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

Part 42:

**Integrated generic resource: Geometric and
topological representation**

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

ISO 10303-42:2000
*Partie 42: Ressource générique intégrée: Représentation géométrique et
topologique*
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the 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.

Attention is drawn to the possibility that some of the elements of this part of ISO 10303 may be subject to patent rights. ISO shall not be held responsible for any or all such patent rights.

International Standard ISO 10303-42 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 4, *Industrial data*.

This second edition constitutes a technical revision of the first edition (ISO 10303-42:1994), which is provisionally retained in order to support the continued use and maintenance of implementations based of the first edition and to satisfy the normative references of other parts of ISO 10303.

It incorporates the corrections published in ISO 10303-42:1994/Cor.1:1999, 10303-42:1994/Cor.2:1999 and ISO 10303-42:1994/Cor.3:—¹⁾

This International Standard is organised as a series of parts, each published separately. The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

- Parts 11 to 14 specify the description methods;
- Parts 21 to 29 specify the implementation methods;
- Parts 31 to 35 specify the conformance testing methodology and framework;
- Parts 41 to 50 specify the integrated generic resources;
- Parts 101 to 107 specify the integrated application resources;
- Parts 201 to 237 specify the application protocols;

¹⁾To be published
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- Parts 301 to 307 specify the abstract test suites;
- parts 501 to 520 specify the application interpreted constructs.

A complete list of parts of ISO 10303 is available from Internet:

`<http://www.nist.gov/sc4/editing/step/titles/>`

Should further parts of ISO 10303 be published, they will follow the same numbering pattern.

This part of ISO 10303 is a member of the integrated resources series. The integrated resources specify a single conceptual product data model.

Annexes A and B form a normative part of this part of ISO 10303. Annexes C and D are for information only.

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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 generic resource series.

This part of ISO 10303 specifies the integrated resources used for geometric and topological representation. Their primary application is for explicit representation of the shape or geometric form of a product model. The shape representation presented here has been designed to facilitate stable and efficient communication when mapped to a physical file.

The geometry in clause 4 is exclusively the geometry of parametric curves and surfaces. It includes the curve and surface entities and other entities, functions and data types necessary for their definition. A common scheme has been used for the definition of both two-dimensional and three-dimensional geometry. All geometry is defined in a coordinate system which is established as part of the context of the item which it represents. These concepts are fully defined in ISO 10303 Part 43.

The topology in clause 5 is concerned with connectivity relationships between objects rather than with the precise geometric form of objects. This clause contains the basic topological entities and specialised subtypes of these. In some cases the subtypes have geometric associations. Also included are functions, particularly constraint functions, and data types necessary for the definitions of the topological entities.

The geometric models in clause 6 provide basic resources for the communication of data describing the precise size and shape of three-dimensional solid objects. The geometric shape models provide a complete representation of the shape which in many cases includes both geometric and topological data. Included here are the two classical types of solid model, constructive solid geometry (CSG) and boundary representation (B-rep). Other entities, providing a rather less complete description of the geometry of a product, and with less consistency constraints, are also included.

This edition incorporates modifications that are upwardly compatible with the previous edition. Modifications to EXPRESS specifications are upwardly compatible if:

- instances encoded according to ISO 10303-21 and that conform to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;

- interfaces that conform to ISO 10303-22 and to an ISO 10303 application protocol based on the previous edition of this part, also conform to a revision of that application protocol based on this edition;
- the mapping tables of ISO 10303 application protocols based on the previous edition of this part remain valid in a revision of that application protocol based on this edition.

Technical modifications to ISO 10303-42:1994 are categorised as follows:

- changes to the EXPRESS declarations,
- new EXPRESS declarations.

The following EXPRESS declarations have been modified:

geometry schema:

- **axis1_placement;**
- **base_axis;**
- **build_axes;**
- **build_2axes;**
- **cartesian_transformation_operator_3d;**
- **cartesian_transformation_operator_2d;**
- **composite_curve_segment;**
- **constraints_param_b_spline;**
- **cross_product;**
- **curve_bounded_surface;**
- **default_b_spline_curve_weights;**
- **default_b_spline_knot_mult;**
- **default_b_spline_knots;**
- **default_b_spline_surface_weights;**
- **geometric_representation_item;**

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