
**Industrial automation systems —
Manufacturing Message Specification —
Part 2:
Protocol specification**

*iTeh STANDARD PREVIEW
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Systèmes d'automatisation industrielle — Spécification de messagerie
industrielle —
Partie 2: Spécification de protocole

ISO 9506-2:2003

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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 matter of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9506-2 was prepared by the Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 5, *Architecture, communications and integration frameworks*.

This second edition of ISO 9506-2 cancels and replaces the first edition (ISO 9506-2:2000), of which it constitutes a technical revision. It incorporates several technical corrections to ISO 9506-2:2000. The first edition of ISO 9506-2:2000 included corrections published in ISO/IEC 9506-2/Cor.1:1995 and in ISO/IEC 9506-2/Cor.2:1995, the additional services published in ISO/IEC 9506-2/Amd.1:1993, and in ISO/IEC 9506-2/Amd.2:1995, and the material published in ISO/TR 13345.

ISO 9506 consists of the following parts, under the general title *Industrial automation systems — Manufacturing Message Specification*:

- Part 1: Service definition (standards.iteh.ai)
- Part 2: Protocol specification

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Introduction

This part of ISO 9506 provides a wide variety of services useful for various manufacturing and process control devices. It is designed to be used both by itself and in conjunction with Companion Standards that describe the application of subsets of these services to particular device types.

The services provided by the Manufacturing Message Specification (MMS) range from simple to highly complex. It is not expected that all of these services will be supported by all devices. The subset to be supported is limited in some cases by Companion Standards, and in all cases may be limited by the implementor. Characteristics important in selection of a subset of services to be supported include:

- a) applicability of the service to the device;
- b) the complexity of services and requirements;
- c) the complexity of provision of a particular class of service via the network versus the complexity of the device.

Security Considerations

When implementing MMS in secure or safety critical applications, features of the OSI security architecture may need to be implemented. This International Standard provides simple facilities for authentication (passwords) and access control. Systems requiring a higher degree of security will have to consider features beyond the scope of this International Standard. This International Standard does not provide facilities for non-repudiation.

Complexity of Services and Requirements

Some MMS services are quite complex and should be considered advanced functions. Devices used in very simple applications often will not require such advanced functions, and hence will not support such MMS services.

Keywords

Application Interworking
 Application Layer Protocol
 Information Processing Systems
 Manufacturing Communications Network
 Manufacturing Message Specification
 Numerical Control System
 Open Systems Interconnection
 OSI Reference Model
 Process Control System
 Programmable Controller
 Programmable Device
 Robotics Control System
 Virtual Manufacturing Device

General

This part of ISO 9506 is one of a set of standards produced to facilitate the interconnection of information processing systems. It is positioned within the application layer of the Open Systems Interconnection Environment as an Application Service Element (ASE) with respect to other standards by the Basic Reference Model for Open Systems Interconnection (ISO 7498).

The aim of Open Systems Interconnection is to allow, with a minimum of technical agreement outside the interconnection standards, the interconnection of information processing systems:

- a) from different manufacturers;
- b) under different managements;
- c) of different levels of complexity;
- d) of different ages.

Purpose

The purpose of this part of ISO 9506 is to define the Manufacturing Message Specification Protocol. It is most closely related to and lies within the field of application of the Manufacturing Message Specification Service Definition, ISO 9506-1. It uses services provided by the communication system that it employs for transferring its PDUs.

The MMS protocol is structured so that subsets of protocol can be defined. The variations and options available within this part of ISO 9506 are essential to enable a Manufacturing Message Specification to be provided for a wide variety of applications. Thus, a minimally conforming implementation will not be suitable for use in all possible circumstances. It is important, therefore, to qualify all references to this part of ISO 9506 with statements of the options provided or required with statements of the intended purpose of provision or use.

NOTE The services of this part of ISO 9506 are generic, and intended to be referenced by Companion Standards, each of which is directed to a more specific class of application. The services of this part of ISO 9506 may also be used in a stand-alone manner (without the use of Companion Standards).

It should be noted that, as the number of valid protocol sequences is very large, it is not possible with current technology to verify that an implementation will operate the protocol defined in this part of ISO 9506 correctly under all circumstances. It is possible by means of testing to establish confidence that an implementation correctly operates the protocol in a representative sample of circumstances.

Edition

This part of ISO 9506 differs from the first edition of ISO 9506-2 by correcting several protocol errors related to the ASN.1 type definitions and modelling structures. It also corrects several typographical errors in that document.

This part of ISO 9506 differs from ISO/IEC 9506-2:1990 in the following ways:

- a) The material in ISO/IEC TR 13345 to specify subsets of protocol for MMS has been incorporated into this part of ISO 9506.
- b) All the material of Amendments 1 and 2 have been incorporated into the document, as well as the Technical Corrigenda.
- c) The formal object model used in ISO 9506-1 provides some type definitions for the protocol specified in this part of ISO 9506. Hence, an IMPORT statement occurs in the ASN.1 module.
- d) The services and protocol present in the Companion Standards already published, ISO/IEC 9506-3, ISO/IEC 9506-4, and ISO/IEC 9506-6, have been incorporated into the base standard.

As a result of this incorporation, the need for separate abstract syntaxes for each of the Companion Standards has been removed. All Companion Standards can now operate in the single abstract syntax of the base standard, although using other abstract syntaxes remains a possibility for backward compatibility. The separate definition of a module in Clause 19 of the first edition of ISO/IEC 9506-2 is no longer needed and this clause has been removed.

- e) The communication requirements of MMS have been generalized so that MMS is described with respect to an abstract set of services needed for its support. The relation between this abstract set of services and the services provided by the suite of OSI communication protocols is specified in an annex. This opens the possibility of having MMS operating correctly over alternate communication systems (such as reduced stack implementations) as long as the equivalent of these abstract services are provided.
- f) The restrictions on the characters that can be used as an Identifier have been relaxed to allow an Identifier to begin with a numeric character and, by extension, to consist solely of numeric characters.
- g) Many (but not all) occurrences of VisibleString have been replaced by a new production MMSString that provides the option of using an arbitrary string of characters taken from ISO 10646. Similarly, these more general strings may also be used as Identifiers. A new parameter CBB has been added to provide for negotiation of the use of these more general strings.
- h) A new service, ReconfigureProgramInvocation, has been introduced into the clause on Program Invocation management. This service provides a technique of dynamically changing the constituent Domains of a running Program Invocation.
- i) A new field was added to the object model of the Named Variable and the Named Type. This field may be used to describe the semantics associated with the Named Variable or Named Type. The field is either predefined or it has its value established as the name of the Named Type used to construct it in the DefineNamedVariable or DefineNamedType service. This field can be reported with the GetVariableAccessAttributes or GetNamedTypeAttributes service if **sem**, a new parameter CBB, has been negotiated.

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- j) The material of the document has been reorganized to provide more and shorter clauses.
- k) The Real Data type has been removed from the document.
- l) The Scattered Access has been removed from the base document and placed in an informative annex.
- m) In accordance with the recommendations in ISO/IEC 8824-1, all occurrences of EXTERNAL in the protocol have been replaced with CHOICE { EXTERNAL, EMBEDDED PDV }.
- n) The PICS of the first edition has been replaced by a clause providing configuration and initialization information. This clause provides initialization prescriptions for some fields (relatively few) of the VMD and subordinate objects, and provides a tabular report for initialization values of other fields as supplied by the implementor. A new annex (annex B) has been added that provides an ASN.1 module suitable for communicating the information contained in these tables.

Protocol

Because of the use of the ASN.1 object modelling technique, the protocol now exists in three separate modules, one that is part of the object model contained in ISO 9506-1, and two modules defined in this part of ISO 9506 that describes the content and structure of all valid PDUs. Despite the fact that the ASN.1 formulation appears different in some cases, nevertheless the PDUs produced through application of the first edition of ISO 9506 are identical with those produced by this edition. For this reason, this edition continues to be identified by the major version number one. (The minor version number has been changed to reflect all the new additions to the document.)

There are two exceptions to this statement that should be noted.

- a) Syntactic extensions defined by the companion standards are now identified by new parameter CBBs instead of a separate abstract syntax. Therefore, for any use of MMS involving companion standard facilities, there is a change in the Initiate PDU. However, if the companion standard facilities are not used, the Initiate PDU remains the same as that defined by the first edition.
- b) Some small changes have been made to the tagging in the ChangeAccessControl service (part of Amendment 2) to bring it into alignment with corresponding protocol in the GetNameList and Rename services.
- c) Encoding of the PDUs using PER (ISO/IEC 8825-2) may not be completely compatible with PDUs generated by the first edition of ISO/IEC 9506:1990; this is because replacement of a type by a CHOICE containing that type will result in a different encoding using PER; BER encoding for these two situations is identical. Thus, if the PDUs contain any elements that are EXTERNAL, according to item m) above, they will be replaced by a CHOICE resulting in a different PER encoding.

ASN.1 Modules

The ASN.1 modules defined in ISO 9506 may be obtained from the SC 4 Secretariat in computer readable format. The modules are available in two forms: as published and with the IF - ENDIF brackets removed.

To obtain these files use the Internet location: <http://forums.nema.org:8080/~iso_tc184_sc5>

Industrial automation systems — Manufacturing Message Specification —

Part 2: Protocol specification

1 Scope

The Manufacturing Message Specification is an application layer standard designed to support messaging communications to and from programmable devices in a Computer Integrated Manufacturing (CIM) environment.

1.1 Specifications

This part of ISO 9506 specifies:

- a) procedures for a single protocol for the transfer of data and control information from one application entity to a peer application entity in the MMS-context;
- b) the means of selecting the services to be used by the application entities while communicating in the MMS-context;
- c) the structure of the Manufacturing Messaging Specification Protocol Data Units used for the transfer of data and control information.

1.2 Procedures

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The procedures are defined in terms of

- a) the interactions between peer application entities through the exchange of Manufacturing Message Specification Application Protocol Data Units;
- b) the interactions between an MMS-provider and the MMS-user in the same system through the exchange of MMS primitives;
- c) the interactions between an MMS-provider and the abstract services provided by the underlying communication system.

1.3 Applicability

These procedures are applicable to instances of communication between systems that support MMS within the application layer of the OSI Reference Model, and that require the ability to interconnect in an open systems interconnection environment.

1.4 Conformance

This part of ISO 9506 also specifies conformance requirements for systems implementing these procedures. This part of ISO 9506 does not contain tests to demonstrate compliance with such requirements.

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.

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ISO/IEC 646:1991,	<i>Information technology - ISO 7-bit coded character set for information interchange</i>
ISO/IEC 7498-1:1994,	<i>Information technology - Open Systems Interconnection - Basic Reference Model: The Basic Model</i>
ISO 7498-2:1989,	<i>Information processing systems - Open Systems Interconnection - Basic Reference Model: Security Architecture</i>
ISO 7498-3:1997,	<i>Information technology - Open Systems Interconnection - Basic Reference Model: Naming and addressing</i>
ISO 8571 (all parts),	<i>Information processing systems - Open Systems Interconnection - File Transfer, Access and Management</i>
ISO/IEC 8649:1996,	<i>Information technology - Open Systems Interconnection - Service definition for the Association Control Service Element</i>
ISO/IEC 8650-1:1996,	<i>Information technology - Open Systems Interconnection - Connection-oriented protocol for the Association Control Service Element: Protocol specification</i>
ISO 8822:1994,	<i>Information technology - Open Systems Interconnection - Presentation service definition</i>
ISO/IEC 8824-1:1998,	<i>Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation</i>
ISO/IEC 8824-2:1998,	<i>Information technology - Abstract Syntax Notation One (ASN.1): Information object specification</i>
ISO/IEC 8825-1:1998,	<i>Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER)</i>
ISO/IEC 8825-2:1998,	<i>Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)</i>
ISO 9506-1 ¹⁾	<i>Industrial automation systems - Manufacturing Message Specification - Part 1: Service definition</i>
ISO/IEC 9545:1994,	<i>Information technology - Open Systems Interconnection - Application Layer structure</i>
ISO/IEC 10646-1:2000	<i>Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane</i>
ISO/IEC 10731:1994,	<i>Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI Services</i>
ANSI/IEEE 754:1985,	<i>IEEE Standard for Binary Floating-Point Arithmetic</i>

3 Terms and definitions

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

NOTE The definitions contained in this clause make use of abbreviations defined in clause 4.

¹⁾ To be published.

3.1 Reference Model definitions

This part of ISO 9506 is based on the concepts developed in the Basic Reference Model for Open Systems Interconnection (ISO 7498), and makes use of the following terms defined in that International Standard:

- | | |
|---------------------------------|------------------------------|
| a) application-entity; | e) (N) - protocol; |
| b) application-process; | f) (N) - protocol-data-unit; |
| c) application service element; | h) (N) - layer; |
| d) open system; | i) system; |

3.2 Service Convention definitions

This part of ISO 9506 makes use of the following terms defined in the Conventions for the definition of OSI Services (ISO/IEC 10731) as they apply to the Manufacturing Message Specification:

- | | |
|----------------|-----------------------|
| a) confirm; | e) response; |
| b) indication; | f) service primitive; |
| c) primitive; | g) service provider; |
| d) request; | h) service user. |

3.3 Abstract Syntax Notation definitions

This part of ISO 9506 makes use of the following terms defined in the Abstract Syntax Notation One (ASN.1) Specification (ISO/IEC 8824):

- | | |
|------------------------------------|----------------------------|
| a) value; | o) octetstring type; |
| b) type; | p) null type; |
| c) simple type; | q) sequence type; |
| d) structure type; | r) sequence-of type; |
| e) component type; | s) tagged type; |
| f) tag; | t) choice type; |
| g) tagging; | u) selection type; |
| h) type (or value) reference name; | v) real type; |
| i) character string type; | w) object identifier type; |
| j) boolean type; | x) module; |
| k) true; | y) production; |
| l) false; | z) ASN.1 encoding rules; |
| m) integer type; | aa) ASN.1 character set; |
| n) bitstring type; | ab) external type. |