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

**Part 17:  
Description methods: EXPRESS to  
SysML CXMI transformation**

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

*Partie 17: Méthodes de description: Transformation EXPRESS vers  
SysML CXMI*



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# Contents

Page

<b>Foreword</b>	<b>iv</b>
<b>Introduction</b>	<b>v</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms, definitions and abbreviated terms</b>	<b>2</b>
3.1 Terms related to generic concepts	2
3.2 Terms related to EXPRESS constructs	3
3.3 Terms related to SysML constructs	4
3.4 Abbreviated terms	6
<b>4 EXPRESS to SysML CXMI</b>	<b>6</b>
4.1 General	6
4.2 Presentation conventions	7
4.3 Common mapping conventions	8
4.3.1 Reference to external files	8
4.3.2 Treatment of Xmi:id, xmi:uuid, and UUID	8
4.3.3 Assumed sysml:Block in fragments	8
4.3.4 Containment and reference relationships	9
4.3.5 Used stereotypes to represent EXPRESS concepts	9
4.3.6 Select type and supertype	9
4.4 Mapping of a schema	9
4.5 Mapping of entities	10
4.5.1 General mapping of an entity	10
4.5.2 Mapping of abstract supertype	10
4.5.3 Mapping of entity with one supertype	11
4.5.4 Mapping of entity with multiple supertypes	11
4.5.5 Constraints between subtypes	12
4.5.6 Mapping of entity attribute	12
4.5.7 Local rules	19
4.6 Mapping of global rules	19
4.7 Mapping of type	20
4.7.1 Mapping of simple type	20
4.7.2 Mapping of aggregation types	22
4.7.3 Mapping of nested of aggregation types	25
4.7.4 Mapping of select type	30
4.7.5 Proxy artefact	33
4.7.6 Mapping of enumeration type	33
<b>Annex A (normative) Information object registration</b>	<b>36</b>
<b>Annex B (informative) EXPRESS / Information modelling constructs and the equivalent SysML modelling constructs</b>	<b>37</b>
<b>Bibliography</b>	<b>44</b>

## 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.

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 documents 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://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*.

A list of all parts in the ISO 10303 series can be found on the ISO website.

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](http://www.iso.org/members.html).

## Introduction

The ISO 10303 series of international standards describe the computer-interpretable representation of product information in the exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product and 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.

The EXPRESS language and the EXPRESS-G diagrams are specified in ISO 10303-11. It is used to specify the information requirements of other parts of the ISO 10303 series.

This document is a member of the description methods series. This document specifies a mapping of EXPRESS to SysML CXMI. This document supports the STEP Extended Architecture<sup>[9][10][11]</sup>.

The Object Management Group (OMG) has standardized the XML Metadata Interchange specification (XMI), and the Canonical XML Metadata Interchange specification (CXMI) that integrates the OMG Systems Modeling Language (SysML), the OMG Unified Modeling Language (UML), and the World Wide Web Consortium (W3C) Extensible Mark-up Language (XML)<sup>[12]</sup>. SysML inherits the CXMI interchange capability from UML. CXMI is a mechanism for the interchange of metadata and formal diagrams between UML-based modeling tools. OMG has also standardized an CXMI compliant interchange format for the SysML thus specifying a lexical representation of SysML models based on a standardized metamodel of the SysML.

This document specifies a description method of the STEP parts family, which defines the transformation of a subset of EXPRESS constructs to SysML. Because the CXMI standard specifies the XML representation of SysML metamodel constructs, standardizing the mapping of EXPRESS constructs into SysML constructs supports the representation of EXPRESS schemas as SysML models.

The specified mapping is a one-way transformation from a subset of an EXPRESS schema to a SysML model represented by an CXMI specification. These limitations make the mapping unsuitable for the transformation of arbitrary EXPRESS schemas to SysML models.

A detailed knowledge of the of the EXPRESS and SysML languages is useful.



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

## Part 17:

## Description methods: EXPRESS to SysML CXMI transformation

### 1 Scope

This document specifies a mapping of EXPRESS (ISO 10303-11) constructs to SysML constructs for the purpose of representing EXPRESS schemas in SysML models. The specified mapping is a one-way transformation from an EXPRESS schema to a SysML information model.

The following are within the scope of this document:

- the specification of the transformation of EXPRESS constructs to SysML constructs represented in CXMI;
- the specification of the transformation of EXPRESS UNIQUE rules to SysML constructs represented in CXMI;
- the specification of the transformation of derived attributes to implement renaming to SysML constructs represented in CXMI.

The following are outside the scope of this document:

- the transformation of EXPRESS elements into SysML metamodel constructs that are not used in the STEP Extended Architecture<sup>[9][10][11]</sup>;
- transformation of EXPRESS FUNCTIONS;
- transformation of EXPRESS-G to SysML diagrams;
- tools, codes, and scripts to transform an EXPRESS schema to SysML CXMI;
- transformation of EXPRESS interface specification;
- SysML constraints transformation from EXPRESS DERIVE attributes, except the ones used for renaming;
- SysML constraints transformation from EXPRESS SUPERTYPE expressions;
- SysML constraints transformation from EXPRESS GLOBAL rules;
- SysML constraints transformation from EXPRESS WHERE rules.

**NOTE** EXPRESS DERIVE attributes, EXPRESS SUPERTYPE expressions, EXPRESS GLOBAL rules and EXPRESS WHERE rules are transformed into OCL<sup>[2]</sup> specifications. OCL specifications are integrated in the SysML model based on a separate process.

### 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 10303-11:2004, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO/IEC 19505-1:2012, *Information technology — Object Management Group Unified Modeling Language (OMG UML) — Part 1: Infrastructure*

ISO/IEC 19509:2014, *Information technology — Object Management Group XML Metadata Interchange (XMI)*

ISO/IEC 19514:2017, *Information technology — Object management group systems modeling language (OMG SysML)*

### 3 Terms, definitions and abbreviated terms

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 Terms related to generic concepts

##### 3.1.1

##### **EXPRESS**

data specification language that consists of language elements that allow an unambiguous data definition and specification of constraints on the data defined

Note 1 to entry: The elements of the EXPRESS language are specified in ISO 10303-11.

##### 3.1.2

##### **data**

representation of information in a formal manner suitable for communication, interpretation, or processing by human beings or computers

[SOURCE: ISO 10303-1:2021, 3.1.29]

##### 3.1.3

##### **data model**

description of the organization of data in the management information system of an enterprise

[SOURCE: ISO/IEC 2382:2015, 2121422, modified — Notes 1 and 2 to entry were removed.]

##### 3.1.4

##### **information**

facts, concepts, or instructions

[SOURCE: ISO 10303-1:2021, 3.1.41]

##### 3.1.5

##### **resulting CXMI**

CXMI based on the transformation specification

##### 3.1.6

##### **information model**

conceptual model of product data

Note 1 to entry: In ISO 10303, an information model is based on the Object-relationship modeling technique that organizes the product data as represented in different system aspects.