

# INTERNATIONAL STANDARD

**IEC  
62264-1**

First edition  
2003-03

---

---

## Enterprise-control system integration –

### Part 1: Models and terminology

iTech Standards  
(<https://standards.iteh.ai>)  
Document Preview

[IEC 62264-1:2003](https://standards.iteh.ai/standards/iec/62264-1:2003)

<https://standards.iteh.ai/standards/iec/62264-1:2003>



Reference number  
IEC 62264-1:2003(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.

## Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

## Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** ([www.iec.ch](http://www.iec.ch))

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site ([http://www.iec.ch/searchpub/cur\\_fut.htm](http://www.iec.ch/searchpub/cur_fut.htm)) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications ([http://www.iec.ch/online\\_news/justpub/jp\\_entry.htm](http://www.iec.ch/online_news/justpub/jp_entry.htm)) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: [custserv@iec.ch](mailto:custserv@iec.ch)  
Tel: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

# IEC 62264-1

First edition  
2003-02

---

---

## Enterprise-control system integration –

### Part 1: Models and terminology

iTech Standards  
(<https://standards.itih.ai>)  
Document Preview

[IEC 62264-1:2003](https://standards.itih.ai/standards/iec/62264-1-2003)

<https://standards.itih.ai/standards/iec/62264-1-2003>

© IEC 2003

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 the publisher.

IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland

---

---



PRICE CODE **XG**

*For price, see current catalogue*

## CONTENTS

FOREWORD .....	5
INTRODUCTION .....	7
1 Scope.....	9
2 Normative references .....	9
3 Terms and definitions .....	10
4 Enterprise-control system integration overview.....	13
4.1 Introduction .....	13
4.2 Criteria for inclusion in manufacturing operations and control domain.....	14
5 Hierarchy models .....	15
5.1 Hierarchy model introduction .....	15
5.2 Scheduling and control hierarchy .....	15
5.3 Equipment hierarchy .....	19
5.4 Decision hierarchy .....	21
6 Functional data flow model.....	22
6.1 Functional data flow model contents .....	22
6.2 Functional data flow model notation.....	22
6.3 Functional enterprise-control model.....	23
6.4 Functions.....	23
6.5 Information flows .....	29
7 Object model.....	34
7.1 Model explanation .....	34
7.2 Categories of information.....	35
7.3 Object model structure.....	42
7.4 Object model extensibility .....	43
7.5 Resources and views.....	43
7.6 Production capability information .....	52
7.7 Product definition information .....	56
7.8 Production information.....	59
7.9 Model cross-reference .....	67
8 Completeness, compliance and conformance .....	70
8.1 Completeness.....	70
8.2 Compliance .....	70
8.3 Conformance .....	70
Annex A (informative) IEC 62264 relationship with some other standardization work in the manufacturing related area.....	71
Annex B (informative) Business drivers and key performance indicators .....	77
Annex C (informative) Discussion on models.....	84
Annex D (informative) Selected elements of the Purdue Reference Model.....	87
Annex E (informative) PRM correlation to MESA International model and IEC 62264 models.....	131
Annex F (informative) Systems, resources, capability, capacity and time .....	134
Bibliography.....	141

Figure 1 – Outline of models in the standard .....	13
Figure 2 – Enterprise-control system interface .....	14
Figure 3 – Functional hierarchy .....	15
Figure 4 – Equipment hierarchy.....	19
Figure 5 – Functional enterprise/control model.....	23
Figure 6 – Areas of information exchange .....	35
Figure 7 – Production capability information .....	36
Figure 8 – Process segment capabilities .....	37
Figure 9 – Production information definition .....	38
Figure 10 – Example of process segments .....	39
Figure 11 – Possible information overlaps .....	40
Figure 12 – Production information.....	40
Figure 13 – Segment relationships .....	42
Figure 14 – Personnel model.....	44
Figure 15 – Equipment model.....	45
Figure 16 – Material model.....	48
Figure 17 – Process segment model .....	51
Figure 18 – Production capability model.....	53
Figure 19 – Process segment capability model.....	55
Figure 20 – Current and future capacities.....	56
Figure 21 – Product definition model.....	57
Figure 22 – Production schedule model.....	60
Figure 23 – Production performance model .....	64
Figure 24 – Object model inter-relations.....	68
Figure B.1 – Multiple business and production processes.....	78
Figure C.1 – Scope for Purdue Reference Model (PRM) for manufacturing.....	86
Figure D.1 – Assumed hierarchical computer control structure for a large manufacturing complex.....	88
Figure D.2 – Assumed hierarchical computer control system structure for an industrial plant.....	89
Figure D.3 – Assumed hierarchical computer control structure for an industrial company to show Level 5 and its relationship to Level 4.....	90
Figure D.4 – Definition of the real tasks of the hierarchical computer control system (as modified).....	94
Figure D.5 – Hierarchy arrangement of the steel plant control to show relationship of hierarchy to plant structure.....	99
Figure D.6 – Hierarchy arrangement of the steel plant control system as studied for energy optimization.....	99
Figure D.7 – Hierarchy arrangement of the paper-mill control to show relationship of hierarchy to plant structure.....	100
Figure D.8 – The hierarchy control scheme as applied to a petrochemical plant .....	100
Figure D.9 – The hierarchy control scheme as applied to a pharmaceuticals plant .....	101
Figure D.10 – Computer-integrated manufacturing system (CIMS) (Cincinnati-Milicron proposal).....	101
Figure D.11 – Relationship of the several classes of functional entities which comprise the CIM reference model and computer-integrated manufacturing itself.....	109

Figure D.12 – Major external influences as used in the data-flow model .....	109
Figure D.13 – Requirements interfacing of corporate management and staff functional entities to the factory .....	110
Figure D.14 – Report interfacing to corporate management and staff functional entities from the factory .....	110
Figure D.15 – Interface of government regulations, etc., to the factory .....	111
Figure D.16 – 0.0 facility model .....	112
Figure D.17 – 1.0 order processing .....	113
Figure D.18 – 2.0 production scheduling .....	114
Figure D.19 – 3.0 production control .....	115
Figure D.20 – 3.1 process support engineering .....	116
Figure D.21 – 3.2 maintenance .....	117
Figure D.22 – 3.3 operations control .....	118
Figure D.23 – 4.0 materials and energy control .....	119
Figure D.24 – 5.0 procurement .....	120
Figure D.25 – 6.0 quality assurance .....	121
Figure D.26 – 7.0 product inventory .....	122
Figure D.27 – 8.0 cost accounting .....	123
Figure D.28 – 9.0 product shipping administration .....	124
Figure F.1 – Production or manufacturing system .....	137
Figure F.2 – IDEF0 actigram .....	137
Table 1 – Yourdon notation used .....	22
Table 2 – UML notation used .....	43
Table 3 – Model cross-reference .....	69-70
Table D.1 – Generic list of duties of all integrated information and automation systems .....	92
Table D.2 – An overall plant automation system provides .....	92
Table D.3 – Notes regarding optimization (improvement) of manufacturing efficiency .....	93
Table D.4 – Summary of duties of control computer systems .....	93
Table D.5 – Potential factors for facilitating integrated control system development and use .....	95
Table D.6 – Required tasks of the intra-company management information system (Level 4B of Figure D.1 or Figure D.2 or Level 5 of Figure D.3) .....	95
Table D.7 – Duties of the production scheduling and operational management level (Levels 4A or 5A) .....	95
Table D.8 – Duties of the area level (Level 3) .....	96
Table D.9 – Duties of the supervisory level (Level 2) .....	97
Table D.10 – Duties of the control level (Level 1) .....	97
Table D.11 – Information flow model of generic production facility mini-specs (definition of functions) .....	102-108
Table D.12 – Correlation of information flow tasks with the tasks of the scheduling and control hierarchy .....	125

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENTERPRISE-CONTROL SYSTEM INTEGRATION –****Part 1: Models and terminology**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62264-1 has been developed by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control, and by ISO technical committee 184/SC5: Architecture, communication and integration frameworks.

This standard is based upon ANSI/ISA-95.00.01-2000, Enterprise-Control System Integration, Part 1: Models and Terminology. It is used with permission of the copyright holder, the Instrumentation, Systems and Automation Society (ISA)\*. ISA encourages the use and application of its industry standards on a global basis.

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

FDIS	Report on voting
65A/369/FDIS	65A/373/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 10 having cast a vote.

\* For information on ISA standards, contact ISA at: ISA – The Instrumentation, Systems and Automation Society, PO Box 12277, Research Triangle Park, NC 27709, USA, Tel. 1+919.549.8411, URL: standards.isa.org.

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 models and attributes
- Part 3: Models of manufacturing operations

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

WITHDRAWN

iTeh Standards  
(<https://standards.itih.ai>)  
Document Preview

[IEC 62264-1:2003](#)

<https://standards.itih.ai/standards/iec/62264-1-2003>



## INTRODUCTION

IEC 62264 is a multi-part standard that defines the interfaces between enterprise activities and control activities. This standard provides standard models and terminology for describing the interfaces between the business systems of an enterprise and its manufacturing-control systems. The models and terminology presented in this standard

- a) emphasize good integration practices of control systems with enterprise systems during the entire life cycle of the systems;
- b) can be used to improve existing integration capabilities of manufacturing control systems with enterprise systems; and
- c) can be applied regardless of the degree of automation.

Specifically, this standard provides a standard terminology and a consistent set of concepts and models for integrating control systems with enterprise systems that will improve communications between all parties involved. Some of the benefits produced will

- a) reduce users' times to reach full production levels for new products;
- b) enable vendors to supply appropriate tools for implementing integration of control systems to enterprise systems;
- c) enable users to better identify their needs;
- d) reduce the costs of automating manufacturing processes;
- e) optimize supply chains; and
- f) reduce life-cycle engineering efforts.

It is not the intent of this standard to

- suggest that there is only one way of implementing integration of control systems to enterprise systems;
- force users to abandon their current methods of handling integration; or
- restrict development in the area of integration of control systems to enterprise systems.

This standard discusses the interface content between manufacturing-control functions and other enterprise functions, based upon the Purdue Reference Model for CIM (hierarchical form) as published by ISA. This standard presents a partial model or reference model as defined in ISO 15704.

The scope of this standard is limited to describing the relevant functions in the enterprise and the control domain and which objects are normally exchanged between these domains. Subsequent parts will address how these objects can be exchanged in a robust, secure, and cost-effective manner preserving the integrity of the complete system.

The intent of Clause 4 is to describe the context of the models in Clause 5 and Clause 6. It gives the criteria used to determine the scope of the manufacturing control system domain. Clause 4 does not contain the formal definitions of the models and terminology but describes the context to understand the other clauses.

The intent of Clause 5 is to describe hierarchy models of the activities involved in manufacturing-control enterprises. It presents in general terms the activities that are associated with manufacturing control and the activities that occur at the business logistics level. It also gives an equipment hierarchy model of equipment associated with manufacturing control.

The intent of Clause 6 is to describe a general model of the functions within an enterprise which are concerned with the integration of business and control. It presents, in detail, an abstract model of control functions and, in less detail, the business functions that interface to control. The purpose is to establish a common terminology for functions involved in information exchange.

The intent of Clause 7 is to state in detail the objects that make up the information streams defined in Clause 6. The purpose is to establish a common terminology for the elements of information exchanged.

Annex A defines the relationship of this standard with other related standardization work in the manufacturing area.

The intent of Annex B is to present the business reasons for the information exchange between business and control functions. The purpose is to establish a common terminology for the reason for information exchange.

Annex C discusses the rationale for multiple models.

Annex D contains selected elements from the Purdue Reference Model that may be used to place the functions described in Clauses 5 and 6 in context with the entire model.

Annex E is informative. It correlates the Purdue Reference Model to the MESA International Model.

This standard is intended for those who are

- involved in designing, building, or operating manufacturing facilities;
- responsible for specifying interfaces between manufacturing and process control systems and other systems of the business enterprise; or
- involved in designing, creating, marketing, and integrating automation products used to interface manufacturing operations and business systems.

Annex F is a discussion of systems, resources, capability, capacity, and time as used in this standard.

# ENTERPRISE-CONTROL SYSTEM INTEGRATION –

## Part 1: Models and terminology

### 1 Scope

This standard describes the 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 by this standard. The goal is to reduce the risk, cost, and errors associated with implementing these interfaces.

The standard can be used to reduce the effort associated with implementing new product offerings. The goal is to have enterprise systems and control systems that inter-operate and easily integrate.

The scope of this standard is limited to

- a) a presentation of the scope of the manufacturing operations and control domain;
- b) a discussion of the organization of physical assets of an enterprise involved in manufacturing;
- c) a listing of the functions associated with the interface between control functions and enterprise functions; and
- d) a description of the information that is shared between control functions and enterprise functions.

### 2 Normative references

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 61512-1:1997, *Batch control – Part 1: Models and terminology*

ISO/IEC 19501-1, *Information technology – Unified Modeling Language (UML) – Part 1: Specification*<sup>1</sup>

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

ISO 15531-1, *Industrial automation systems and integration – Industrial manufacturing management data – Part 1: General overview*<sup>2</sup>

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

<sup>1</sup> To be published.

<sup>2</sup> To be published.

### 3 Terms and definitions

For the purposes of this document, the following definitions apply.

#### 3.1

##### **area**

physical, geographical or logical grouping determined by the site

NOTE It can contain process cells, production units, and production lines.

#### 3.2

##### **available capacity**

portion of the production capacity that can be attained but is not committed to current or future production

#### 3.3

##### **bill of lading**

##### **BOL**

contract or receipt for goods that a carrier agrees to transport from one place to another and to deliver to a designated person or that it assigns for compensation upon the conditions stated therein

#### 3.4

##### **bill of material**

##### **BOM**

listing of all the subassemblies, parts, and/or materials that are used in the production of a product including the quantity of each material required to make a product

#### 3.5

##### **bill of resources**

listing of all resources and when in the production process they are needed to produce a product

NOTE It is also a listing of the key resources required to manufacture a product, organized as segments of production and is often used to predict the impact of activity changes in the master production schedule on the supply of resources.

#### 3.6

##### **capability**

ability to perform actions, including attributes on qualifications and measures of the ability as capacity

NOTE See Annex F for additional background on this concept.

#### 3.7

##### **capacity**

measure of the ability to take action, a subset of a capability

NOTE See Annex F for additional background on this concept.

EXAMPLE Measures of the production rates, flow rates, mass or volume.

#### 3.8

##### **certificate of analysis**

##### **COA**

certification of conformance to quality standards or specifications for products or materials

NOTE It can include a list or reference of analysis results and process information. It is often required for custody transfer of materials.

**3.9****committed capacity**

portion of the production capacity that is currently in use or is scheduled for use

**3.10****consumables**

resources that are not normally included in bills of material or are not individually accounted for in specific production requests

**3.11****control domain**

in this standard, control domain is synonymous with the manufacturing operations and control domain

**3.12****enterprise**

one or more organizations sharing a definite mission, goals and objectives to offer an output such as a product or service

**3.13****equipment class**

means to describe a grouping of equipment with similar characteristics for purposes of scheduling and planning

**3.14****finished goods**

final materials on which all processing and production is completed

**3.15****finished good waivers**

approvals for deviation from normal product specifications

**3.16****in-process waiver requests**

requests for waivers on normal production procedures due to deviations in materials, equipment, or quality metrics, where normal product specifications are maintained

**3.17****manufacturing operations and control domain****MO&C**

domain that includes all the activities in Level 3 and information flows to and from levels 0, 1, and 2 across the boundary to Level 4

**3.18****material class**

means to describe a grouping of materials with similar characteristics for purposes of scheduling and planning

**3.19****material lot**

uniquely identifiable amount of a material

NOTE It describes the actual total quantity or amount of material available, its current state, and its specific property values.

**3.20****material definition**

definition of the properties and characteristics for a substance

**3.21**

**material subplot**

uniquely identifiable subset of a material lot, containing quantity and location

NOTE This may be a single item.

**3.22**

**personnel class**

means to describe a grouping of persons with similar characteristics for purposes of scheduling and planning

**3.23**

**process segment**

view of a collection of resources needed for a segment of production, independent of any particular product at the level of detail required to support business processes that may also be independent of any particular product

NOTE This may include material, energy, personnel, or equipment.

**3.24**

**production capacity**

ability of resources to perform production in the enterprise. The production capacity includes the capacity of those resources and represents

- a) the collection of personnel, equipment, material, and process segment capabilities;
- b) the total of the current committed, available, and unattainable capacity of the production facility;
- c) the highest sustainable output rate that could be achieved for a given product mix, raw materials, worker effort, plant, and equipment

**3.25**

**production control**

collection of functions that manages all production within a site or area

**3.26**

**production line**

series of pieces of equipment dedicated to the manufacture of a specific number of products or families

**3.27**

**production rules**

information used to instruct a manufacturing operation how to produce a product

**3.28**

**production unit**

set of production equipment that converts, separates, or reacts one or more feedstocks to produce intermediate or final products

**3.29**

**product segments**

shared information between a bill of resources and a production rule for a specific product

NOTE A logical grouping of personnel resources, equipment resources, and material specifications required to carry out the production step.

**3.30**

**resource**

enterprise entity that provides some or all of the capabilities required by the execution of an enterprise activity and/or business process (in the context of this standard, a collection of personnel, equipment, and/or material)