

Industrial automation systems and integration — Product data representation and exchange —

Part 49: Integrated generic resources: Process structure and properties

ICS 35.240.50

National foreword

This British Standard reproduces verbatim ISO 10303-49:1998 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee AMT/4, Product data exchange, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii to xi, a blank page, pages 1 to 50, an inside back cover and a back cover.

Amendments issued since publication

Amd. No.	Date	Text affected

This British Standard, having been prepared under the direction of the DISC Board, was published under the authority of the Standards Committee and comes into effect on 15 December 1998

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ISBN 0 580 32013 8

INTERNATIONAL STANDARD

ISO
10303-49

First edition
1998-06-15

Industrial automation systems and integration — Product data representation and exchange —

Part 49: Integrated generic resources: Process structure and properties

*Systèmes d'automatisation industrielle et intégration — Représentation et
échange de données de produits —*

*Partie 49: Ressources génériques intégrées: Structure et propriétés du
procédé*



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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.

Draft International Standards adopted by technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 10303-49 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*.

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration - Product data representation and exchange*:

- Part 1, Overview and fundamental principles;
- Part 11, Description methods: The EXPRESS language reference manual;
- Part 12, Description method: The EXPRESS-I language reference manual;
- Part 21, Implementation methods: Clear text encoding of the exchange structure;
- Part 22, Implementation method: Standard data access interface specification;
- Part 23, Implementation method: C++ language binding to the standard data access interface;
- Part 24, Implementation method: C language binding to the standard data access interface;
- Part 26, Implementation method: Interface definition language binding to the standard data access;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- Part 34, Conformance testing methodology and framework: Abstract test methods;
- Part 35, Conformance testing methodology and framework: Abstract test methods

- Part 41, Integrated generic resource: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resource: Representation structures;
- Part 44, Integrated generic resource: Product structure configuration;
- Part 45, Integrated generic resource: Materials;
- Part 46, Integrated generic resources: Visual presentation;
- Part 47, Integrated generic resource: Shape variation tolerances;
- Part 49, Integrated generic resource: Process structure and properties;
- Part 101, Integrated application resource: Draughting;
- Part 104, Integrated application resource: Finite element analysis;
- Part 105, Integrated application resource: Kinematics;
- Part 106, Integrated application resource: Building construction core model;
- Part 107, Integrated application resources: Engineering analysis core application reference model (EA C-ARM);
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 204, Application protocol: Mechanical design using boundary representation;
- Part 205, Application protocol: Mechanical design using surface representation;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 208, Application protocol: Life cycle management - Change process;
- Part 209, Application protocol: Composite and metallic structural analysis and related design;
- Part 210, Application protocol: Electronic assembly, interconnect, and packaging design;
- Part 212, Application protocol: Electrotechnical design and installation

- Part 213, Application protocol: Numerical control process plans for machined parts;
- Part 214, Application protocol: Core data for automotive design;
- Part 215, Application protocol: Ship arrangement;
- Part 216, Application protocol: Ship moulded forms;
- Part 217, Application protocol: Ship piping;
- Part 218, Application protocol: Ship structures;
- Part 221, Application protocol: Functional data and their schematic representation for process plant;
- Part 222, Application protocol: Exchange of product data for composite structures;
- Part 223, Application protocol: Exchange of design and manufacturing product information for casting parts;
- Part 224, Application protocol: Mechanical product definition for process plans using machining features;
- Part 225, Application protocol: Building elements using explicit shape representation;
- Part 226, Application protocol: Ship mechanical systems;
- Part 227, Application protocol: Plant spatial configuration;
- Part 229, Application protocol: Exchange of design and manufacturing product information for forged parts;
- Part 230, Application protocol: Building structural frame: Steelwork;
- Part 231, Application protocol: Process engineering data: Process design and process specification of major equipment;
- Part 232, Application protocol: Technical data packaging core information and exchange;
- Part 301, Abstract test suite: Explicit draughting;
- Part 302, Abstract test suite: Associative draughting;
- Part 303, Abstract test suite: Configuration controlled design;
- Part 304, Abstract test suite: Mechanical design using boundary representation;

- Part 305, Abstract test suite: Mechanical design using surface representation;
- Part 307, Abstract test suite: Sheet metal die planning and design;
- Part 308, Abstract test suite: Life cycle management - Change process;
- Part 309, Abstract test suite: Composite and metallic structural analysis and related design;
- Part 310, Abstract test suite: Electronic assembly, interconnect, and packaging design;
- Part 312, Abstract test suite: Electrotechnical design and installation;
- Part 313, Abstract test suite: Numerical control process plans for machined parts;
- Part 314, Abstract test suite: Core data for automotive mechanical design;
- Part 315, Abstract test suite: Ship arrangement;
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- Part 317, Abstract test suite: Ship piping;
- Part 318, Abstract test suite: Ship structures;
- Part 321, Abstract test suite: Functional data and their schematic representation for process plant;
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- Part 325, Abstract test suite: Building elements using explicit shape representation;
- Part 326, Abstract test suite: Ship mechanical systems;
- Part 327, Abstract test suite: Plant spatial configuration;
- Part 329, Abstract test suite: Exchange of design and manufacturing product information for forged parts;
- Part 330, Abstract test suite: Building structural frame: Steelwork;

- Part 331, Abstract test suite: Process engineering data: Process design and process specification of major equipment;
- Part 332, Abstract test suite: Technical data packaging core information and exchange;
- Part 501, Application interpreted construct: Edge-based wireframe;
- Part 502, Application interpreted construct: Shell-based wireframe;
- Part 503, Application interpreted construct: Geometrically bounded 2D wireframe;
- Part 504, Application interpreted construct: Draughting annotation;
- Part 505, Application interpreted construct: Drawing structure and administration;
- Part 506, Application interpreted construct: Draughting elements;
- Part 507, Application interpreted construct: Geometrically bounded surface;
- Part 508, Application interpreted construct: Non-manifold surface;
- Part 509, Application interpreted construct: Manifold surface;
- Part 510, Application interpreted construct: Geometrically bounded wireframe;
- Part 511, Application interpreted construct: Topologically bounded surface;
- Part 512, Application interpreted construct: Faceted boundary representation;
- Part 513, Application interpreted construct: Elementary boundary representation;
- Part 514, Application interpreted construct: Advanced boundary representation;
- Part 515, Application interpreted construct: Constructive solid geometry;
- Part 517, Application interpreted construct: Mechanical design geometric presentation;
- Part 518, Application interpreted construct: Mechanical design shaded presentation.

The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of the International Standard reflects its structure:

- Parts 11 to 12 specify the description methods,
- Parts 21 to 26 specify the implementation methods,
- Parts 31 to 35 specify the conformance testing methodology and framework,

- Parts 41 to 49 specify the integrated generic resources,
- Parts 101 to 106 specify the integrated application resources,
- Parts 201 to 232 specify the application protocols,
- Parts 301 to 332 specify the abstract test suites, and
- Parts 501 to 518 specify the application interpreted constructs.

Should further parts be published, they will follow the same numbering pattern.

Annexes A and B form an integral part of this part of ISO 10303. Annexes C, D, and E are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product, independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application interpreted constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the integrated resources series. Major subdivisions of this part of ISO 10303 are:

- method definition;
- process property;
- process property representation.

This part of ISO 10303 specifies the information necessary to specify the actions or potential actions to realize a process. This includes the relationships between the actions or potential actions in the process and the relationships between the processes that are used to realize a product. A process plan is the specification of instructions to realize a product. This part of ISO 10303 does not specify any particular process, but defines the elements to exchange process information. This part of ISO 10303 is applicable to all types of process definitions that can be represented in a discrete manner.

Industrial automation systems and integration — Product data representation and exchange — Part 49: Integrated generic resource: Process structure and properties

1 Scope

This part of ISO 10303 specifies the resource constructs to specify the actions or potential actions to effect a process. The integrated resource constructs within this part of ISO 10303 define the structure for specifying: relationships between processes, the effectivity of a process, the properties of a process, the resources required for the process, the properties of the resource, the representation of the process, the representation of the resource, and the relationship of the process to the product. When these integrated resource constructs are utilized in the context of an application resource or an application protocol, the integrated resource constructs can be assembled into a structure to represent a process plan.

The following are within the scope of this part of ISO 10303:

- specification of a process;
- specification of the relationships between processes;
- specification of the effectivity of a process;
- specification of the relationship between a process and a product;
- specification of the steps for a process plan to realize a product;

NOTES

1 - This part of ISO 10303 does not make any distinction between a process plan that has been executed and one that has not been executed.

2 - This part of ISO 10303 does not address administrative information within a process plan. Administrative information may include organization, date, or person responsible for developing a process plan.

- specification of alternative process plan definitions;
- specification of the method for realizing a process plan;
- specification of a resource;

- process requirements of the resource;
- identification of resources used by a process;
- specification of the properties of a resource.

The following are outside the scope of this part of ISO 10303:

- definition of specific processes or specific process plans;

NOTE 3 - This part of ISO 10303 does not address any specific industrial process.

- process specifications for continuous processes;

NOTE 4 - This part of ISO 10303 has the capability to represent some aspects of continuous processes. This part of ISO 10303 does not have the capability to represent continuous processes that require interrupts, alarms, and other messaging service requirements.

- scheduling;
- process planning;

NOTE 5 - Process planning is the action of developing a process plan. The action of creating a process plan is outside the scope of this part of ISO 10303. This part of ISO 10303 provides a representation for the output of process planning.

- peer-to-peer communication mechanisms, including synchronization;
- process control.

NOTE 6 - Capabilities for process control and peer-to-peer communication are defined by other ISO standards such as ISO/IEC 9506 (Industrial Automation Systems - Manufacturing Message Specification). These other ISO/IEC standards are concerned with the communication and interworking of programmable devices of industrial process control systems utilized in the process industries. An application resource or an application protocol may specify a relationship between this part of ISO 10303 and ISO/IEC 9506.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 8824-1:1995, *Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

ISO 10303-1:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 1: Overview and fundamental principles.*

ISO 10303-11:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 11: Description methods: The EXPRESS language reference manual.*

ISO 10303-41:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 41: Integrated generic resources: Fundamentals of product description and support.*

ISO 10303-43:1994, *Industrial automation systems and integration - Product data representation and exchange - Part 43: Integrated generic resources: Representation structures.*

ISO 10303-45:1998, *Industrial automation systems and integration - Product data representation and exchange - Part 45: Integrated generic resource: Materials.*

3 Definitions and Abbreviations

3.1 Terms defined in ISO 10303-1

This part of ISO 10303 makes use of the following terms defined in ISO 10303-1:

- application;
- application protocol;
- application resource;
- context;
- component;
- data;
- information;
- interpretation;
- integrated resources;
- product;
- product data;
- product information;

- resource construct;
- structure.

3.2 Terms defined in ISO 10303-45

This part of ISO 10303 makes use of the following terms defined in ISO 10303-45:

- material;
- material property.

3.3 Other definitions

For the purposes of this International Standard, the following definitions apply.

3.3.1 process: a particular procedure for doing something involving one or more steps or operations. The process may produce a product, a property of a product, or an aspect of a product.

3.3.2 process plan: the sequence of processes required to realize or produce a given product.

3.3.3 resource: something that may be described in terms of a behavior, a capability, or a performance measure that is pertinent to the process.

3.4 Abbreviations

URL - Universal Reference Locator

4 Method definition

The following EXPRESS declaration begins the **method_definition_schema** and identifies the necessary external references.

EXPRESS specification:

```

*)
SCHEMA method_definition_schema;

REFERENCE FROM action_schema
  (action_method,
   action_method_relationship,
   action_relationship);

REFERENCE FROM document_schema
  (document,
   document_usage_constraint);

REFERENCE FROM effectivity_schema
  (effectivity);

REFERENCE FROM measure_schema
  (count_measure);

REFERENCE FROM support_resource_schema
  (label,
   text);

REFERENCE FROM process_property_schema
  (product_definition_process,
   property_process);
(*)

```

NOTES

1 - The schemas referenced above can be found in the following parts of ISO 10303:

action_schema	ISO 10303-41
document_schema	ISO 10303-41
effectivity_schema	ISO 10303-41
measure_schema	ISO 10303-41
support_resource_schema	ISO 10303-41
process_property_schema	Clause 5 of this part of ISO 10303

2 - See annex D, figure D.1, for a graphical presentation of this schema.

4.1 Introduction

The subject of the **method_definition_schema** is the specification of the instructions required to perform a process. This part of ISO 10303 is applicable to all types of process definitions that can be represented in a discrete manner. This clause provides:

- composition structure of a process, based on a series of actions or potential actions;
- control structure for defining the order of execution of processes;
- method for identifying a document that defines a process;

- method for identification of process effectivity;
- structure for defining conditions that may alter order of completion of the process.

NOTE - See ISO 10303-41 for further information related to **action_method** and **action_method_relationship**.

The **method_definition_schema** represents the data in a process plan, but not the process and data that are required to develop the process plan. The **method_definition_schema** may be used in many contexts for process representation. A context is defined by an application resource or an application protocol.

4.2 Fundamental concepts and assumptions

The **method_definition_schema** provides structures for specifying the decomposition and ordering of actions or potential actions that effect a process. This schema supports the identification of resources that are employed by processes. The domain is not restricted to manufacturing.

An **action_method** defines a potential means of satisfying an **action**. An **action_method_to_select_from**, an **action_method_with_associated_documents**, and an **action_method_associated_documents_constrained**, specify different types of **action_methods** that may be used to satisfy an action.

A **concurrent_action_method**, a **serial_action_method**, and a **sequential_action_method** specify different types of **action_method_relationships** that may be used to create a process. The **action_method**, **action_method_to_select_from**, **action_method_with_associated_documents**, and the **action_method_with_associated_documents_constrained** may be combined by means of the **action_method_relationship** or the different types of **action_method_relationships** defined in this part of ISO 10303 to specify process information.

An **action_method**, or different types of **action_methods** defined in this part of ISO 10303, may be a parent in multiple parent to child relationships that are defined by means of **action_method_relationship** or the different types of **action_method_relationships** defined in this part of ISO 10303. Combination of **action_method_relationship**, or the different types of **action_method_relationships** defined in this part of ISO 10303, through parent to child and peer relationships specify the decomposition and ordering of **action_methods** that effect a process. An application protocol or an application resource specify how the **action_method_relationships** are combined into collections to specify process information.

4.3 method_definition_schema type definitions

4.3.1 relationship_with_condition

A **relationship_with_condition** type is the means for specifying items that define a relationship and have a condition on the relationship or a constraint on the relationship.