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# Industrial automation systems and integration — Industrial manufacturing management data —

## Part 44: Information modelling for shop floor data acquisition

*Systèmes d'automatisation industrielle et intégration — Données de gestion de fabrication industrielle —*

*Partie 44: Modélisation de l'information de gestion de fabrication pour l'acquisition des données d'atelier*

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# Contents

Page

**Foreword** ... **iv**

**Introduction** ... **v**

**1 Scope** ... **1**

**2 Normative references** ... **1**

**3 Terms, definitions, and abbreviated terms** ... **1**
3.1 Terms and definitions ... 1
3.2 Abbreviated terms ... 4

**4 General purpose and scope of ISO 15531** ... **4**

**5 Purpose, principles and structure of this document** ... **6**
5.1 Purpose of this document ... 6
5.2 Basic principles of this document and overview of the main entities ... 6
5.3 Structure of shop floor data acquisition system ... 8
5.4 The captured data and their organization ... 9
5.4.1 General characteristics ... 9
5.4.2 Manufacturing management data ... 11
5.4.3 Quality management ... 11
5.4.4 Productivity and maintenance ... 11
5.4.5 Traceability ... 11
5.5 The question of time: time stamping and time measure ... 11
5.6 Size optimization ... 12

**6 The EXPRESS schema definition of shop floor captured data** ... **12**
6.1 Shop floor captured data schema definition ... 12
6.2 Shopfloor_captured_data type definitions ... 13
6.2.1 type_of_movement ... 13
6.2.2 stock_in ... 13
6.2.3 stock_out ... 13
6.2.4 stock_taking ... 14
6.3 Shop floor captured data entity definitions ... 14
6.3.1 Stock ... 14
6.3.2 Manufactured_product ... 14
6.3.3 Orders ... 15
6.3.4 Manufacturing_batch ... 16
6.3.5 Work_order ... 16
6.3.6 material_consumption ... 17
6.3.7 Productivity_and_maintenance ... 18
6.3.8 Quality ... 20
6.3.9 Resource ... 21
6.3.10 Time stamping and time reference ... 22

**Annex A** (normative) **Information object registration** ... **23**

**Annex B** (informative) **EXPRESS listing** ... **24**

**Annex C** (informative) **EXPRESS-G Diagram** ... **28**

**Bibliography** ... **30**

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

This second edition cancels and replaces the first edition (ISO 15531-44:2010), which has been technically revised.

A list of all parts in the ISO 15531 series can be found on the ISO website.


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# Introduction

ISO 15531 is an International Standard for the modelling of data used in manufacturing management (except for product and component data as well as catalogue or library data that are modelled using ISO 10303 and ISO 13584). ISO 15531-31 and ISO 15531-32 address the modelling of data used for the management of resources usage, whereas ISO 15531-43 addresses the modelling of manufacturing management data and ISO 15531-42 provides a time model.

The other data that are used for manufacturing management include some data that are captured at the control level of manufacturing, but that are stored at the management level and used at this level to manage manufacturing for quality, maintenance, rescheduling or any other management purpose.

These data are very often captured in various formats that are determined by device and process constraints. The time stamping and time measure related to this data capture, as well as the batch and resource to which this capture is associated, are also needed to manage manufacturing in an efficient way. Each occurrence of time measure and time stamping is also specific to the resource and its result is further related to a unique time model and reference.

After several translation operations and handling, the raw data collected from level 2 become level 3 data. They are stored in a database that gathers and organizes all the collected data in accordance with level 3 models that are predefined to be reusable. Their subsequent usage in various manufacturing management software implies that the corresponding models are well defined and unique for given information, even if that kind of information can appear several times from several resources.

NOTE The definitions of functional levels used here are those of IEC 62264-1 and are repeated for information in Clause 4 of this document. The monitoring and control of physical devices belong to level 2, while the management of manufacturing operations belongs to level 3. This document addresses the modelling of level 3 data that are the result of the collection at level 2 of raw data and the result of their translation and handling. The translation and handling are outside the scope of this document.

It is the aim of this document to provide, for those data, models that are shareable by any software used to manage and improve manufacturing.

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# Industrial automation systems and integration — Industrial manufacturing management data —

# Part 44: Information modelling for shop floor data acquisition

## 1 Scope

This document addresses the modelling of the data collected from data acquisition systems at control level to be stored at the manufacturing management level and processed further at this level for any management purpose.

The following are within the scope of this document:

— quantitative or qualitative data collected from data acquisition systems at the control or management level to be stored at the management level and used later on to manage manufacturing;

— time stamping and time measurement provided from data acquisition systems for control and management data.

The following are outside the scope of this document:

— any data only related to remote and real time measurement and management;

— product definition data as modelled in the ISO 10303 series;

— catalogue and library data as modelled in ISO 13584 and ISO 15926;

— control data that are only used at the control level as well as those that are not used for manufacturing management.

## 2 Normative references

There are no normative references in this document.

## 3 Terms, definitions, and abbreviated terms

### 3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1.1**
**beginning date**
instance of point in time that identifies an *event* (3.1.4) that is the starting point of something noticeable and durable

EXAMPLE Beginning date of a data capture occurrence, of a task, of a measure, or of a *state* (3.1.14) change.

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Note 1 to entry: "Point in time" is defined in ISO 15531-42:2005, 3.1.13.

**3.1.2**
**connection**
junction of an identifier to another identifier related to an assembly operation

EXAMPLE Joining a part batch number to a subset.

Note 1 to entry: A connection does not have a property or attribute while the association is a semantic relationship.

**3.1.3**
**ending date**
instance of point in time that identifies an *event* (3.1.4) that is the ending point of something noticeable that has had duration

EXAMPLE Ending date of an activity, of a data capture.

Note 1 to entry: Point in time is defined in ISO 15531-42:2005, 3.1.13.

**3.1.4**
**event**
something noticeable that takes or can take place at a given place and point in time

EXAMPLE The start of a given activity, the anniversary of another event, the end of machine failure.

**3.1.5**
**genealogy**
*connection* (3.1.2) that relates unique identifiers

EXAMPLE Joining a serial number to another serial number.

Note 1 to entry: Genealogy is not a semantic relationship. For example, no property or attribute is associated with the junction between the serial numbers of the example given in this entry.

**3.1.6**
**hazard event**
noticeable failure during a *manufacturing process* (3.1.9)

Note 1 to entry: The failure is noticeable enough to be recorded in the database. It can be caused by the *resource* (3.1.13) on which the *event* (3.1.4) appears or by a previous event.

**3.1.7**
**manufacturing**
function or act of converting or transforming material from raw material or a semi-finished *state* (3.1.14) to a state of further completion

Note 1 to entry: Definition adapted from the APICS dictionary[22].

[SOURCE: ISO 15531-1:2004, 3.6.22]

**3.1.8**
**manufacturing order**
document, group of documents, or schedule conveying authority for the manufacture of specified parts or products in specified quantity

Note 1 to entry: A manufacturing order identifies a unit of scheduled work to be manufactured; it includes, for example, a reference, a quantity and a due date. The manufacturing order is also the *event* (3.1.4) that triggers a *manufacturing* (3.1.7) operation.

Note 2 to entry: Adapted from the APICS dictionary[22].


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**3.1.9**
**manufacturing process**
structured set of activities or operations performed upon material to convert it from raw material or a semi-finished *state* (3.1.14) to a state of further completion

Note 1 to entry: Manufacturing processes can be arranged in process layout, product layout, cellular layout or fixed position layout. Manufacturing processes can be planned to support make-to-stock, make-to-order, assemble-to-order, etc., based on strategic use and placements of inventories.

[SOURCE: ISO 15531-1:2004, 3.6.25]

**3.1.10**
**operation mode**
one of the ways of operation expected from a *resource* (3.1.13) and set up in a given application

Note 1 to entry: Each machine can have one or more operation modes (e.g. automatic, step-by-step, manual) determined by the type of machine and its application.

Note 2 to entry: The operation mode is selected from those available by the operator.

Note 3 to entry: The operation mode is represented in the model by the entity mode (see 6.3.7.2).

**3.1.11**
**process**
structured set of activities involving various enterprise entities, that is designed and organized for a given purpose

Note 1 to entry: The definition provided here is very close to that given in ISO 10303-49. Nevertheless ISO 15531 needs the notion of structured set of activities, without any predefined reference to the time or steps. In addition, from the point of view of flow management, some empty processes can be needed for synchronization purposes although they are not actually doing anything (ghost tasks).

[SOURCE: ISO 15531-1:2004, 3.6.29]

**3.1.12**
**product defect**
anomaly identified, during a control, on a badly manufactured product

**3.1.13**
**resource**
device, tool and means at the disposal of the enterprise to produce goods or services

Note 1 to entry: Resources as defined in ISO 15531-1:2004, 3.6.43, exclude raw materials, products and components that are considered from a system theory point of view as parts of the environment of the system and do not belong to the system itself. Furthermore, this definition includes the definition found in ISO 10303-49 but is included in the definition that applies for ISO 18629-14 and ISO 18629-44 (which also includes raw materials and consumables), as well as ISO 18629-13.

Note 2 to entry: Resources, as they are defined here, include human resources considered as specific means with a given capability and a given capacity. Those means are considered to be capable of being involved in the *manufacturing process* (3.1.9) through assigned tasks, which does not include any modelling of an individual or common behaviour of human resources, except in their capability to perform a given task in the manufacturing process (e.g. transformation of a raw material or component, provision of logistic services). This means that human resources are only considered, as are the other resources, from the point of view of their functions, their capabilities and their status (e.g. idle, busy), excluding any modelling or representation of any aspect of individual or common "social" behaviour.

Note 3 to entry: Adapted from ISO 15531-1:2004, 3.6.43.

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**3.1.14**
**state**
condition or situation during the life of an object during which it satisfies some condition, performs some activity, or waits for some *event* (3.1.4)

Note 1 to entry: The meaning of state here is similar to the meaning of state in "state automaton".

[SOURCE: ISO 15745-1:2003, 3.31, modified — the note to entry has been added]

**3.1.15**
**work order**
unit of scheduled work, that can be dispatched to a *resource* (3.1.13) and that addresses a specific phase of the *manufacturing process* (3.1.9)

Note 1 to entry: A work order can be dispatched to a physical device and/or a human (or group of humans), that are the two subclasses of the entity resource. This work order consists of lower level elements and is a component of a *manufacturing order* (3.1.8).

## 3.2 Abbreviated terms

| | |
|---|---|
| KPI | Key Performance Indicator |
| LAN | Local Area Network |
| PLC | Programmable Logic Controller |
| PLIB | Parts Libraries (ISO 13584) |
| MANDATE | Manufacturing Data Exchange (ISO 15531) |
| RFID | Radio-Frequency IDentification |
| STEP | STandard for the Exchange of Product model data (ISO 10303) |

# 4 General purpose and scope of ISO 15531

ISO 15531, also known as MANDATE, specifies the characteristics for a representation of manufacturing management information over the entire industrial process, with the necessary mechanisms and definitions to enable manufacturing management data to be shared and exchanged within the factory, with other plants or with companies.

Exchanges are made through different computer systems and environments associated with the complete industrial process. ISO 15531 (ISO 15531-1, ISO 15531-31, ISO 15531-32, ISO 15531-42 and ISO 15531-43) focuses on discrete manufacturing but is not limited to it. Nevertheless, any extension to industrial processes which does not belong to discrete manufacturing is always under consideration when it does not imply any contradiction or inconsistency with the initial objective of ISO 15531.

The following are within the scope of ISO 15531:

— the representation of production and resources information including capability capacity, monitoring, maintenance constraints and control;

NOTE 1 Maintenance constraints and relevant maintenance management data are taken into account from the point of view of their impact on the flow control.

— the exchange and sharing of production information and resources information, including storing, transferring, accessing and archiving.

The following are outside the scope of ISO 15531:

— enterprise modelling;


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