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Industrial automation systems — Manufacturing Message Specification —

Part 2: Protocol specification

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Systèmes d'automatisation industrielle — Spécification de messagerie industrielle — Partie 2: Spécification de protocole

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Contents

Page

1 Scope 1
1.1 Specifications 1
1.2 Procedures 1
1.3 Applicability 1
1.4 Conformance 1

2 Normative references 1

3 Definitions 2
3.1 Reference Model definitions 3
3.2 Service Convention definitions 3
3.3 Abstract Syntax Notation definitions 3
3.4 Other definitions 4

4 Abbreviations 8

5 Conventions 9
5.1 Service Conventions 9
5.2 Base of Numeric Values 9
5.3 Notation 9
5.4 Supporting Productions 9
5.5 Pass-through Parameters 9
5.6 Negative Confirmation 10
5.7 Modifiers to a Service Request 11
5.8 Presentation of Errors 11
5.9 Use of Companion Standard Fields 11
5.10 Calling and Called MMS-user 11
5.11 Sending and Receiving MMS-user and MMPM 11
5.12 Requesting and Responding MMS-user 11
5.13 Client and Server of a Service 12
5.14 ASN.1 Definitions 12

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ISO/IEC 9506-2:1990
https://standards.iteh.ai/catalog/standards/sist/1df337b1-4dea-40f1-818e-36c1f96fd16b/iso-iec-9506-2-1990

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6 Elements of Protocol Procedure 12
6.1 Descriptive Conventions 12
6.2 Entering and Leaving the MMS Environment 12
6.3 Operating in the MMS Environment 13
6.4 Handling of Error Conditions 18
6.5 The Reject Service and RejectPDU 18

7 MMS PDU 18
7.1 The Confirmed-RequestPDU 19
7.2 The Unconfirmed-PDU 20
7.3 The Confirmed-ResponsePDU 20
7.4 The Confirmed-ErrorPDU 20
7.5 Supporting Productions 21
7.6 Common MMS Types 31

8 Environment And General Management Protocol 34
8.1 Introduction 34
8.2 Initiate 34
8.3 Conclude 37
8.4 Abort 37
8.5 Cancel 37
8.6 Reject 38

9 VMD Support Protocol 39
9.1 Introduction 39
9.2 Status 39
9.3 UnsolicitedStatus 40
9.4 GetNameList 40
9.6 Rename 42
9.7 GetCapabilityList 43

10 Domain Management Protocol 44
10.1 Introduction 44
10.2 InitiateDownloadSequence 44
10.3 DownloadSegment 45
10.4 TerminateDownloadSequence 45
10.5 InitiateUploadSequence 46
10.6 UploadSegment 46
10.7 TerminateUploadSequence 47
10.8 RequestDomainDownload 47
10.9 RequestDomainUpload 48
10.10 LoadDomainContent 48
10.11 StoreDomainContent 49
10.12 DeleteDomain 49
10.13 GetDomainAttributes 50

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 9506-2:1990
https://standards.iteh.ai/catalog/standards/sist/1df337b1-4dca-40f1-818e-36c0f96fd16b/iso-iec-9506-2-1990

11 Program Invocation Management Protocol 50

11.1 Introduction 51

11.2 CreateProgramInvocation 51

11.3 DeleteProgramInvocation 52

11.4 Start 52

11.5 Stop 53

11.6 Resume 54

11.7 Reset 54

11.8 Kill 55

11.9 GetProgramInvocationAttributes 55

12 Variable Access Protocol 56

12.1 Conventions 56

12.2 Protocol For Specifying Types 57

12.3 Protocol For Specifying Alternate Access 57

12.4 Protocol for Specifying Data Values 59

12.5 Protocol for Specifying Access To Variables 62

12.6 Read 63

12.7 Write 63

12.8 InformationReport 64

12.9 GetVariableAccessAttributes 64

12.10 DefineNamedVariable 65

12.11 DefineScatteredAccess 65

12.12 GetScatteredAccessAttributes 66

12.13 DeleteVariableAccess 66

12.14 DefineNamedVariableList 67

12.15 GetNamedVariableListAttributes 67

12.16 DeleteNamedVariableList 68

12.17 DefineNamedType 68

12.18 GetNamedTypeAttributes 69

12.19 DeleteNamedType 69

13 Semaphore Management Protocol 70

13.1 Introduction 70

13.2 TakeControl 70

13.3 RelinquishControl 71

13.4 DefineSemaphore 71

13.5 DeleteSemaphore 72

13.6 ReportSemaphoreStatus 72

13.7 ReportPoolSemaphoreStatus 72

13.8 ReportSemaphoreEntryStatus 73

13.9 AttachToSemaphore Modifier 74

13.10 Semaphore and Resource Management Supporting Productions 74

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 9506-2:1990
https://standards.iteh.ai/catalog/standards/sist/1df337b1-4dea-40f1-818e-36c1f96fd16b/iso-iec-9506-2-1990

14 Operator Communication Protocol 74

14.1 Introduction 74

14.2 Input 74

14.3 Output 75

15 Event Management Protocol 75

15.1 Introduction 75

15.2 DefineEventCondition 76

15.3 DeleteEventCondition 76

15.4 GetEventConditionAttributes 77

15.5 ReportEventConditionStatus 78

15.6 AlterEventConditionMonitoring 79

15.7 TriggerEvent 79

15.8 DefineEventAction 79

15.9 DeleteEventAction 80

15.10 GetEventActionAttributes 81

15.11 ReportEventActionStatus 81

15.12 DefineEventEnrollment 82

15.13 DeleteEventEnrollment 83

15.14 GetEventEnrollmentAttributes 83

15.15 ReportEventEnrollmentStatus 85

15.16 AlterEventEnrollment 86

15.17 EventNotification 86

15.18 AcknowledgeEventNotification 88

15.19 GetAlarmSummary 88

15.20 GetAlarmEnrollmentSummary 89

15.21 AttachToEventCondition 91

15.22 Supporting Productions 91

16 Journal Management Protocol 92

16.1 Introduction 93

16.2 ReadJournal 93

16.3 WriteJournal 94

16.4 InitializeJournal 94

16.5 ReportJournalStatus 95

16.6 CreateJournal 95

16.7 DeleteJournal 95

16.8 Supporting Productions 96

17 Mapping to ACSE and Presentation Services 97

17.1 Mapping of PDUs 97

17.2 Directly-Mapped Abort Service 97

17.3 Construction of MMS PDUs 98

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 9506-2:1990
https://standards.iteh.ai/catalog/standards/sist/1df337b1-4dea-40f1-818e-36e1f96fd168/iso-iec-9506-2-1990

17.4 Delivery of Service Primitives to an MMS-user 98
17.5 Right to Send Data 98
17.6 Reliable Underlying Service 98
17.7 Flow Control 98
17.8 Use of Presentation Contexts 98
17.9 Negotiation of MMS Abstract Syntaxes 99
17.10 Termination of Application Association 101
17.11 Abstract Syntax Definition 101
17.12 Application Context Name 101

18 Conformance 102
18.1 Introduction 102
18.2 PICS Part One: Implementation Information 102
18.3 PICS Part Two: Service CBBs 103
18.4 PICS Part Three: Parameter CBBs 107
18.5 PICS Part Four: Local Implementation Values 107

19 MMS Abstract Syntax 109

Annexes

A Requirements for Companion Standards (normative) 115
B File Access Protocol (normative) 119
C File Management Protocol (informative) 121

Index 127

iTeh STANDARD PREVIEW
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ISO/IEC 9506-2:1990
https://standards.iteh.ai/catalog/standards/sist/1df337b1-4dea-40f1-818e-36c1f96fd16b/iso-iec-9506-2-1990

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.

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.

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International Standard ISO/IEC 9506-2 was prepared by Technical Committee ISO/IEC TC 184, *Industrial automation systems*, Sub-Committee SC 5, *System integration and communication.*

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

— *Part 1: Service definition*

— *Part 2: Protocol specification.*

Introduction

This part of ISO/IEC 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, which 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.

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Security considerations

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When implementing MMS in secure or safety critical applications, features of the OSI security architecture may need to be implemented. Appropriate features should be selected from ISO 7498-2 covering safety architectures and features. Those of particular interest cover the position (in OSI) of

a) access control;

b) authentication;

c) non-repudiation.

Specific implementation methods shall be at the discretion of the implementor.

Complexity of services and requirements

Some MMS services are quite complex and should be considered as 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/IEC 9506 is one of a set of International 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 related 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/IEC 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/IEC 9506-1. It also uses and references the Association Control Service Element Definition (ISO 8649) and the Presentation Layer Service Definition (ISO 8822), whose provisions it assumes in order to accomplish the aims of the Manufacturing Message Specification Protocol. The inter-relationship of these International Standards is depicted in Figure 1.

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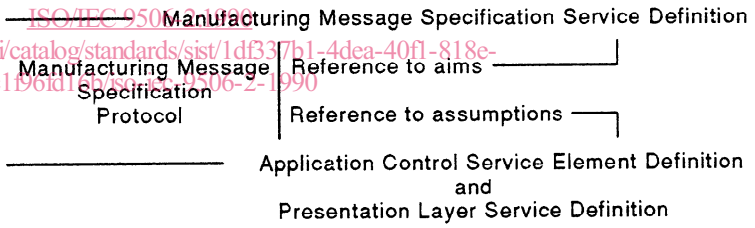

Figure 1 — Relationship between the Manufacturing Message Specification Protocol and adjacent services

The MMS protocol is structured so that subsets of protocol can be defined. The variations and options available within this part of ISO/IEC 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/IEC 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/IEC 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/IEC 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/IEC 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. It is, however, intended that this part of ISO/IEC 9506 can be used in circumstances where two implementations fail to communicate in order to determine whether one or both have failed to operate the protocol correctly.

Intended users

The primary aims of this part of ISO/IEC 9506 is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer MMS entities at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

a) as a guide for implementors and designers;

b) for use in the testing and procurement of equipment;

c) as part of an agreement for the admittance of systems into the open systems environment;

d) as a refinement to the understanding of OSI.

This part of ISO/IEC 9506 is concerned, in particular, with the communication and interworking of programmable devices on the plant floor. By using this part of ISO/IEC 9506 together with other standards positioned within the OSI Reference Model, otherwise incompatible systems may work together in any combination.

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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/IEC 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.

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1.2 Procedures

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;

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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 Association Control Service Element through the exchange of association control service primitives;

d) the interactions between an MMS-provider and a presentation service provider through the exchange of Presentation service primitives.

1.3 Applicability

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

1.4 Conformance

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

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9506. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 9506 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 646: 1983, *Information processing — ISO 7-bit coded character set for information interchange.*

ISO 7498: 1984, *Information processing systems — Open Systems Interconnection — Basic Reference Model.*

ISO 7498-2: 1989, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 2: Security Architecture.*

ISO 7498-3: 1989, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 3: Naming and addressing.*

ISO 8326: 1987, *Information processing systems — Open Systems Interconnection — Basic connection oriented session service definition.*

ISO/TR 8509: 1987, *Information processing systems — Open Systems Interconnection — Service conventions.*

ISO 8571: 1988, *Information processing systems — Open Systems Interconnection — File Transfer, Access and Management.*

ISO 8649: 1988, Information processing systems — Open Systems Interconnection — Service definition for the Association Control Service Element.

ISO 8650: 1988, *Information processing systems — Open Systems Interconnection — Protocol specification for the Association Control Service Element.*

ISO 8822: 1988, *Information processing systems — Open Systems Interconnection — Connection oriented presentation service definition.*

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ISO 8824: 1987, *Information processing systems — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1).*

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ISO 8824/Add 1: — [1], *Information processing systems — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1) Addendum 1: ASN.1 Extensions.*

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ISO 8825: 1987, *Information processing systems — Open Systems Interconnection — Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*

ISO 8825/Add 1: — [1], *Information processing systems — Open Systems Interconnection — Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1) Addendum 1: ASN.1 Extensions.*

ISO 9040: — [1], *Information processing systems — Open Systems Interconnection — Virtual terminal service — Basic class.*

ISO 9041: — [1], *Information processing systems — Open Systems Interconnection — Virtual terminal protocol — Basic class.*

ISO/IEC 9506-1: 1990, *Industrial automation systems — Manufacturing Message Specification — Part 1: Service definition.*

ISO/IEC 9545-1: 1989, *Information technology — Open Systems Interconnection — Application Layer Structure.*

ISO/IEC 9594: — [1], *Information processing systems — Open Systems Interconnection — The Directory.*

IEEE 754: 1985, *IEEE Standard for Binary Floating-Point Arithmetic.*

3 Definitions

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

For the purposes of this part of ISO/IEC 9506, the following definitions apply.

1) To be published.

3.1 Reference Model definitions

This part of ISO/IEC 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;

b) application-process;

c) application service element;

d) open system;

e) (N)-protocol;

f) (N)-protocol-data-unit;

g) (N)-service-access-point;

h) (N)-layer;

i) system;

j) (N)-user-data.

3.2 Service Convention definitions

This part of ISO/IEC 9506 makes use of the following terms defined in the OSI Service Conventions (ISO TR 8509) as they apply to the Manufacturing Message Specification:

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a) confirm;

b) indication;

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c) primitive;

d) request;

e) response;

f) service primitive;

g) service provider;

h) service user.

3.3 Abstract Syntax Notation definitions

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

1) value;

2) type;

3) simple type;

4) structure type;

5) component type;

6) tag;

7) tagging;

8) type (or value) reference name;

9) character string type;

10) boolean type;

11) true;

12) false;

13) integer type;

14) bitstring type;

15) octetstring type;

16) null type;

17) sequence type;

18) sequence-of type;

19) tagged type;

20) choice type;

21) selection type;

22) real type;

23) object identifier type;

24) MACRO;

25) module;

26) production;

27) ASN.1 encoding rules;

28) ASN.1 character set;

29) external type.

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3.4 Other definitions

For the purpose of this part of ISO/IEC 9506, the following definitions also apply:

3.4.1 AA-specific (Application Association specific):

An adjective used to describe an object whose name has a scope that is a single application association (i.e. the name may be referenced only on the application association over which the object was defined).

3.4.2 attribute:

A data element, having a defined meaning, together with a statement of the set of possible values it may take.

3.4.3 Called MMS-user:

The MMS-user that issues the Initiate.response service primitive.

3.4.4 Calling MMS-user:

The MMS-user that issues the Initiate.request service primitive.

3.4.5 Client:

The peer communicating entity which makes use of a VMD for some particular purpose via a service request instance.

3.4.6 conformance building block (CBB):

An atomic unit used to describe MMS conformance requirements.

3.4.7 data:

Any representation to which meaning is or might be assigned (e.g. characters).

3.4.8 domain:

An abstract object that represents a subset of the capabilities of a VMD which is used for a specific purpose.

3.4.9 Domain-specific:

An adjective used to describe an object whose name has a scope that is a single domain (i.e. the name can be referenced over all application associations established with the VMD that may reference this domain).

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3.4.10 download:

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The process of transferring the content of a domain, including any subordinate objects, via load data to an MMS-user.

3.4.11 event management:

The management of event conditions, event actions, and event enrollments.

3.4.12 file:

An unambiguously named collection of information having a common set of attributes.

3.4.13 file operation:

The transfer of files between open systems, the inspection, modification, or replacement of part of a file's content, or the management of a file and its attributes.

3.4.14 filestore:

An organized collection of files, including their attributes and names, residing at a particular open system.

3.4.15 information:

The combination of data and the meaning that it conveys.