO 15926 series, the ISO 18101 series, the ISO 22745 series, the IEC 61360 series[23] including the IEC Common Data Dictionary[30] and the IEC 62656 series.[25]

This document specifies a set of resources that enable organizations to use concept dictionaries as the basis for unambiguous exchange of characteristic data.

The following are within the scope of this document:

— fundamental principles for the exchange of characteristic data and for data dictionaries and ontologies;

— a conceptual model for basic entities and types;

— an exchange format for basic entities and types;

— data elements for identification of objects described by a concept dictionary, where those objects include concepts and their associated concept information elements;

— syntax of an identifier of objects described by a concept dictionary;

— rules regarding compatibility of restricted schemas with this document;

— a conceptual model for dictionaries of concepts and their defining terminological data;

— an exchange format for terminological data that can be fetched via a concept dictionary resolution service (CDRS);

— a conceptual model for characteristic data;

— an exchange format for characteristic data;

— a specification of a mechanism to resolve a unique concept identifier to its service provider;

— a specification of an identification scheme and identifier format for retrievable objects in a concept dictionary;

— a specification of a mechanism to retrieve the terminological data associated with a concept and other objects from the concept dictionary terminology reference model, given the identifier of the concept or object;

— a specification of a mechanism to search for concepts and other objects from the concept dictionary terminology reference model, using a set of search patterns and parameters;

— a specification of a mechanism to retrieve the ontological description of a concept, given the identifier of the concept;

— Web Services Definition Language (WSDL)[33] and Simple Object Access Protocol (SOAP)[34] binding of the specified services;

— a query for characteristic data of items that have a given supplier identification;

— a query for supplier identification of items that have a given set of characteristic data;

— a query for characteristic data and supplier identification of items that match a search expression;

— a query to supply missing characteristic data.

The formats in this document provide interoperability between implementations of the ISO 13584 series and the ISO 22745 series. These formats also have more general applicability.

This document serves as a generic resource that can be restricted through implementation profiles by standards that reference it. It can also be implemented without restriction.

The following is outside of the scope of this document:

— rules specific to the ISO 13584 series or the ISO 22745 series.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4217, *Codes for the representation of currencies*

ISO/IEC 6523 (all parts), *Information technology — Structure for the identification of organizations and organization parts*

3 Terms and definitions

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
concept
unit of thought

EXAMPLE “automobile”, “colour”, “red” and “metre” are all concepts.

3.2
concept identifier
globally unique identifier of a *concept* (3.1)

Note 1 to entry: A *concept dictionary* (3.9) uses a concept identifier for each concept in the dictionary.

Note 2 to entry: Concept identifiers are the metadata that enable unambiguous exchange of characteristic data. This document specifies the *international registration data identifier* (3.22) as the appropriate type of concept identifier to achieve such exchange.

3.3
concept information element
object (3.12) for which data has been recorded as a contribution to the description of a *concept* (3.1)

EXAMPLE An *image* (3.5), a symbol, an *abbreviation* (3.6), a *term* (3.7), an identifier, a source document, the location of a source document on the internet.

Note 1 to entry: Concepts and concept information elements are both recorded in a *concept dictionary* (3.9).

3.4
definition
representation of a *concept* (3.1) by an expression that describes it and differentiates it from related concepts

[SOURCE: ISO 1087:2019, 3.3.1]

3.5
image
representation of a *concept* (3.1), where the representation is primarily graphic

Note 1 to entry: An image can include text.

[SOURCE: ISO 22745-2:2010, 14.8]

3.6
abbreviation
designation that is formed by omitting parts from its full form and that represents the same *concept* (3.1)

Note 1 to entry: Abbreviations can be created by removing individual words, or can be acronyms, initialisms or clipped *terms* (3.7).

3.7
term
verbal designation of a *concept* (3.1) in a specific domain and with a particular language

EXAMPLE "automobile", "colour", "red" and "metre" are all terms that designate concepts.

3.8
concept dictionary entry
description of a *concept* (3.1) containing, at a minimum, a *concept identifier* (3.2), a *term* (3.7) and a *definition* (3.4)

Note 1 to entry: The description can consist of just a term and definition, but it can also contain other *concept information elements* (3.3).

3.9
concept dictionary
collection of *concept dictionary entries* (3.8) where the dictionary enables lookup by *concept identifier* (3.2)

3.10
administered item
item for which a *concept dictionary* (3.9) can contain data and can also record administrative information

Note 1 to entry: Administered items include *concepts* (3.1) and *concept information elements* (3.3).

3.11
concept equivalence
semantic equivalence
relation between designations in different natural languages representing the same *concept* (3.1)

Note 1 to entry: In terminological systems, two concepts are (semantically) equivalent if their domain of meaning overlaps and their semantic *definitions* (3.4) are interpreted as identical.

Note 2 to entry: In the context of terminological resources, "equivalence" and "semantic equivalence" are often considered as synonyms.

3.12
object
anything perceivable or conceivable

EXAMPLE The radial flow centrifugal pump with serial number AX52386 is an object. Its general structure is defined by the radial flow centrifugal pump *class* (3.13).

Note 1 to entry: Objects can be material (e.g. “engine”, “sheet of paper”, “diamond”), immaterial (e.g. “conversion ratio”, “project plan”) or imagined (e.g. “unicorn”, “scientific hypothesis”).

[SOURCE: ISO 1087:2019, 3.1.1, modified — Example has been added.]

3.13
class
abstraction of a set of similar *objects* (3.12)

3.14
property
quality or feature of an *object* (3.12)

[SOURCE: ISO 22745-2:2010, 2.2]

3.15
property value pair
instance of a specific value together with an identifier for a *concept dictionary entry* (3.8) that defines a *property* (3.14)

Note 1 to entry: See Annex H for further information.

3.16
product ontology
model of product knowledge, made by a formal and consensual representation of the *concepts* (3.1) of a product domain in terms of characterization *classes* (3.13), class relations and *properties* (3.14)

EXAMPLE 1 The IEC Common Data Dictionary,[30] is a reference dictionary for electric components and, thus, is a product ontology for electric components. This ontology conforms to the common dictionary model specified by the ISO 13584 series and the IEC 61360 series.[23]

EXAMPLE 2 A corporate reference dictionary is agreed upon by experts designated by management on behalf of the organization.

Note 1 to entry: Product ontologies are based on a class-instance model that makes it possible to recognize and to designate the sets of products, called characterization classes, that have a similar function (e.g. ball bearing, capacitor), but also to discriminate within a class the various subsets of products, called instances, that are considered as identical. ISO/IEC Guide 77-2 recommends using the rules defined in ISO 1087-1 when formulating designation and *definitions* (3.4) of characterization classes. Instances have no definitions. They are designated by the class to which they belong and a set of *property value pairs* (3.15).

Note 2 to entry: Ontologies are not concerned with words, but with concepts, independent of any particular language.

Note 3 to entry: Consensual means that the conceptualization is agreed upon in some community.

Note 4 to entry: The ISO/IEC 77 series recommends the ontology is formal by being machine interpretable, ensuring some level of machine reasoning be possible over the ontology, e.g. consistency checking.

Note 5 to entry: Identified means that each ontology characterization class and property is associated with a globally unique identifier, making it possible to reference this concept from any context.

Note 6 to entry: For a data model for ontology, the ISO/IEC 77 series recommends using the common dictionary model specified by the ISO 13584 and IEC 61360 series. This dictionary mode is specified by ISO 13584-42 and IEC 61360-2.

Note 7 to entry: The ISO/IEC 77 series uses the term “reference dictionary for the domain” to indicate a product ontology addressing a particular product domain and conforming to the common dictionary model specified by the ISO 13584 and IEC 61360 series.

Note 8 to entry: ISO/IEC 19763-3:2020 defines an ontology as a “specification of concrete or abstract things, and the relationships among them, in a prescribed domain of knowledge” and notes that it is recommended for these specifications to be computer processable.

Note 9 to entry: ISO 13584-32:2010 specifies an XML schema for representing data according to the ISO 13584 series data model. This enables the exchange of both ontologies conformant with the common ISO 13584 series/ IEC 61360 series model. Such an exchange context is called an "OntoML library".

Note 10 to entry: ISO/TS 29002-5 and ISO/TS 29002-10 are both listed as normative references in ISO 13584-32. The content of ISO/TS 29002-5 is updated as Clause 6 of this document, and the content of ISO/TS 29002-10 is updated as Clause 8 of this document.

[SOURCE: ISO/IEC Guide 77-2:2008, 2.17, modified — Examples and Notes 1 to 7 to entry have been refined. Notes 8 to 10 to entry have been added.]

3.17
characteristic
unit of thought that corresponds to *properties* (3.14) that are common to a set of *objects* (3.12)

[SOURCE: ISO 22745-2:2010, 9.1]

3.18
characteristic data
description of an entity by the *class* (3.13) to which it belongs and a set of *property* (3.14) values

EXAMPLE 1 The item "Socket Head Hex Cap Screw — ISO 4762 Stainless Steel 316, M12 × 20 appears in a manufacturer's catalogue. It can be described as:

— class: socket head hexagon cap screw;

— property values: [standard, ISO 4762]; [material specification, 316 Stainless Steel (Molybdenum content 2–3 % and nickel content 10–14 %)]; [diameter, 12,00 mm]; [thread pitch, 1,75 mm]; [length, 20,00 mm].

EXAMPLE 2 In actual characteristic data, the first element of each bracketed pair would be an identifier for a data dictionary entry. In this example, the elements are shown decoded for clarity.

Note 1 to entry: The ISO 13584 series, the ISO 15926 series, the ISO 22745 series, the ISO 13399 series and this document all specify the representation of characteristic data in their data models.

3.19
formal syntax
specification of the valid sentences of a formal language using a formal grammar

EXAMPLE 1 An Extensible Markup Language (XML) document type definition (DTD) is a formal syntax.

EXAMPLE 2 ISO 10303-21 contains a formal syntax in Wirth Syntax Notation (WSN) for ISO 10303 series physical files.

Note 1 to entry: A formal language is computer-interpretable.

Note 2 to entry: Formal grammars are usually Chomsky context-free grammars.

Note 3 to entry: Variants of Backus-Naur Form (BNF) such as Augmented Backus-Naur Form (ABNF) and Wirth Syntax Notation (WSN) are often used to specify the syntax of computer programming languages and data languages.

[SOURCE: ISO 8000-2:2022, 3.9.1]

3.20
data specification
identification guide
IG
part ontology
rules for describing items belonging to a particular *class* (3.13) using entries from a *concept dictionary* (3.9) and reference to a specific *formal syntax* (3.19)

Note 1 to entry: Identification guide (IG) is defined as a "data specification that is in the syntax specified in ISO/TS 22745-30 and that uses *concept identifiers* (3.2) from an open technical dictionary".

Note 2 to entry: An identification guide is sometime referred to as a "template of properties and rules".

Note 3 to entry: *Product ontology* (3.16), part ontology and ontology are grouped as synonyms in ISO 13584-32:2010, 3.17.

EXAMPLE 1 An ISO/TS 22745-30 compliant identification guide is a data specification.

EXAMPLE 2 ISO 13584-501 defines a data specification.

[SOURCE: ISO 22745-2:2010, B.2.18, modified — Notes 1 to 3 to entry and admitted terms have been added.]

3.21
item of supply
class (3.13) of substitutable goods or services that fulfil a fit, form or function defined by a buyer

[SOURCE: ISO 22745-2:2010, 22.1]

3.22
international registration data identifier
IRDI
internationally unique identifier for an identified item in a *concept dictionary* (3.9)

3.23
registration authority
organization responsible for a *concept dictionary* (3.9)

3.24
registration authority identifier
identifier assigned to a *registration authority* (3.23)

3.25
issuing organization
IO
body that assumes responsibility for the administration of a specific organization identification scheme

[SOURCE: ISO/IEC 6523-2:2025, 3.1]

3.26
International Code Designator
ICD

data element used to uniquely identify an organization identification scheme

[SOURCE: ISO/IEC 6523-1:2023, 3.8]

3.27
organization identifier
identifier assigned to an organization within an organization identification scheme, and unique within that scheme

[SOURCE: ISO/IEC 6523-1:2023, 3.10]

3.28
organization part identifier
OPI
identifier allocated to a particular organization part

[SOURCE: ISO/IEC 6523-1:2023, 3.11]

3.29
organization part identifier source
OPIS
data element used to specify the source for the *organization part identifier* (3.28)

[SOURCE: ISO/IEC 6523-1:2023, 3.12, modified — "indicator" has been removed from the end of the preferred term.]

3.30
additional information
AI
data element used to distinguish between multiple dictionaries produced by the same organization

EXAMPLE The IEC Common Data Dictionary,[51] is a common repository with data dictionaries for all ISO and IEC industrial/technical related-domains. The additional information data element identifies the source standard.

3.31
code space
domain within which each code denotes a single meaning

Note 1 to entry: This document assigns a distinct code space for each *administered item* (3.10).

3.32
code space identifier
CSI
unique identifier for a *code space* (3.31)

3.33
item code
IC
identifier for an item, where the identifier is unique within the corresponding *code space* (3.31)

3.34
data identifier
DI
unique code assigned to an *administered item* (3.10) by a *registration authority* (3.23) consisting of a *code space identifier* (3.32) and an *item code* (3.33)

3.35
version identifier
unique code assigned to a version under which an *administered item* (3.10) is submitted or updated by the *registration authority* (3.23)

3.36
class
<administered item identification> *administered items* (3.10) that are *classes* (3.13)

Note 1 to entry: The value “01” is assigned to the *code space identifier* (3.32) for the class category.

3.37
property
<administered item identification> *administered items* (3.10) that are *properties* (3.14)

Note 1 to entry: The value “02” is assigned to the *code space identifier* (3.32) for the property category.

3.38
feature
<administered item identification> preconceived form patterns having some (engineering) meaning

Note 1 to entry: The value “03” is assigned to the *code space identifier* (3.32) for administrative items that are features.

3.39
representation
<administered item identification> *administered items* (3.10) that are a set of rules for mapping between bit or character sequences in a computer file and members of a conceptual domain (an abstract set of values)

EXAMPLE 1 ISO 22745-2 includes a list of bearing features that includes:

— field width;

— padding (for numbers);