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

Part 11:

**Description methods: The EXPRESS language
reference manual**

[ISO 10303-11:1994](https://standards.iso.org/iso/10303-11:1994)

[https://standards.iteh.ai/catalog/standards/sist/ab54ebcc-9bf8-4c36-9ddc-](https://standards.iteh.ai/catalog/standards/sist/ab54ebcc-9bf8-4c36-9ddc-9031d2c0a033/iso-10303-11:1994)

*Systemes d'automatisation industrielle et integration — Représentation
et échange de données de produits —*

*Partie 11: Méthodes de description: Manuel de référence du langage
EXPRESS*



Contents	Page
1 Scope	1
2 Normative references	1
3 Definitions	2
3.1 Terms defined in ISO 10303-1	2
3.2 Other definitions	2
3.2.1 complex entity data type	2
3.2.2 complex entity (data type) instance	2
3.2.3 constant	2
3.2.4 data type	2
3.2.5 entity	3
3.2.6 entity data type	3
3.2.7 entity (data type) instance	3
3.2.8 instance	3
3.2.9 partial complex entity data type	3
3.2.10 partial complex entity value	3
3.2.11 population	3
3.2.12 simple entity (data type) instance	3
3.2.13 subtype/supertype graph	3
3.2.14 token	3
3.2.15 value	3
4 Conformance requirements	3
4.1 Formal specifications written in EXPRESS	3
4.1.1 Lexical language	3
4.1.2 Graphical form	4
4.2 Implementations of EXPRESS	5
4.2.1 EXPRESS language parser	5
4.2.2 Graphical editing tool	5
5 Fundamental principles	5
6 Language specification syntax	6

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6.1	The syntax of the specification	7
6.2	Special character notation	8
7	Basic language elements	8
7.1	Character set	9
7.1.1	Digits	9
7.1.2	Letters	9
7.1.3	Special characters	10
7.1.4	Underscore	10
7.1.5	Whitespace	10
7.1.6	Remarks	11
7.2	Reserved words	12
7.2.1	Keywords	12
7.2.2	Reserved words which are operators	13
7.2.3	Built-in constants	13
7.2.4	Built-in functions	13
7.2.5	Built-in procedures	13
7.3	Symbols	14
7.4	Identifiers	14
7.5	Literals	15
7.5.1	Binary literal	15
7.5.2	Integer literal	15
7.5.3	Real literal	16
7.5.4	String literal	16
7.5.5	Logical literal	18
8	Data types	18
8.1	Simple data types	18
8.1.1	Number data type	18
8.1.2	Real data type	19
8.1.3	Integer data type	19
8.1.4	Logical data type	20
8.1.5	Boolean data type	20
8.1.6	String data type	20
8.1.7	Binary data type	21
8.2	Aggregation data types	22
8.2.1	Array data type	23
8.2.2	List data type	24
8.2.3	Bag data type	25
8.2.4	Set data type	25
8.2.5	Value uniqueness on aggregates	26
8.3	Named data types	28
8.3.1	Entity data type	28
8.3.2	Defined data type	28
8.4	Constructed data types	29
8.4.1	Enumeration data type	29

8.4.2	Select data type	30
8.5	Generalized data types	31
8.6	Data type usage classification	31
8.6.1	Base data types	32
8.6.2	Parameter data types	32
8.6.3	Underlying data types	32
9	Declarations	33
9.1	Type declaration	33
9.2	Entity declaration	35
9.2.1	Attributes	35
9.2.2	Local rules	40
9.2.3	Subtypes and supertypes	43
9.2.4	Subtype/supertype constraints	49
9.2.5	Implicit declarations	53
9.2.6	Specialization	55
9.3	Schema	55
9.4	Constant	56
9.5	Algorithms	56
9.5.1	Function	57
9.5.2	Procedure	58
9.5.3	Parameters	58
9.5.4	Local variables	62
9.6	Rule	63
10	Scope and visibility	65
10.1	Scope rules	67
10.2	Visibility rules	67
10.2.1	General rules of visibility	67
10.2.2	Named data type identifier visibility rules	68
10.3	Explicit item rules	69
10.3.1	Alias statement	69
10.3.2	Attribute	69
10.3.3	Constant	70
10.3.4	Enumeration item	70
10.3.5	Entity	70
10.3.6	Function	71
10.3.7	Parameter	72
10.3.8	Procedure	72
10.3.9	Query expression	73
10.3.10	Repeat statement	73
10.3.11	Rule	73
10.3.12	Rule label	74
10.3.13	Schema	74
10.3.14	Type	75
10.3.15	Type label	76

10.3.16	Variable	76
11	Interface specification	76
11.1	Use interface specification	77
11.2	Reference interface specification	77
11.3	The interaction of use and reference	78
11.4	Implicit interfaces	78
11.4.1	Constant interfaces	79
11.4.2	Defined data type interfaces	79
11.4.3	Entity data type interfaces	80
11.4.4	Function interfaces	81
11.4.5	Procedure interfaces	81
11.4.6	Rule interfaces	81
12	Expression	81
12.1	Arithmetic operators	83
12.2	Relational operators	85
12.2.1	Value comparison operators	85
12.2.2	Instance comparison operators	89
12.2.3	Membership operator	91
12.2.4	Interval expressions	92
12.2.5	Like operator	93
12.3	Binary operators	94
12.3.1	Binary indexing	94
12.3.2	Binary concatenation operator	95
12.4	Logical operators	95
12.4.1	NOT operator	95
12.4.2	AND operator	96
12.4.3	OR operator	96
12.4.4	XOR operator	96
12.5	String operators	96
12.5.1	String indexing	96
12.5.2	String concatenation operator	97
12.6	Aggregate operators	97
12.6.1	Aggregate indexing	98
12.6.2	Intersection operator	99
12.6.3	Union operator	99
12.6.4	Difference operator	100
12.6.5	Subset operator	102
12.6.6	Superset operator	102
12.6.7	Query expression	103
12.7	References	104
12.7.1	Simple references	104
12.7.2	Prefixed references	105
12.7.3	Attribute references	106
12.7.4	Group references	106

12.8	Function call	108
12.9	Aggregate initializer	109
12.10	Complex entity instance construction operator	110
12.11	Type compatibility	111
13	Executable statements	112
13.1	Null (statement)	112
13.2	Alias statement	113
13.3	Assignment statement	113
13.4	Case statement	114
13.5	Compound statement	115
13.6	Escape statement	116
13.7	If . . . Then . . . Else statement	116
13.8	Procedure call statement	117
13.9	Repeat statement	117
13.9.1	Increment control	118
13.9.2	While control	119
13.9.3	Until control	119
13.10	Return statement	120
13.11	Skip statement	120
14	Built-in constants	121
14.1	Constant e	121
14.2	Indeterminate	121
14.3	False	121
14.4	Pi	121
14.5	Self	122
14.6	True	122
14.7	Unknown	122
15	Built-in functions	122
15.1	Abs - arithmetic function	122
15.2	ACos - arithmetic function	122
15.3	ASin - arithmetic function	123
15.4	ATan - arithmetic function	123
15.5	BLength - binary function	123
15.6	Cos - arithmetic function	123
15.7	Exists - general function	124
15.8	Exp - arithmetic function	124
15.9	Format - general function	124
15.9.1	Symbolic representation	125
15.9.2	Picture representation	126
15.9.3	Standard representation	127
15.10	HiBound - arithmetic function	127
15.11	HiIndex - arithmetic function	127
15.12	Length - string function	128
15.13	LoBound - arithmetic function	128

15.14	Log - arithmetic function	129
15.15	Log2 - arithmetic function	129
15.16	Log10 - arithmetic function	129
15.17	LoIndex - arithmetic function	130
15.18	NVL - null value function	130
15.19	Odd - arithmetic function	130
15.20	RolesOf - general function	131
15.21	Sin - arithmetic function	132
15.22	SizeOf - aggregate function	132
15.23	Sqrt - arithmetic function	133
15.24	Tan - arithmetic function	133
15.25	TypeOf - general function	133
15.26	UsedIn - general function	135
15.27	Value - arithmetic function	136
15.28	Value_in - membership function	137
15.29	Value_unique - uniqueness function	137
16	Built-in procedures	138
16.1	Insert	138
16.2	Remove	138

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Annexes

A	EXPRESS language syntax	139
A.1	Tokens	139
A.1.1	Keywords	139
A.1.2	Character classes	142
A.1.3	Lexical elements	142
A.1.4	Remarks	143
A.1.5	Interpreted identifiers	143
A.2	Grammar rules	143
A.3	Cross reference listing	147
B	Determination of the allowed entity instantiations	155
B.1	Formal approach	155
B.2	Supertype operators	157
B.2.1	ONEOF	157
B.2.2	AND	157
B.2.3	ANDOR	157
B.2.4	Precedence of operators	157
B.3	Interpreting the possible complex entity data types	157
C	Instance limits imposed by the interface specification	168
D	EXPRESS-G: A graphical subset of EXPRESS	172
D.1	Introduction and overview	172
D.2	Definition symbols	172

D.2.1	Symbol for simple data types	174
D.2.2	Symbols for constructed data types	174
D.2.3	Symbols for defined data types	175
D.2.4	Symbols for entity data types	175
D.2.5	Symbols for functions and procedures	175
D.2.6	Symbols for rules	175
D.2.7	Symbols for schemas	176
D.3	Relationship symbols	176
D.4	Composition symbols	177
D.4.1	Page references	178
D.4.2	Inter-schema references	178
D.5	Entity level diagrams	179
D.5.1	Role names	179
D.5.2	Cardinalities	179
D.5.3	Constraints	179
D.5.4	Constructed and defined data types	180
D.5.5	Entity data types	180
D.5.6	Inter-schema references	182
D.6	Schema level diagrams	183
D.7	Complete EXPRESS-G diagrams	184
D.7.1	Complete entity level diagram	184
D.7.2	Complete schema level diagram	185
E	Protocol implementation conformance statement (PICS)	187
E.1	EXPRESS language parser	187
E.2	EXPRESS-G editing tool	187
F	Information object registration	189
G	Relationships	190
G.1	Relationships via attributes	190
G.1.1	Simple relationship	191
G.1.2	Collective relationship	193
G.1.3	Distributive relationship	194
G.1.4	Inverse attribute	196
G.2	Subtype/supertype relationships	197
H	EXPRESS models for EXPRESS-G illustrative examples	198
H.1	Example single schema model	198
H.2	Relationship sampler	199
H.3	Simple subtype/supertype tree	200
H.4	Attribute redeclaration	201
H.5	Multi-schema models	201
J	Bibliography	204
Index	205

Figures

B.1	EXPRESS-G diagram of schema for example 155.	160
B.2	EXPRESS-G diagram of schema for example 156.	162
B.3	EXPRESS-G diagram of schema for example 157.	164
D.1	Complete entity level diagram of example 171 (Page 1 of 2).	173
D.2	Complete entity level diagram of example 171 (Page 2 of 2).	173
D.3	Symbols for EXPRESS simple data types.	174
D.4	Symbols for EXPRESS constructed data types.	174
D.5	Abbreviated symbols for the EXPRESS constructed data types when used as the representation of defined data types.	175
D.6	Example of alternative methods for representing an ENUMERATION	175
D.7	Symbols for EXPRESS defined data type.	175
D.8	Symbol for an EXPRESS entity data type.	176
D.9	Symbol for a schema.	176
D.10	Relationship line styles	176
D.11	Partial entity level diagram illustrating relationship directions from example 172. (Page 1 of 1)	177
D.12	Composition symbols: page references	178
D.13	Composition symbols: inter-schema references	178
D.14	Complete entity level diagram of example 172. (Page 1 of 1)	180
D.15	Complete entity level diagram of the inheritance graph from example 173. (Page 1 of 1)	182
D.16	Complete entity level diagram of example 174 showing attribute redeclarations in subtypes. (Page 1 of 1)	182
D.17	Complete entity level diagram of the top schema of example 175 illustrating inter- schema references. (Page 1 of 1).	183
D.18	Complete schema level diagram of example 175. (Page 1 of 1)	184
D.19	Complete schema level diagram of example 176. (Page 1 of 1)	184

Tables

1	EXPRESS keywords	12
2	EXPRESS reserved words which are operators	13

3	EXPRESS reserved words which are constants	13
4	EXPRESS reserved words which are function names	13
5	EXPRESS reserved words which are procedure names	14
6	EXPRESS symbols	14
7	The use of data types	32
8	Supertype expression operator precedence	53
9	Scope and identifier defining items	66
10	Operator precedence	83
11	Pattern matching characters	94
12	NOT operator	96
13	AND operator	97
14	OR operator	98
15	XOR operator	98
16	Intersection operator – operand and result types	100
17	Union operator – operand and result types	101
18	Difference operator – operand and result types	102
19	Subset and superset operators - operand types	102
20	Example symbolic formatting effects	126
21	Picture formatting characters	126
22	Example picture formatting effects	127

Foreword

The International Organization for Standardization (ISO) 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 10303-11 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data and global manufacturing programming languages*.

This part of ISO 10303 is based in part upon material in:

- ISO 10646-1:1993, Information technology – Universal multiple-octet coded character set (UCS) – Architecture and basic multilingual plane.

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 21, Implementation methods: Clear text encoding of the exchange structure;
- Part 22, Implementation methods: Standard data access interface specification;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- 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 resources: Materials;
- Part 46, Integrated generic resources: Visual presentation;

- Part 47, Integrated generic resources: Shape variation tolerances;
- Part 49, Integrated generic resources: Process structure and properties;
- Part 101, Integrated application resources: Draughting;
- Part 104, Integrated application resources: Finite element analysis;
- Part 105, Integrated application resources: Kinematics;
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 210, Application protocol: Printed circuit assembly product design data;
- Part 213, Application protocol: Numerical control process plans for machined parts.

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

- Part 11 specifies the description methods;
- Parts 21 and 22 specify the implementation methods;
- Parts 31 and 32 specify the conformance testing methodology and framework;
- Parts 41 to 49 specify the integrated generic resources;
- Parts 101 to 105 specify the integrated application resources;
- Parts 201 to 213 specify the application protocols.

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

Annexes A, B, C, D, E and F form an integral part of this part of ISO 10303. Annexes G, H and J 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 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 descriptive methods series.

This part of ISO 10303 specifies the elements of the *EXPRESS* language. Each element of the language is presented in its own context with examples. Simple elements are introduced first, then more complex ideas are presented in an incremental manner.

Language overview

EXPRESS is the name of a formal information requirements specification language. It is used to specify the information requirements of other parts of this International Standard. It is based on a number of design goals among which are:

- the size and complexity of ISO 10303 demands that the language be parsable by both computers and humans. Expressing the information elements of ISO 10303 in a less formal manner would eliminate the possibility of employing computer automation in checking for inconsistencies in presentation or for creating any number of secondary views, including implementation views;
- the language is designed to enable partitioning of the diverse material addressed by ISO 10303. The schema is the basis for partitioning and intercommunication;
- the language focuses on the definition of entities, which represent objects of interest. The definition of an entity is in terms of its properties, which are characterized by specification of a domain and the constraints on that domain;
- the language seeks to avoid, as far as possible, specific implementation views. However, it is possible to manufacture implementation views (such as static file exchange) in an automatic and straightforward manner.

In *EXPRESS*, entities are defined in terms of attributes: the traits or characteristics considered important for use and understanding. These attributes have a representation which might be a simple data type (such as integer) or another entity type. A geometric point might be defined in terms of three real numbers. Names are given to the attributes which contribute to the definition of an entity. Thus, for a geometric point the three real numbers might be named *x*, *y* and *z*. A relationship is established between the entity being defined and the attributes that define it, and, in a similar manner, between the attribute and its representation.

NOTES

1 – A number of languages have contributed to *EXPRESS*, in particular, Ada, Algol, C, C++, Euler, Modula-2, Pascal, PL/I and SQL. Some facilities have been invented to make *EXPRESS* more suitable for the job of expressing an information model.

2 – The examples of *EXPRESS* usage in this manual do not conform to any particular style rules. Indeed, the examples sometimes use poor style to conserve space or to show flexibility. The examples are not intended to reflect the content of the information models defined in other parts of this International Standard. They are crafted to show particular features of *EXPRESS*. Any similarity between the examples and the normative information models specified in other parts of ISO 10303 should be ignored.

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Industrial automation systems and integration — Product data representation and exchange — Part 11 : Description methods: The EXPRESS language reference manual

1 Scope

This part of ISO 10303 defines a language by which aspects of product data can be specified. The language is called *EXPRESS*.

This part of ISO 10303 also defines a graphical representation for a subset of the constructs in the *EXPRESS* language. This graphical representation is called *EXPRESS-G*.

EXPRESS is a data specification language as defined in ISO 10303-1. It consists of language elements which allow an unambiguous data definition and specification of constraints on the data defined.

The following are within the scope:

- data types; [ISO 10303-11:1994](https://standards.iteh.ai/catalog/standards/sist/ab54ebcc-9bf8-4c36-9ddc-317956d1edee/iso-10303-11-1994)
- constraints on instances of the data types.

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

- definition of database formats;
- definition of file formats;
- definition of transfer formats;
- process control;
- information processing;
- exception handling.

EXPRESS is not a programming language.

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