IEC 62264-1

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Enterprise-control system integration –
Part 1: Models and terminology

Intégration des systèmes entreprise-contrôle –
Partie 1: Modèles et terminologie

IEC 62264-1:2013

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62264-1 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation, in co-operation with ISO technical committee 184/SC5: Interoperability, integration and architectures for enterprise systems and automation applications.

It is published as a double logo standard.

This standard is based upon ANSI/ISA-95.00.01-2010, 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 second edition cancels and replaces the first edition published in 2003. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) the functional hierarchy in 5.2 was extended using the definitions from IEC 62264-3;
b) the equipment hierarchy in 5.3 was extended using the definitions from IEC 62264-3;
c) a physical asset equipment model was added in 5.3;
d) the generic model of manufacturing operations management categories in Clause 7 was added using information from IEC 62264-3;
e) the formal UML models that were in Clause 7 were moved to IEC 62264-2 and the remaining data definitions are now in Clause 8;
f) the capacity and capability model in Clause 8 was extended;
g) a new Annex A was moved from IEC 62264-3;
h) a new Annex B was moved from IEC 62264-3;
i) Subclause 5.5 on the decision hierarchy was removed and a reference added to ISO 15704 which is now available;
j) old Annex C was removed and moved to a Technical Report;
k) old Annex D was removed and, moved to a Technical Report;
l) old Annex E was removed and moved to a Technical Report;
m) old Annex F was removed.

The text of this standard is based on the following documents of IEC:

FDIS	Report on voting
65E/285/FDIS	65E/298/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.

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

A list of all parts in the IEC 62264 series, published under the general title *Enterprise control system integration* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 62264 is limited to describing the relevant functions in the enterprise and the manufacturing and control domains and which information is normally exchanged between these domains. Subsequent parts will address how this information can be exchanged in a robust, secure, and cost-effective manner preserving the integrity of the complete system. For purposes of IEC 62264-1, the manufacturing and control domain includes manufacturing operations management systems, manufacturing control systems, and other associated systems and equipment associated with manufacturing. The terms “enterprise,” “controls,” “process control,” and “manufacturing” are used in their most general sense and are held to be applicable to a broad sector of industries.

This part of IEC 62264 provides standard models and terminology for describing the interfaces between the business systems of an enterprise and its manufacturing operations and control systems. The models and terminology presented in IEC 62264-1

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 operations and control systems with enterprise systems; and

c) can be applied regardless of the degree of automation.

Specifically, IEC 62264 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.

This part of IEC 62264 standard is intended for those who are:

a) involved in designing, building, or operating manufacturing facilities;

b) responsible for specifying interfaces between manufacturing and process control systems and other systems of the business enterprise; or

c) involved in designing, creating, marketing, and integrating automation products used to interface manufacturing operations and business systems;

d) involved in specifying, designing or managing product creation, movement and storage within manufacturing enterprises.

It is not the intent of IEC 62264 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 part of IEC 62264 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. IEC 62264 presents a partial model or reference model as defined in ISO 15704.

IEC 62264-1 is limited to describing the relevant functions in the enterprise domain and the manufacturing and control domain and the information that is normally exchanged between these domains.

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

Clause 5 describes the hierarchy models of the activities involved in manufacturing enterprises. It presents in general terms the activities that are associated with manufacturing operations and control and the activities that occur at the business logistics level. It also gives an equipment hierarchy model of equipment associated with manufacturing operations and control. Clause 5 contains format definitions of the models and terminology.

Clause 6 describes a general model of the functions within an enterprise which are concerned with the integration of business and control. It defines, 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 understanding for functions and data flows involved in information exchange.

Clause 7 defines in detail the information that makes up the information streams defined in Clause 6. The purpose is to establish a common terminology for the elements of information exchanged. Clause 7 contains formal definitions of the models and terminology. The attributes and properties are not formally defined in this clause of IEC 62264-1.

Clause 8 provides a description of the categories of information structures that are exchanged between applications at Level 4 and those at Level 3. The clause also provides the information categories that are exchanged between the applications within Level 3.

Clause 9 provides statements regarding the conformance of implementations, the compliance of specifications and the completeness of these specifications and implementations relative to IEC 62264-1.

Annex A defines the relationship of IEC 62264 with other related standardization work in the manufacturing area.

Annex B provides listings of associated standards generally related to enterprise integration.

Annex C describes business drivers and key performance indicators that are the reasons for the information exchange between business and control functions.

Subsequent parts will address how this information can be exchanged in a robust, secure, and cost-effective manner preserving the integrity of the complete system.

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 1: Models and terminology

1 Scope

This part of the IEC 62264 series describes the manufacturing operations management domain (Level 3) and its activities, and the interface content and associated transactions within Level 3 and between Level 3 and Level 4. This description enables integration between the manufacturing operations and control domain (Levels 3, 2, 1) and the enterprise domain (Level 4). The interface content between Level 3 and Level 2 is only briefly discussed.

The goals are to increase uniformity and consistency of interface terminology and reduce the risk, cost, and errors associated with implementing these interfaces. IEC 62264-1 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 part of IEC 62264 is limited to:

a) a presentation of the enterprise domain and the manufacturing operations and control domain;

b) the definition of three hierarchical models; a functional hierarchy model, a role-based equipment hierarchy model, and a physical asset equipment hierarchy model;

c) a listing of the functions associated with the interface between manufacturing operations and control functions and enterprise functions; and

d) a description of the information that is shared between manufacturing operations and control functions and enterprise functions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *Batch control – Part 1: Models and terminology*

IEC 62264-2, *Enterprise-control system integration – Part 2: Object model attributes*

IEC 62264-3, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*

IEC 62264-5, *Enterprise-control system integration – Part 5: Business to manufacturing transactions*

ISO/IEC 19501, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) – Version 1.4.2*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
activity
function
group of tasks that are classified as having a common objective

3.1.2
area
physical, geographical or logical grouping of resources determined by the site

EXAMPLE It can contain process cells, production units, production lines, and storage zones.

3.1.3
available capacity
portion of the production capacity that can be attained but is not committed to current or future production

3.1.4
bill of material

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

Note 1 to entry: The term product can refer to a finished product or an intermediate product.

3.1.5
bill of resources
list of resources needed to produce a product

Note 1 to entry: 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.

Note 2 to entry: The bill of resources does not normally include the consumables.

3.1.6
capability
ability to perform actions

3.1.7
capacity
measure of the ability to take action as an aspect of a capability

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

3.1.8
committed capacity
portion of the production capacity that is currently in use or is scheduled for use

3.1.9
consumables
resources that are not individually accounted for in specific production requests, not normally included in bills of material, or not lot tracked

3.1.10
enterprise
one or more organizations sharing a definite mission, goals and objectives which provides an output such as a product or service

3.1.11
entreprise domain
domain that includes all the activities in Level 4 and information that flows to and from level 3

3.1.12
finished goods
final materials on which all processing and production is completed

3.1.13
finished goods waiver
approval for deviation from normal product specifications

3.1.14
in-process waiver request
request for waivers from normal production procedures

Note 1 to entry: Can be due to deviations in materials, equipment, or quality metrics, where normal product specifications can be maintained.

3.1.15
inventory operations management
activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track inventory and material movement within manufacturing operations

3.1.16
level 4
functions involved in the business-related activities needed to manage a manufacturing organization

3.1.17
level 3
functions involved in managing the work flows to produce the desired end-products

level 2
functions involved in monitoring and controlling of the physical process

3.1.18
level 1
functions involved in sensing and manipulating the physical process

3.1.19
level 0
actual physical process

3.1.20
manufacturing facility
site, or area within a site, that includes the resources within the site or area and includes the activities associated with the use of the resources

3.1.21
manufacturing operations and control domain
MO&C domain
domain that includes all the activities and information that flows in Level 3, 2, and 1 and information flows to and from Level 4

Note 1 to entry: Traditional use of the terminology “control domain” included the activities defined here as the terminology “manufacturing operations and control domain”.

3.1.22
manufacturing operations management
MOM
activities within Level 3 of a manufacturing facility that coordinate the personnel, equipment and material in manufacturing

3.1.23
manufacturing operations management domain
MOM domain
domain that includes all the activities in Level 3 and information that flows to and from levels 1, 2 and 4

Note 1 to entry: The manufacturing operations management domain is a subset of the manufacturing operations and control domain.

3.1.24
maintenance operations management
activities within Level 3 of a manufacturing facility which coordinate, direct and track the functions that maintain the equipment, tools and related assets to ensure their availability for manufacturing and ensure scheduling for reactive, periodic, preventive, or proactive maintenance

3.1.25
operations segment
identification of personnel, equipment, physical assets, and material resources required to complete an operational step for a specific operations definition

3.1.26
process segment
business process segment
identification of personnel, equipment, physical assets, and material resources with specific capabilities 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 1 to entry: The business process segment synonym is included to reflect the business process oriented aspects of the process segment.

3.1.27
product
desired output or by-product of the processes of an enterprise

Note 1 to entry: A product can be an intermediate product, end product, or finished goods from a business perspective.

3.1.28
product definition
identification of personnel, equipment, physical assets, and material resources, production rules and scheduling required to create a product which includes a reference to a bill of materials, a product production rule, and a bill of resources

3.1.29
product segment
identification of personnel, equipment, physical asset, and material resources required of a process segment to complete a production step for a specific product

3.1.30
production capability
capability of resources to perform production and the capacity of those resources

EXAMPLE 1: Includes the collection of personnel, equipment, material, and process segment capabilities.

EXAMPLE 2: Includes the sum total of the current committed, available, and unattainable capacity of the production facility.

EXAMPLE 3: Includes the highest sustainable output rate that could be achieved for a given product mix, raw materials, worker effort, plant, and equipment.

3.1.31
production control
collection of functions that manage all production within a site or area

3.1.32
production line
collection of equipment dedicated to the manufacture of a specific number of products or product families

Note 1 to entry: A production line is a type of work center.

3.1.33
production operations management
activities within Level 3 of a manufacturing facility which coordinate, direct, manage and track the functions that use raw materials, energy, equipment, personnel and information to produce products, with the required costs, qualities, quantities, safety and timeliness

3.1.34
production rules
information used to instruct a manufacturing operation how to produce a product

3.1.35
production unit
collection of equipment that converts, separates, or reacts one or more feedstocks to produce intermediate or final products

Note 1 to entry: A production unit is a type of work center.

3.1.36
physical asset
physical object uniquely identified and tracked for maintenance and/or financial purposes

Note 1 to entry: IEC 62264 addresses physical assets used in equipment roles. There are many other physical assets in an enterprise.

3.1.37
quality operations management
activities within Level 3 of a manufacturing facility which coordinate, direct and track the functions that measure and report on quality