

First edition
2000-12-01

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

Part 23: Implementation methods: C++ language binding to the standard data access interface

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

*Partie 23: Méthodes de mise en application: Liant de langage C++ à
l'interface d'accès aux données normalisées*



Reference number
ISO 10303-23:2000(E)

© ISO 2000

This is a preview of "ISO 10303-23:2000". [Click here to purchase the full version from the ANSI store.](#)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2000

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

	Page
1 Scope	1
2 Normative references	1
3 Definitions and abbreviations	2
3.1 Definitions	2
3.1.1 Terms defined in ISO 10303-1	2
3.1.2 Terms defined in ISO 10303-11	3
3.1.3 Terms defined in ISO 10303-22	3
3.1.4 Terms defined in The Annotated C++ Reference Manual	4
3.1.5 Term defined in IEEE standard	5
3.1.6 Other definitions	5
3.2 Abbreviations	6
3.3 Typographical conventions	6
4 Overall requirements	6
4.1 Characteristics of the binding functions	6
4.2 Language specific features	8
4.2.1 Names of types and operations	8
4.2.2 Memory management	8
4.3 Binding styles	8
5 Constants and data type definitions and global functions	9
5.1 SDAI namespace	9
5.2 EXPRESS built-in constants	9
5.3 EXPRESS attribute data types	10
5.3.1 Primitive data types	10
5.3.2 Aggregate and iterator data types	18
5.3.3 Enumeration data type	20
5.3.4 Select data type	22
5.3.5 Number data type	28
5.3.6 Handles	28
5.3.7 TYPE data type	29
5.3.8 ENTITY data type	30
5.3.9 Entity instance	32
5.3.10 Persistent data and persistent object identifiers	35
5.3.11 Domain equivalence for early binding	42
5.3.12 Application instance	43
5.3.13 Binding-specific data types	52
5.4 EXISTS functions	60

6	Error handling	61
6.1	Event	63
6.2	Error event	63
7	C++ binding of the SDAI operations	64
7.1	Session classes	64
7.1.1	Session_instance	64
7.1.2	Session	69
7.1.3	Implementation	75
7.1.4	Transaction	75
7.2	Schema_instance	76
7.2.1	Rename schema instance	77
7.2.2	Add SDAI-model	77
7.2.3	Remove SDAI-model	77
7.2.4	Validate global rule	77
7.2.5	Validate uniqueness rule	78
7.2.6	Validate instance reference domain	78
7.2.7	Validate schema instance	79
7.2.8	Is validation current	79
7.2.9	SDAI query	79
7.3	Schema-specific schema_instance (early binding)	80
7.4	Repository classes	80
7.4.1	Repository_contents	80
7.4.2	Repository	81
7.5	Model classes	84
7.5.1	Model	84
7.5.2	Model_contents_instances	87
7.5.3	Model_contents	87
7.5.4	Entity extent	90
7.5.5	Model contents by schema	91
7.5.6	Scope	92
7.6	Aggregate and iterator classes	93
7.6.1	Aggregate instance	93
7.6.2	Array	94
7.6.3	List	100
7.6.4	Set	105
7.6.5	Bag	108
7.6.6	Iterator	112
7.7	Dictionary Classes	116
7.7.1	Named_type	116
7.7.2	Dictionary_instance	117
7.7.3	Schema_definition	117
7.7.4	Defined_type	119
7.7.5	Entity_definition	120

7.7.6 Attribute	121
7.7.7 Derived_attribute	122
7.7.8 Explicit_attribute	122
7.7.9 Inverse_attribute	123
7.7.10 Uniqueness_rule	124
7.7.11 Where_rule	124
7.7.12 Enumeration_type	125
7.7.13 Select_type	125
7.7.14 Global_rule	126
7.7.15 Simple_type	126
7.7.16 Number_type	127
7.7.17 Integer_type	127
7.7.18 Real_type	128
7.7.19 String_type	128
7.7.20 Binary_type	129
7.7.21 Logical_type	129
7.7.22 Boolean_type	130
7.7.23 Bound	130
7.7.24 Population_dependent_bound	131
7.7.25 Integer_bound	131
7.7.26 Aggregation_type	132
7.7.27 Variable_size_aggregation_type	132
7.7.28 Set_type	133
7.7.29 Bag_type	133
7.7.30 List_type	134
7.7.31 Array_type	134
7.7.32 Underlying_type	135
7.7.33 Base_type	136
7.7.34 Constructed_type	137
7.7.35 Interface_specification	138
7.7.36 Interfaced_item	138
7.7.37 Explicit_item_id	139
7.7.38 Used_item	139
7.7.39 Referenced_item	140
7.7.40 Implicit_item_id	140
7.7.41 External_schema	141
7.7.42 Domain_equivalent_type	141
7.7.43 Type_or_rule	142
7.7.44 Explicit_or_derived	143
8 Conformance levels	144
8.1 Conformance level features	144
8.2 Header files	144
8.3 Indexing of aggregates	145

Annex A (normative) Information object registration	146
Annex B (informative) Concept of operations	147
B.1 Background	147
B.2 Influence of IDL on this part of ISO 10303	148
B.3 IDL-C++ concepts	149
B.4 Influence of POS on this part of ISO 10303	150
B.4.1 Object	150
B.4.2 SessionInstance and DAObject	150
B.4.3 SessionInstance	151
B.4.4 ModelContents	151
B.4.5 PID and PID_SDAI	151
B.4.6 DAObject and DAObject_SDAI	152
B.4.7 Application_instance and application_instance factory	152
B.4.8 PID_DA	152
B.5 Scenarios	152
Bibliography	154
Index	155
Figures	
Figure B.1 - Inheritance hierarchy	151
Tables	
Table 1 - Arguments and return values	7
Table 2 - EXPRESS built-in constants	10
Table 3 - Mapping of EXPRESS types to TypeCode values	54

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 the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10303-23 was prepared by Technical Committee ISO/TC 184, *Industrial automation and 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 for SDAI implementations;
- Part 41, Integrated generic resources: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resources: Representation structures;
- Part 44, Integrated generic resources: 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, 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;
- Part 316, Abstract test suite: Ship moulded forms;
- 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;
- Part 322, Abstract test suite: Exchange of product data for composite structures;
- Part 323, Abstract test suite: Exchange of design and manufacturing product information for casting parts;
- Part 324, Abstract test suite: Mechanical product definition for process plans using machining features;
- 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 representation;
- Part 519, Application interpreted construct: Geometric tolerances;
- Part 520, Application interpreted construct: Associative draughting.

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 107 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 520 specify the application interpreted constructs.

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

Annex A forms a normative part of this part of ISO 10303. Annex B is 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 integrated constructs, application protocols, abstract test suites, implementation methods, and conformance testing. The series is described in ISO 10303-1. This part of ISO 10303 is a member of the implementation methods series.

This part of ISO 10303 specifies a C++ language binding to the standard data access interface (SDAI). SDAI is the access interface specification to data which has been defined using ISO 10303-11. SDAI is specified in ISO 10303-22.

Computer application systems are implemented using computing or definition languages. The specification of the functionality defined in ISO 10303-22 in a particular computing or definition language is referred to as an SDAI language binding. Since there are many computing and definition languages, many SDAI language bindings are possible.

Readers of this part of ISO 10303 are advised that this part of ISO 10303 presupposes a working knowledge of the functionality of the SDAI which is described in ISO 10303-22. Moreover, this part of ISO 10303 presupposes a working knowledge of the C++ programming language. The source for the C++ programming language is specified in the normative references of this part of ISO 10303.

Major subdivisions of this part of ISO 10303 are:

- language binding characteristics, constants and data types found in clauses 4 and 5;
- language bindings to SDAI operations and error handling found in clauses 6 and 7.