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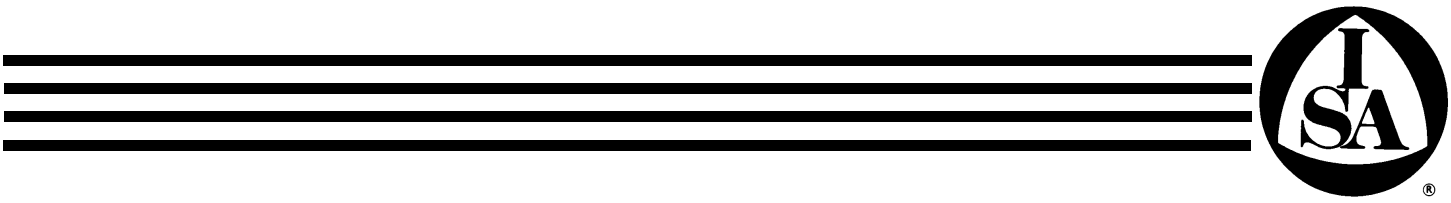
American National Standard

Batch Control
Part 1: Models and Terminology



ANSI/ISA-S88.01, Batch Control, Part 1: Models and Terminology

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Preface

This preface as well as all footnotes and annexes are included for informational purposes and are not part of ISA-S88.01.

This standard has been prepared as part of the service of the ISA, the international society for measurement and control, toward a goal of uniformity in the field of instrumentation. 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) 990-9227; Fax (919) 549-8288;e-mail: standards@isa.org.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards, recommended practices, and technical reports. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards to the greatest extent possible. *The Metric Practice Guide*, which has been published by the Institute of Electrical and Electronics Engineers as ANSI/IEEE Std. 268-1992, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

It is the policy of ISA to encourage and welcome the participation of all concerned individuals and interests in the development of ISA standards, recommended practices, and technical reports. Participation in the ISA standards-making process by an individual in no way constitutes endorsement by the employer of that individual, of ISA, or of any of the standards, recommended practices, and technical reports that ISA develops.

This standard is structured to follow the IEC guidelines. Therefore, the first three sections discuss the *Scope* of the standard, *Normative References, and Definitions*, in that order.

Section 4 is entitled *Batch Processes and Equipment*. The intent of this section is to discuss batch processing and the batch manufacturing plant. Things that are involved in batch manufacturing (e.g., batch process classification, equipment, and processes) are described in this section. The models and terminology defined in this section provide a foundation for understanding the application of batch control to the batch manufacturing plant in Sections 5 and 6.

Section 5 is entitled *Batch Control Concepts*. The intent of this section is to discuss key aspects of batch processing and batch manufacturing plants. This is where control is finally introduced to physical equipment, and the concept of equipment entities is introduced. Recipes are introduced in Section 5. The concepts of Allocation and Arbitration, Modes and States, and Exception Handling are introduced in this section so that they can be applied to the discussions in Section 6.

Section 6 is entitled *Batch Control Activities and Functions*. The intent of the models and terminology introduced in this section is to establish the necessary control activities that are needed to address the diverse control requirements of batch manufacturing. The concept of a Control Activity Model is introduced in this section. Each control activity from the Control Activity Model is discussed in terms of the individual control functions that are needed to address the batch processing, manufacturing, and control requirements of the previous two sections. Note

that there will be no attempt to define compliance requirements within this section since the overall purpose of this standard is to define a common approach to defining and modeling batch processes and their associated controls.

This standard (Part 1, Models and Terminology) is intended for people who are

— involved in designing and/or operating batch manufacturing plants;

— responsible for specifying controls and the associated application programs for batch manufacturing plants; or

— involved in the design and marketing of products in the area of batch control.

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Foreword

1) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.

3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules insofar as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

4) The IEC has not laid down any procedure concerning marking as an indication of approval and has no responsibility when an item of equipment is declared to comply with one of its recommendations.

This part of this International Standard has been prepared by IEC/SC65A/WG11 and ISA SP88.

It forms part 1 of a series, the other part being Part 2: Data structures and guidelines for languages.

Annex A forms an integral part of this part of this international standard. Refer to Annex A for an explanation of the format and general associations used in creating the diagrams in this international standard. Annex B is for information only.

Introduction

This part of this international standard on Batch Control provides standard models and terminology for defining the control requirements for batch manufacturing plants. The models and terminology defined in this standard

— emphasize good practices for the design and operation of batch manufacturing plants;

— can be used to improve control of batch manufacturing plants; and

— 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 batch manufacturing plants and batch control that will improve communications between all parties involved; and that will

— reduce the user's time to reach full production levels for new products;

— enable vendors to supply appropriate tools for implementing batch control;

— enable users to better identify their needs;

— make recipe development straightforward enough to be accomplished without the services of a control systems engineer;

— reduce the cost of automating batch processes; and

— reduce life-cycle engineering efforts.

It is not the intent of this standard to

— suggest that there is only one way to implement or apply batch control;

— force users to abandon their current way of dealing with their batch processes; or

— restrict development in the area of batch control.

The models presented in this standard are presumed to be complete as indicated. However, they may be collapsed and expanded as described below. The unit and the control module levels may not be omitted from the physical model. The master recipe and the control recipe may not be omitted from the recipe types model. Specific rules for collapsing and expanding these models are not covered in this standard.

— Collapsing: Elements in the models may be omitted as long as the model remains consistent, and the functions of the element removed are taken into account.

— Expanding: Elements may be added to the modules. When they are added between related elements, the integrity of the original relationship should be maintained.

1 Scope

This part of the standard on Batch Control defines reference models for batch control as used in the process industries and terminology that helps explain the relationships between these models and terms. This standard may not apply to all batch control applications.

2 Normative references

The following normative documents contain provisions, which through reference in this text, constitute provisions of this part of this standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid normative documents.

IEC 848: 1988, *Preparation of function charts for control systems*

NOTE – Structures defined in IEC 848 may be useful in the definition of procedural control, and in particular in the definition of a phase.

IEC 902: 1987, *Industrial-process measurement and control — Terms and definitions*

NOTE – Definitions found in IEC 902 were used as a basis for definitions in this standard. Where necessary, the specific connotation of terms used in batch control were included as definitions in this standard.

3 Definitions

For the purposes of this part of this international standard, the following definitions apply.

3.1 allocation: A form of coordination control that assigns a resource to a batch or unit.

NOTE – An allocation can be for the entire resource or for portions of a resource.

3.2 arbitration: A form of coordination control that determines how a resource should be allocated when there are more requests for the resource than can be accommodated at one time.

3.3 area: A component of a batch manufacturing site that is identified by physical, geographical, or logical segmentation within the site.

NOTE – An area may contain process cells, units, equipment modules, and control modules.

3.4 basic control: Control that is dedicated to establishing and maintaining a specific state of equipment or process condition.

NOTE – Basic control may include regulatory control, interlocking, monitoring, exception handling, and discrete or sequential control.