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IEC 62264-2

First edition
2004-07

Enterprise-control system integration –

Part 2:
Object model attributes

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Reference number
IEC 62264-2:2004(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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CONTENTS

FOREWORD 7
INTRODUCTION 9
1 Scope 10
2 Normative references 10
3 Terms and definitions 10
4 Object model attributes 11
4.1 General 11
4.2 Attribute extensibility 11
4.3 Object model structure 11
4.4 Explanation of tables 12
4.5 Personnel 15
4.6 Equipment 18
4.7 Material 24
4.8 Process segment 29
4.9 Production capability 35
4.10 Process segment capability 43
4.11 Product definition 49
4.12 Production schedule 55
4.13 Production performance 64
4.14 Summary of objects 72
4.15 List of objects 74
5 Compliance 77
Annex A (informative) Use and examples 78
A.1 Use and examples 78
A.2 Application of the standard 81
A.3 Database mapping of the models 82
A.4 XML usage 83
Annex B (informative) Example data sets 87
B.1 Introduction 87
B.2 Material model example 87
B.3 Personnel model example 89
B.4 Equipment model example 90
B.5 Production capability example 91
B.6 Production performance example 92
Annex C (informative) Questions and answers about object use 93
C.1 Introduction 93
C.2 Inflow materials 93
C.3 Multiple products per process segment 93
C.4 Process segments vs. product segments 94
C.5 Production parameter references 95

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IEC 62264-2:2004
https://standards.iteh.ai/catalog/standards/sist/4483141f-ee33-4255-a8e4-a131d8fcb388/iec-62264-2-2004

C.6 How class name and property names are used to identify elements 96
C.7 Possible capability over-counts 97
C.8 Routing and process capability 98
C.9 Product and process capability dependencies 100
C.10 Representation of dependencies 101
C.11 Representation of material produced and consumed 102
C.12 Material produced and the capability model 102
C.13 How a material transfer is handled 102
C.14 Why the maintenance and QA models are different from the production model 103

Annex D (informative) Logical information flows 104

Figure 1 – Detailed relationship models 14
Figure 2 – Personnel model 15
Figure 3 – Equipment model 18
Figure 4 – Material model 24
Figure 5 – Process segment model 29
Figure 6 – Production capability model 35
Figure 7 – Process segment capability 43
Figure 8 – Product definition model 49
Figure 9 – Production schedule model 55
Figure 10 – Production performance model 64
Figure 11 – Object model inter-relationships 73
Figure A.1 – Personnel model 79
Figure A.2 – Instances of a person class 80
Figure A.3 – UML model for class and class properties 80
Figure A.4 – Class property 80
Figure A.5 – Instances of a person properties 81
Figure A.6 – Instances of person and person properties 81
Figure A.7– XML schema for a person object 84
Figure A.8 – XML schema for person properties 84
Figure A.9 – Example of person and person property 85
Figure A.10 – Example of person class information 85
Figure A.11 – Adaptor to map different property names and values 86
Figure C.1 – Class and property names used to identify elements 96
Figure C.2 – A property defining overlapping subsets of the capability 98
Figure C.3 – Routing for a product 99
Figure C.4 – Routing with co-products and material dependencies 99
Figure C.5 – Product and process capability relationships 100
Figure C.6 – Time-based dependencies 101
Figure C.7 – Maintenance schedule and performance model 103
Figure D.1 – Enterprise to manufacturing system logical information flows 104
Figure D.2 – Logical information flows among multiple systems 105

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IEC 62264-2:2004
https://standards.iteh.ai/catalog/standards/sist/4483141f-ee33-4255-a8e4-a131d8fcb388/iec-62264-2-2004

Table 1 – UML notation used 12
Table 2 – Example table 13
Table 3 – Attributes of personnel class 15
Table 4 – Attributes of personnel class property 16
Table 5 – Attributes of person 16
Table 6 – Attributes of person property 17
Table 7 – Attributes of qualification test specification 17
Table 8 – Attributes of qualification test result 18
Table 9 – Attributes of equipment class 19
Table 10 – Attributes of equipment class property 19
Table 11 – Attributes of equipment 20
Table 12 – Attributes of equipment property 20
Table 13 – Attributes of equipment capability test specification 21
Table 14 – Attributes of equipment capability test result 21
Table 15 – Attributes of maintenance request 22
Table 16 – Attributes of maintenance work order 22
Table 17 – Attributes of maintenance response 23
Table 18 – Attributes of material class 24
Table 19 – Attributes of material class property 25
Table 20 – Attributes of material definition 25
Table 21 – Attributes of material definition property 25
Table 22 – Attributes of material lot 26
Table 23 – Attributes of material lot property 26
Table 24 – Attributes of material sublot 27
Table 25 – Attributes of QA test specification 27
Table 26 – Attributes of QA test result 28
Table 27 – Attributes of process segment 30
Table 28 – Attributes of personnel segment specification 30
Table 29 – Attributes of personnel segment specification property 31
Table 30 – Attributes of equipment segment specification 31
Table 31 – Attributes of equipment segment specification property 32
Table 32 – Attributes of material segment specification 32
Table 33 – Attributes of material segment specification property 33
Table 34 – Attributes of process segment parameter 33
Table 35 – Attributes of process segment dependency 34
Tabe 36 – Attributes of production capability 36
Table 37 – Attributes of personnel capability 37
Table 38 – Attributes of personnel capability property 38
Table 39 – Attributes of equipment capability 39

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62264-2:2004
https://standards.iteh.ai/catalog/standards/sist/44831141f-ee33-4255-a8e4-d131a8fcb388/iec-62264-2-2004

Table 40 – Attributes of equipment capability property 40
Table 41 – Attributes of material capability 41
Table 42 – Attributes of material capability property 42
Table 43 – Attributes of process segment capability 44
Table 44 – Attributes of personnel segment capability 45
Table 45 – Attributes of personnel segment capability property 45
Table 46 – Attributes of equipment segment capability 46
Table 47 – Attributes of equipment segment capability property 46
Table 48 – Attributes of material segment capability 47
Table 49 – Attributes of material segment capability property 48
Table 50 – Attributes of product definition 50
Table 51 – Attributes of manufacturing bill 50
Table 52 – Attributes of product segment 51
Table 53 – Attributes of product parameter 51
Table 54 – Attributes of personnel specification 51
Table 55 – Attributes of personnel specification property 52
Table 56 – Attributes of equipment specification 52
Table 57 – Attributes of equipment specification property 53
Table 58 – Attributes of mmaterial specification 53
Table 59 – Attributes of material specification property 54
Table 60 – Attributes of product segment dependency 54
Table 61 – Attributes of production schedule 56
Table 62 – Attributes of production request 56
Table 63 – Attributes of segment requirement 57
Table 64 – Attributes of production parameter 58
Table 65 – Attributes of personnel requirement 58
Table 66 – Attributes of personnel requirement property 59
Table 67 – Attributes of equipment requirement 59
Table 68 – Attributes of equipment requirement property 60
Table 69 – Attributes of material produced requirement 60
Table 70 – Attributes of material produced requirement property 61
Table 71 – Attributes of material consumed requirement 61
Table 72 – Attributes of material consumed requirement property 62
Table 73 – Attributes of consumable expected 62
Table 74 – Attributes of consumable expected property 63
Table 75 – Attributes of production performance 65
Table 76 – Attributes of production response 65
Table 77 – Attributes of segment response 66
Table 78 – Attributes of production data 67
Table 79 – Attributes of personnel actual 67
Table 80 – Attributes of personnel actual property 68
Table 81 – Attributes of equipment actual 68
Table 82 – Attributes of equipment actual property 69

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62264-2:2004
https://standards.iteh.ai/catalog/standards/sist/4483141f-ee33-4255-a8e4-a151f8fc0388/iec-62264-2-2004

Table 83 – Attributes of material produced actual 69
Table 84 – Attributes of material produced actual property 70
Table 85 – Attributes of material consumed actual 70
Table 86 – Attributes of material consumed actual property 71
Table 87 – Attributes of consumable actual 71
Table 88 – Attributes of consumable actual property 72
Table 89 – Personnel model objects 74
Table 90 – Equipment model objects 74
Table 91 – Material model objects 74
Table 92- Process segment model objects 75
Table 93 – Production capability model objects 75
Table 94 – Process segment capability model objects 75
Table 95 – Product definition object models 75
Table 96 – Production schedule model objects 76
Table 97 – Production performance object models 76
Table A.1 – Attributes of person 79
Table A.2 – Database structure for person 82
Table A.3 – Database structure for person property 82
Table A.4 – Database for person with data 82
Table C.1 – Definition of segment types 95

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62264-2:2004
https://standards.iteh.ai/catalog/standards/sist/4483141f-ee33-4255-a8e4-a131d8fcb388/iec-62264-2-2004

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 2: Object model attributes

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International Standard IEC 62264-2 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control, and ISO SC5, JWG 15, of ISO technical committee 184: Enterprise-control system integration.

It is published as double logo standard.

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This standard was submitted to the National Committees for voting under the Fast Track Procedure as the following documents:

FDIS	Report on voting
65A/408/FDIS	65A/416/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 10 P members out of 11 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 62264 consists of the following parts under the general title *Enterprise-control system integration:*

Part 1: Models and terminology

Part 2: Object model attributes

Part 3: Models of manufacturing operations

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- reconfirmed;
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A bilingual version may be issued at a later date.

INTRODUCTION

IEC 62264 is a multi-part standard that defines the interface content between enterprise activities and control activities. This part of IEC 62264 provides the definitions of the attributes of the object models in IEC 62264-1.

IEC 62264 defines object models of exchanged information between enterprise systems and control systems. This part of IEC 62264 adds details to the object models through the definition of attributes, so that implement able interfaces may be constructed. IEC 62264 does not define models of enterprise objects or control objects.

The area of concern of this standard is strongly related to the ISO TC 184 (Industrial automation systems and integration) scope. Nevertheless the objectives and approaches are completely different and complementary. Relevant TC184 standards or work in progress address the modeling of enterprise and/or the modeling of enterprise objects whereas this standard specifies the content of interfaces between control functions and enterprise functions. The functions may be precisely modeled with TC184 standards. See ISO/IEC 62264-1 Annex A for further details.

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 2: Object model attributes

1 Scope

This part of IEC 62264, in conjunction with IEC 62264-1, specifies generic interface content between manufacturing control functions and other enterprise functions. The interfaces considered are the interfaces between Levels 3 and 4 of the hierarchical model defined in IEC 62264-1. The goal is to reduce the risk, cost, and errors associated with implementing these interfaces.

Since IEC 62264 covers many domains, and there are many different standards in those domains, the semantics of this Standard are described at a level intended to enable the other standards to be mapped to these semantics. To this end, this Standard defines a set of generic interfaces content elements, together with a mechanism for extending those elements for implementations.

The scope of this part of IEC 62264 is limited to the definition of attributes of the IEC 62264-1 object models.

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This part of IEC 62264 does not define attributes to represent the object relationships defined in IEC 62264-1.

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2 Normative references

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The following referenced documents are indispensable for the application 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.

IEC 62264-1, *Enterprise-Control System Integration – Part 1: Models and terminology*

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

ISO 15704:2000, *Industrial automation systems – Requirements for enterprise–reference architectures and methodologies*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62264-1 as well as the following apply.

3.1
event
representation of a solicited or unsolicited fact indicating a state change in the enterprise

3.2
product
the desired output or by-product of the processes of an enterprise

NOTE 1 A product may be an intermediate product or end product from a business perspective.

NOTE 2 Also defined in ISO 10303-1 as: 'a substance produced by a natural or artificial process'.

3.3
property
object denoting an implementation specific characteristic of an entity

4 Object model attributes

4.1 General

This clause describes the attributes associated with the objects listed in IEC 62264-1.

Tables 3 to 88 in Clause 4 define the attributes of objects defined in IEC 62264-1, Clause 7. The attributes are an extension to the object information model presented in IEC 62264-1 and are thus a part of the definition of terms. The attributes of this part of IEC 62264 and the object models of IEC 62264-1 define interface content for integration of Level 3 and Level 4 enterprise-control systems. See also IEC 62264-1, Clause 7.4.

In this part of IEC 62264, the word "Class" used as part of an object definition name is to be considered as a category, not as a "Class" in the object-oriented sense.

EXAMPLE "Personnel class" is to be considered a "personnel category", in the sense of distinguishing between the kinds of personnel in the real world.

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A minimum set of industry-independent information has been defined, in this part of IEC 62264, as attributes. However, values for all attributes may not be required depending on the actual usage of the models. If additional information, including industry- and application-specific information, is needed, it shall be represented as property objects. This mechanism is the extension capability referenced in Clause 1. This solution increases the usability through the use of standard attributes, and allows flexibility and extensibility through the use of properties. This was done to make the standard as widely applicable as possible.

4.2 Attribute extensibility

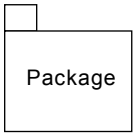
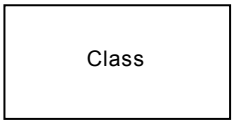
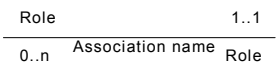
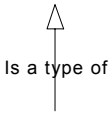
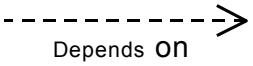
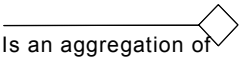
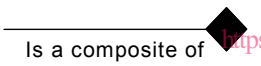
For particular applications, the objects defined in the object models will need to be extended through the addition of attributes to object class definitions. Accordingly, this part of IEC 62264 provides for attributes that are application or industry specific, to be modeled in terms of properties and represented in property classes in the model. For example, the personnel class property would be used to define application or industry specific attributes for personnel classes, and person property would be used to contain instance values for the properties.

4.3 Object model structure

The object models are depicted using the Unified Modelling Language (UML) notational methodology.

Table 1 defines the UML notations used in the object diagrams.

Table 1 – UML notation used

Symbol	Definition
	Defines a package, a collection of object models, state models, use classes, and other UML models. In this document a package is used to specify an external model, such as a production rule model, or a reference to another part of the model.
	Defines a class of objects, each with the same types of attributes. Each object is uniquely identifiable or enumerable. No operations or methods are listed for the classes. Attributes with a " – " before their name indicate attributes that are generally optional in any use of the class.
	An association between elements of a class and elements of another or the same class. Each association is identified. May have the expected number or range of members of the subclass, when '*n*' indicates an indeterminate number. For example, 0,*n* means that zero or more members of the subclass may exist.
	Generalization (arrow points to the super class) shows that an element of the class is a specialized type of the super class.
	Dependence is a weak association that shows that a modelling element depends on another modelling element. The item at the tail depends on the item at the head of the relationship.
	Aggregation (made up of) shows that an element of the class is made up of elements of other classes.
	Composite shows a strong form of aggregation, which requires that a part instance be included in at most one composite at a time and that the composite object has sole responsibility for disposition of its parts.

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4.4 Explanation of tables

4.4.1 Tables of attributes

This subclause gives the meaning of the attribute tables. This includes a listing of the object identification, data types, and presentation of the examples in the tables.

4.4.2 Object identification

Many objects in the information model require unique identifications (IDs). These IDs shall be unique within the scope of the exchanged information. This may require translations:

– from the internal ID of the source system to the interface content ID;

– from the interface content ID to the internal ID of the target system.

EXAMPLE A unit may be identified as "X6777" in the interface content, as resource "R100011" in the business system, and as "East Side Reactor" in the control system.

A unique identification set shall be agreed to in order to exchange information.

The object IDs are used only to identify objects within related exchanged information sets. The object ID attributes are not global object IDs or database index attributes.

Generally, objects that are elements of aggregations, and are not referenced elsewhere in the model, do not require unique IDs.

4.4.3 Data types

The attributes presented are abstract representations, without any specific data type specified. A specific implementation will show how the information is represented.

Example 1 An attribute may be represented as a string in one implementation and as a numeric value in another implementation.

Example 2 A date/time value may be represented in ISO standard format in one implementation and in Julian calendar format in another.

Example 3 A relationship may be represented by two fields (type and key) in database tables or by a specific tag in XML.

4.4.4 Presentation of examples

Examples are included with each attribute given. Where multiple examples are used, there are multiple rows in the right hand column. See Table Table 2 below for how the example rows and columns are used.

Table 2 – Example table

Attribute name	Description	Examples
Name of first attribute	Description of first attribute	Example #1 for first attribute
		Example #2 for first attribute
		Example #3 for first attribute
Name of second attribute	Description of second attribute	Example #1 for second attribute
		Example #2 for second attribute
		Example #3 for second attribute
Name of third attribute	Description of third attribute	Example #1 for third attribute
		Example #2 for third attribute
		Example #3 for third attribute

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When an example value is a set of values, or a member of a set of values, the set of values is given within a set of braces, {}.

The examples are purely fictional. They are provided to further describe attributes in the model. No attempt was made to make the examples complete or representative of any manufacturing enterprise.

4.4.5 Data relationships

The models used to document a reference to a resource, in another package, using the class or instance, with additional optional specification using properties, are not fully illustrated in the IEC 62264-1 object model figures. This relationship does not conform to the Unified Modeling Language (UML) modeling methodology, but was done to keep the diagrams simpler. Figure 1 illustrates how it is currently presented, on the left side, and how it could be more accurately modeled in UML on the right side. UML was used in this standard as a visualization method and not meant to describe implementations. The simplified relationship diagram method is used for the following objects and their relationship to another package: