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Enterprise-Control System Integration

– Part 1: Models and Terminology

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Enterprise-Control System Integration – Part 1: Models and Terminology

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 1: Models and terminology

FOREWORD

This foreword, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-95.00.01-2010 (IEC 62264-1 Mod).

This document has been prepared as part of the service of ISA, the International Society of Automation, toward a goal of uniformity in the fields of instrumentation, systems and automation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

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This Part 1 standard is structured to follow IEC (International Electrotechnical Commission) guidelines. This revised Part 1 replaces ANSI/ISA-95.00.01-2000.

This document is Part 1 of a multi-part set of standards that defines the information exchange interface between enterprise activities and control activities.

As currently envisioned, the ANSI/ISA-95 series will consist of the following parts under the general title, Enterprise-Control System Integration:

- Part 1: Models and terminology
- Part 2: Objects and attributes for enterprise-control system integration
- Part 3: Activity models of manufacturing operations management
- Part 4: Object models and attributes of manufacturing operations management activities (in development at the time of publication of this standard)
- Part 5: Business-to-manufacturing transactions
- Part 6: Manufacturing operations transactions (in development at the time of publication of this standard)

INTRODUCTION

This is a revision of ISA-95.00.01-2000. The major changes made to this standard from the previous version are:

1. The starting point for the update was IEC 62264-1 Enterprise-control system integration: models and terminology. This is the IEC/ISO version of this standard. IEC 62264-1 includes a new section on the Decision Hierarchy in Clause 5.5.
2. The functional hierarchy in Clause 5.2 was extended using the definitions from IEC 62264-3 Enterprise-control system integration - Part 3: Activity Models of Manufacturing Operations Management.
3. The equipment hierarchy in Clause 5.3 was extended using the definitions from IEC 62264-3.
4. A physical asset equipment model was added in Clause 5.3.
5. The generic model of manufacturing operations management categories in Clause 7 was added using information from IEC 62264-3.
6. The formal UML models that were in Clause 7 were moved to the Part 2 standard in the series and the remaining data definitions are now in Clause 8.
7. The capacity and capability model in Clause 8 was extended.
8. A new Annex A was moved from IEC 62264-3.
9. A new Annex B was moved from IEC 62264-3.
10. Clause 5.5 on the decision hierarchy was removed and a reference added to ISO 15704 which is now available.
11. Old Annex C, DISCUSSIONS OF MODELS, was moved to a Technical Report
12. Old Annex D, SELECTED ELEMENTS OF THE PURDUE REFERENCE MODEL, was moved to a Technical Report.
13. Old Annex E, PRM CORRELATION TO MESA INTERNATIONAL MODEL AND ISA-95.01 MODELS, was moved to a Technical Report

This Part 1 standard 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 this standard 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 1 standard 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 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 operations and 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.

This Part 1 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 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 Part 1 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 first three clauses are normative and present the *scope* of the standard, *normative references*, and *definitions*, in that order.

The scope of this part is limited to describing the relevant functions in the enterprise and the manufacturing and control domain 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.

Clause 4 is informative. The intent 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 operations and control system domain. Clause 4, being informative, does not contain the formal definitions of the models and terminology but describes the context to understand the other clauses.

Clause 5 is normative. The intent 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 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 5.5 is informative. Clause 5, being normative, contains format definitions of the models and terminology.

Clause 6 is normative. The intent is to describe 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 is normative. The intent is to define 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, being normative, contains formal definitions of the models and terminology. The attributes and properties are not formally defined in this clause of the standard.

Clause 8 is normative. It 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 is normative. It provides statements regarding the conformance of implementations, the compliance of specifications and the completeness of these specifications and implementations relative to Part 1 of this standard.

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

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

Annex C is informative. It describes business drivers and key performance indicators that are the reasons for the information exchange between business and control function.

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 1: Models and terminology

1 Scope

This standard describes the interface content between manufacturing operations and 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 goals are to increase uniformity and consistency of interface terminology and 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 19501:2005, *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*