BS EN 62264-5:2016

BSI Standards Publication

Enterprise-control system integration

Part 5: Business to manufacturing transactions

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National foreword

This British Standard is the UK implementation of EN 62264-5:2016. It is identical to IEC 62264-5:2016. It supersedes BS EN 62264-5:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Intégration du système de commande d'entreprise - Partie 5 : Transactions entre systèmes de gestion de commande d'entreprise et systèmes de fabrication (IEC 62264-5:2016)

Integration von Unternehmensführungs- und Leitsystemen - Teil 5: Transaktionen zwischen Unternehmungsführungs- und Produktionsleitsystemen (IEC 62264-5:2016)

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European foreword

The text of document 65E/459/CDV, future edition 2 of IEC 62264-5, prepared by SC 65E "Devices and integration in enterprise systems", of IEC/TC 65 "Industrial-process measurement, control and automation" and ISO/SC 5/JWG 5, of ISO/TC 184 "Automation systems and integration" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62264-5:2016.

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- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-05-25
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-11-25

This document supersedes EN 62264-5:2012

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 62264-2	2013	Enterprise-control system integration - Part 2: Objects and attributes for enterprise-control system integration	EN 62264-2	2013
IEC 62264-3	-	Enterprise-control system integration - Part 3: Activity models of manufacturing operations management	EN 62264-3	-
IEC 62264-4	-	Enterprise-control system integration - Part 4: Object model attributes for manufacturing operations management integration	EN 62264-4	-
ISO/IEC 19501	-	Information technology - Open Distributed Processing - Unified Modeling Language (UML) Version 1.4.2	-	-
ISO 8601	-	Data elements and interchange formats - Information interchange - Representation of dates and times	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62264-5 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation and ISO SC5, JWG 5, of ISO technical committee 184: Automation systems and integration.

It is published as a double logo standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

The addition of transaction rules for objects defined in IEC 62264-4: Job, Job List, Job Response, Job Response List, Work Alert Definition, Work Alert, Work Calendar Definition, Work Calendar, Work Capability Work Directive, Work Master, Work Performance, Work Record, Work Schedule, Workflow Specification Node Type, Workflow Specification

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The text is based on the following documents:

CDV	Report on voting
65E/459/CDV	65E/493/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by [...] P members out of [...] having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, IEC 62264-2.

The list of all the parts of the IEC 62264 series, under the general title *Enterprise-control system integration*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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INTRODUCTION

This part of IEC 62264 is based on the use of IEC 62264 abstract models previously defined in IEC 62264-2 and IEC 62264-4 combined with verbs to define a transaction model for information exchange. It is recognized that other non-IEC 62264-5 transaction protocols are possible and are not deemed invalid as a result. Transactions occur at all levels within the enterprise and between enterprise partners, and are related to both required and actual activities, but the focus of this part of IEC 62264 is the interface between enterprise/business systems and manufacturing systems.

This standard defines transactions that are exchanged between Level 4 and Level 3, and within Level 3 as defined in the object models of IEC 62264-2 and IEC 62264-4. Models are introduced which provide descriptions of the transactions and explanations of the required transaction processing behaviour.

Technology specific implementations to provide this behaviour are not defined in this standard. This part of IEC 62264 has the intent of providing insight into the level of work required to construct transactional exchanges.

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

1 Scope

This part of IEC 62264 defines transactions in terms of information exchanges between applications performing business and manufacturing activities associated with Levels 3 and 4. The exchanges are intended to enable information collection, retrieval, transfer and storage in support of enterprise-control system integration. This part of IEC 62264 is consistent with the IEC 62264-2 and IEC 62264-4 object models attributes. This standard also defines transactions that specify how to exchange the objects defined in IEC 62264-2, IEC 62264-4 and this standard. Other uses of the transaction model are not defined in this part.

The models covered in this standard are:

– Personnel model
– Equipment model
– Physical asset model
– Material model
– Process segment model
– Operations capability model
– Operations definition mode
– Operations schedule model
– Operations performance model
– Resource relationship network model
– Work capability model
– Work definition model
– Work schedule model
– Job list model
– Work performance model
– Workflow specification model
– Work calendar
– Work record
– Work alert model

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264-2:2013, *Enterprise-control system integration – Part 2: Object and attributes for enterprise-control system integration*

IEC 62264-3, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*

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IEC 62264-4, *Enterprise-control system integration – Part 4: Object model attributes for manufacturing operations management integration*

ISO/IEC 19501, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3 Terms, definitions, abbreviations, and conventions

3.1 Terms and definitions

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

3.1.1
application
ordered set of physical and logical system processes, performed by a set of resources that conduct a set of transactions intended to accomplish a definite objective performing the activity of an information provider or information user involved in a transaction

EXAMPLE HMIs, data historians, MES and LIMs software are examples of applications.

3.1.2
ID
information to identify an object or a property of an object

3.1.3
message
structured information unit conveyed in a one-way transfer of data between one sending application to one or more receiving applications

3.1.4
noun
one of two parts in the content of a message, which represents one or more objects, as defined in the IEC 62264-2 and IEC 62264-4 object models

3.1.5
transaction
sequence of related messages that are exchanged among applications performing Level 3 or Level 4 activities

3.1.6
verb
one of two parts in the content of a message, which defines the action to be performed, or the response to a request

3.1.7
wildcard
information to identify a collection of objects or properties of objects

3.2 Abbreviations

ERP Enterprise Resource Planning

HMI Human-machine interface

LIM Laboratory information management

MES Manufacturing Execution System

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MOM Manufacturing Operations Management

OAGIS Open Applications Group Interface Standard

PLM Product Lifecycle Management

SYNC Synchronized data

UTC Universal coordinated time

3.3 Conventions

Uppercase words are used to identify the verbs in a transaction message, to differentiate them from verbs in the sentences.

EXAMPLE 1 GET for the get verb used in a transaction message.

Italics and uppercase letters are used to emphasize the 62264 specific meaning of terms. They are used for the following cases:

- names of objects used in exchanged data, including all parts of a compound name
- parts of messages
- verb/noun message examples

EXAMPLE 2 *GET Equipment* for the get verb used with an equipment object.

Uppercase words are used to identify transaction models.

EXAMPLE 3 PUSH transaction for PROCESS, CHANGE, and CANCEL verbs

4 Transaction messages and verbs

4.1 General

Clause 4 defines a common set of transactions, messages and verbs that should be used between Level 4 and Level 3, and among Level 3, applications to exchange the data defined in the object models of IEC 62264-2 and IEC 62264-4.

A transaction shall consist of a sequence of messages, where each message shall have a structure as defined in 4.3.

Messages shall contain both a noun and a verb area. The information conveyed in a message shall be contained in the noun area of a message while the actions associated with the information shall be contained in the verb area.

The role of an application initiating a transaction shall determine the set of verbs to be used in conducting the transaction. These transaction models are described in 4.2.

Three different transaction models are defined:

1) A PULL model where a user of data requests the data from a provider of the data.
2) A PUSH model where a provider of data requests an action (processing, changing, or cancelling) on the data by another user.
3) A PUBLISH model where the owner of data publishes it to users (subscribers) of the data.

NOTE The phrase “owner of data” is used to identify the application that has responsibility for enforcing the consistency of data.

This standard does not address the case where there may be multiple systems that can act as the owner of data. In these situations configuration should be set up so that one master owner of the data should be designated, with other systems performing the role of data users.

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4.2 Transaction models

There are three classes of actions provided by the verb set: data synchronization, transaction processing, and query/reporting. Each is defined in a different transaction model:

a) A PULL model where a user of data requests information from an information provider. This model is used for query/reporting.

   Information provider applications listen for GET messages and respond with SHOW messages to complete the transaction.

   Information user applications send GET messages.

   1) Requests for information are sent through GET messages.
   2) A GET message describes the scope of the requested information.
   3) A SHOW message returns the information.

b) A PUSH model where a sender of information sends new or changed information to the receiver to process requests. This model is used for transaction processing.

   Receiver applications listen for PROCESS, CHANGE, or CANCEL messages.

   Sender applications send PROCESS, CHANGE, and CANCEL messages.

   1) New information is pushed to the receiver through a PROCESS message. Responses may be returned to the sender through an ACKNOWLEDGE message.
   2) Changes to information are pushed to the receiver through a CHANGE message. Responses may be returned to the sender through a RESPOND message.
   3) Information to be removed is pushed to the receiver through a CANCEL message.

c) A PUBLISH model where the provider of data publishes it to users (subscribers) of the data. This model is used for data synchronization.

   Subscriber applications receive SYNC messages.

   Publisher applications send SYNC messages.

   1) The publisher sends SYNC messages containing new, changed, or deleted information to subscribers.
   2) A subscriber receives SYNC messages containing new, changed, or deleted information.

   The timing of the publication and scope of the published information is not defined in a message. It is determined by an out-of-band agreement between the publisher and subscriber, therefore there is no SUBSCRIBE message defined in this standard.

   NOTE 1 An out-of-band agreement means that the agreement is not defined in the transaction protocol.

   EXAMPLE An agreement between a publisher and subscriber that is set up through configuration parameters in the applications, or an agreement that is set up dynamically through a web service agreement, or an agreement that is set up through a third party application.

A single application may support one or more transaction models and the application may take on multiple roles (sender, receiver, provider, and user).

NOTE 2 The transactions are based on the assumption that the exchanged information (noun) is contained in a message of some form. The exact form of the messages is undefined in this specification; for example, the messages could be tab delimited files, XML files, electronic mail messages, or data in a named pipe. The exact form of the transport mechanism for the sending, receiving, listening, and publishing of messages is not defined in this specification.

NOTE 3 The transaction message models do not imply any specific architecture or mechanism for transporting the messages.

The transactions assume the ability to send an empty or nearly empty message that identifies either a specific object (typically by ID), a list of specific objects (by a list of IDs), or a class of objects (by wildcard or property value definition).

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Figure 1 illustrates the exchange of messages in a typical transaction, where a message (*GET Equipment)* is sent from an information user with an identification of an object (*Equipment*), and a message (*Show Equipment)* is returned from the information provider with the object's information (*Equipment*).

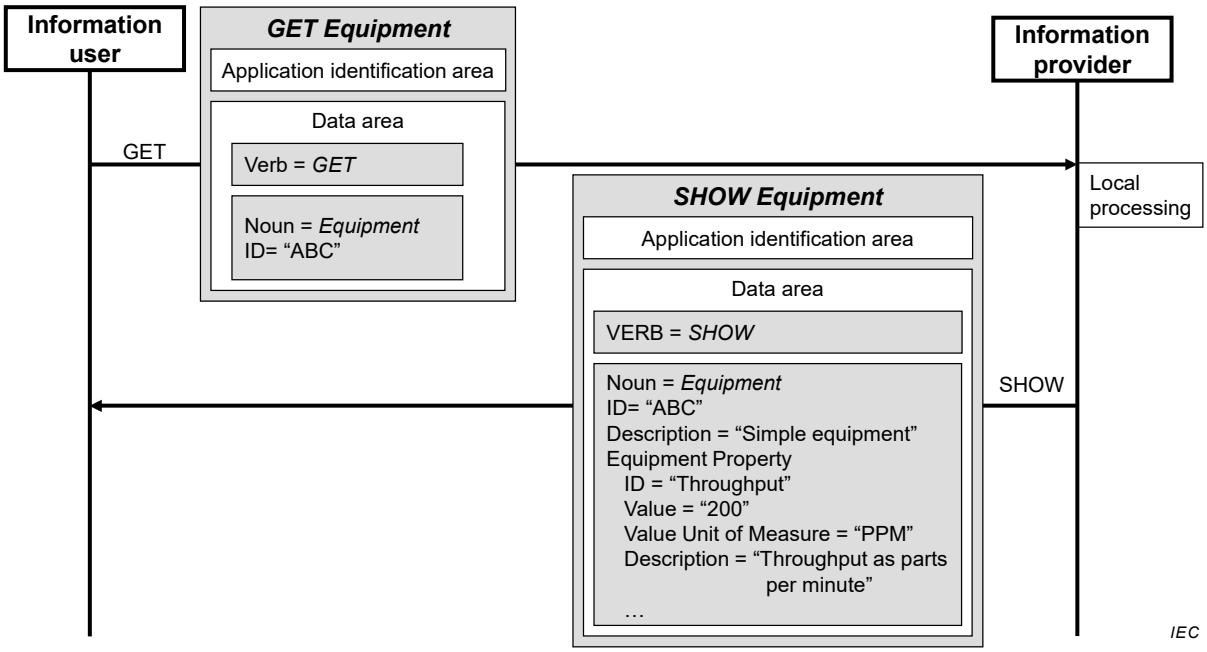

Figure 1 – Typical exchanged messages in a transaction

4.3 Message structure

4.3.1 General structure

Every message shall contain the information required to identify the source of the message and the type of the message. There shall be two main areas in a message, as shown in Figure 2, an application identification area and a data area. Within the data area there shall be a verb area and a noun area.

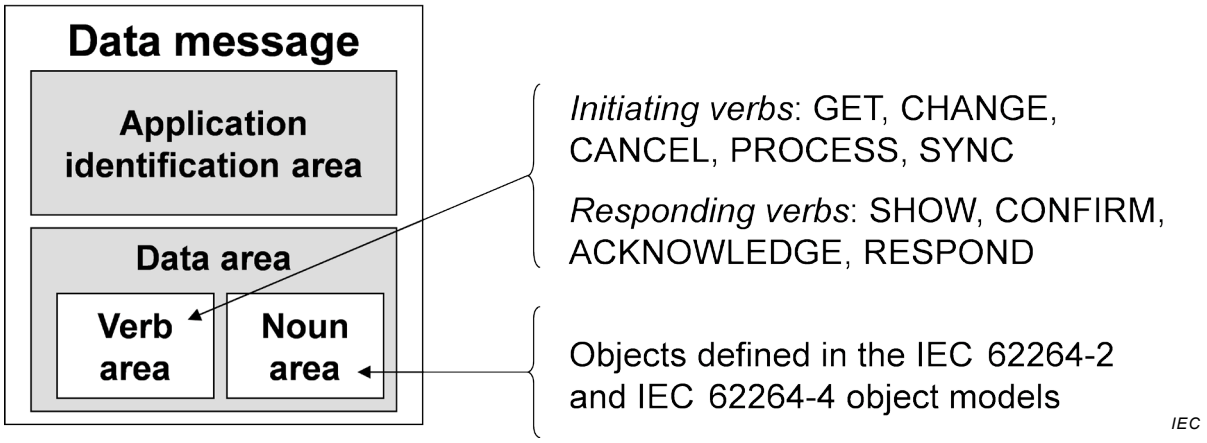

Figure 2 – Typical exchanged data set

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4.3.2 Application identification area

The application identification area shall carry information that a receiving application uses to handle a message. The application identification area is used for the application layer of communication, such as indicating a required confirmation of message processing. This information typically includes the electronic address of the sender, an indication of the confirmation requirement, and the date and time the message was created. The application identification area may also include other information required for identification and authentication of the messages, such as a transaction ID. Figure 3 illustrates a typical layout for an application identification area.

NOTE See the OAGIS (Open Applications Group Integration Specification) 9.0 specification for a format for the application identification area. The data exchange model defined in this document is consistent with the OAGIS specification, such that an implementation of OAGIS, using the objects defined in IEC 62264-2 and IEC 62264-4, can conform to this part of the standard.

Dates and times shall include time information in order to unambiguously identify times, such as universal coordinated time (UTC) or ISO 8601 CE (Common Era) calendar extended format. A time zone specification of the time is optional, and if missing the time shall be represented as UTC.

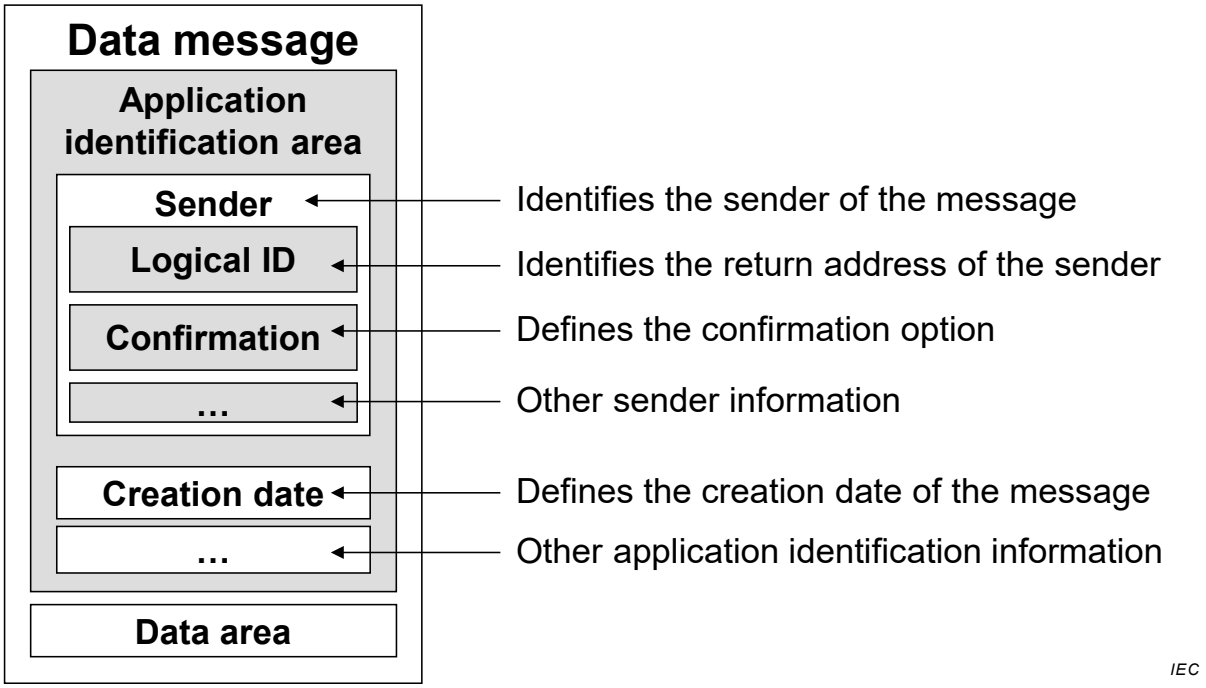

Figure 3 – Typical layout of an application identification area

4.3.3 Data area

The data area in a message shall contain a verb area and a noun area.

The verb area shall contain verbs and associated elements that represent the actions to be performed by the receiving application, or the response to a request by the sending application. The verbs defined in this part of the standard are listed in Clause 5.

The noun area shall contain nouns and associated elements that represent one or more objects defined in the IEC 62264-2 and IEC 62264-4 object models. The nouns defined in this part of the standard are listed in Clause 6.

The verb-noun combinations define messages that are intended to have a unique and unambiguous meaning.

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4.3.4 Message nouns

Nouns represent one or more objects from the object models defined in IEC 62264-2 and IEC 62264-4 that have been grouped together for use with messages.

EXAMPLE A *Material Definition* noun is a composition of a *Material Definition* object instance with its *Material Definition Property* object instances.

4.3.5 Wildcard

The noun may contain a wildcard string used to identify multiple objects.

NOTE 1 Wildcards apply to the ID of a property, not to the value of the properties.

NOTE 2 Wildcards are used with care if combined with lists of object IDs or property IDs. In the case of errors a confirmation message may not have sufficient information to determine the exact error.

NOTE 3 A common convention for specifying wildcards in text strings is as regular expressions (as defined in ISO/IEC 9945-2). Regular expressions are widely supported in programming languages, text processing programs, advanced text editors, and some other programs. Regular expression support is part of the standard library of many programming languages, including Java and Python[1], is built into the syntax of others, including Perl and ECMAScript[2], and is supported by many commonly available libraries.

NOTE 4 Wildcards could also be implemented using limited regular expressions. In a limited regular expression a wildcard string can have the following special characters:

"*" Indicates zero or more characters, any character is acceptable.

EXAMPLE 1 The wildcard "ABC*" would match "ABC", "ABCD", "ABCDEF", "ABC@4!*", but not "ABDDEF".

"%" Indicates one or more characters, any character is acceptable.

EXAMPLE 2 The wildcard "ABC%" would match "ABCD", "ABCDEF", "ABC^4^*", but not "ABC".

"?" Indicates zero or one characters at the specified position, any character is acceptable.

EXAMPLE 3 The wildcard "ABC?" would match "ABCX", "ABCD", "ABC!", "ABC", but not "ABCDE" or "ABDC".

The character following a "\" is considered a literal character, not a wildcard character.

EXAMPLE 4 An object ID of "ABC*" defines the object ID as "ABC*".

EXAMPLE 5 A property ID of "\\\\USM 123" defines the property ID "\\USM 123".

NOTE 5 Two consecutive backslash characters, i.e. "\\" are interpreted to be a single backslash character "\".

Figure 4 illustrates a GET/SHOW transaction with a wildcard specified. The provider of the information returns a list of objects matching the wildcard specification.

[1] Java and Python are examples of a suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these product(s).

[2] Perl and ECMAScript are examples of a suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these product(s).

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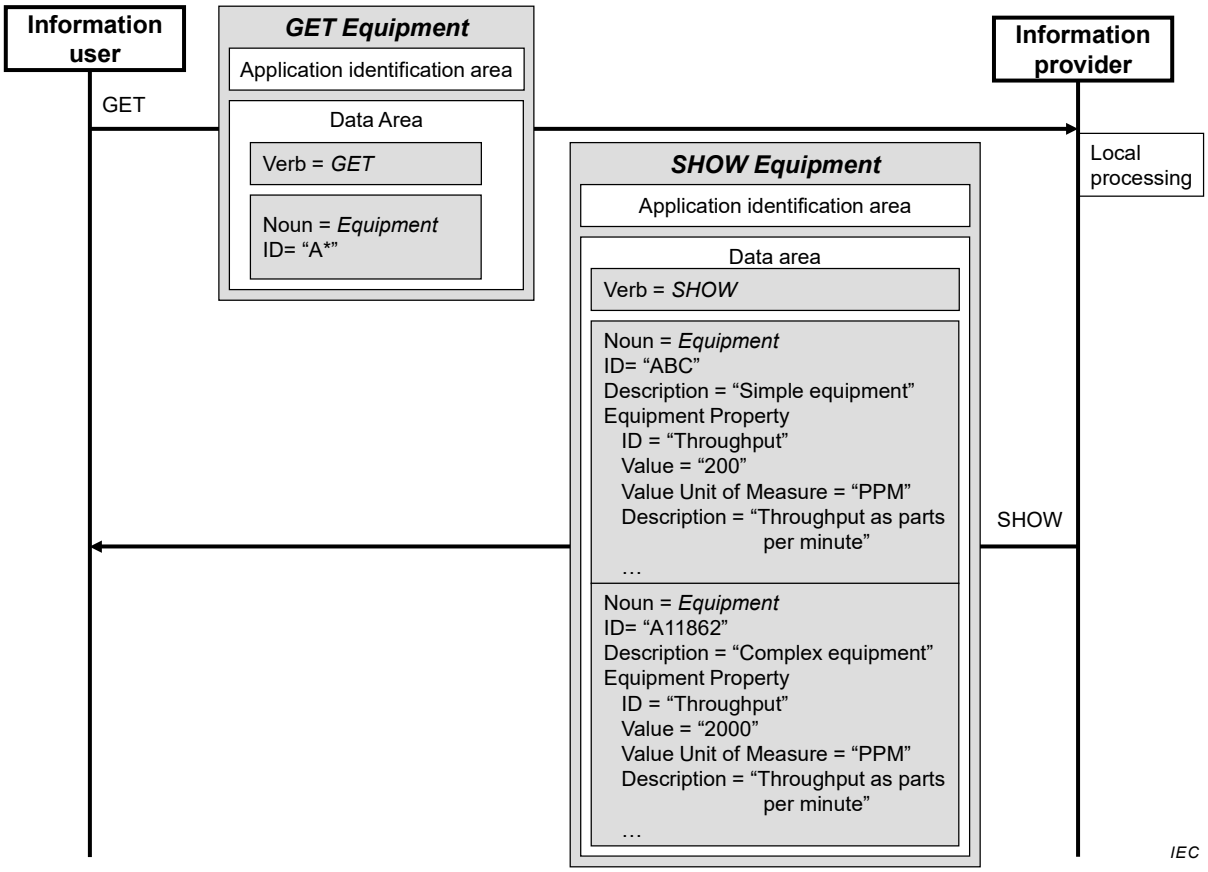

Figure 4 – GET with wildcard and SHOW response

5 Message verbs

5.1 Verbs and transaction models

The verb area of a message shall contain a verb, defined in Clause 5 and listed in Table 1.

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Table 1 – Defined verbs

Verb	Description	Transaction model
ACKNOWLEDGE	Acknowledgement of a PROCESS request. The noun may contain assigned IDs and other information to inform the sender of the PROCESS message of the IDs of any created objects. EXAMPLE A PROCESS message sent with a *Material Lot* may return the ID assigned to the lot by the receiving system.	PUSH
CANCEL	Request to a receiver to remove information. The specified noun's information shall be cancelled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be cancelled, not the noun itself. NOTE 1 This does not indicate that the information is deleted, just that it is no longer available for GET, CHANGE and SYNC messages. NOTE 2 Not all objects have contained elements. Examples of contained elements are properties, specifications, actuals, etc. EXAMPLE A property object for a *Material Class* noun is a contained element.	PUSH
CHANGE	Request to a receiver to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes of the noun shall be changed. NOTE See IEC 62264-2 and IEC 62264-4 for definitions of object attributes.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL, PUBLISH
GET	Request to an information provider for information on one or more objects. The information provider shall return a SHOW message containing each of the specified attributes and each of the specified contained elements of the specified nouns. If no attribute or contained element is specified in the noun area, then all attributes and/or contained elements shall be returned. When wildcards are applied to the noun and property IDs, it shall be possible to further filter the information to be returned by specifying a value for one or more attributes of the noun. Only objects whose attributes match the specified value (out of the list of objects matching the wildcards applied to noun and property IDs) shall be returned. EXAMPLE To get all the *Material Lots* with Status = "New", the wildcard "*" would be specified for the *Material Lot* ID and the "New" value would be specified for the Status attribute.	PULL
PROCESS	Request to a receiver to process new information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUSH
RESPOND	Response to a CHANGE message request. The noun may contain proposed or alternate information that was used in place of the CHANGE noun information. EXAMPLE A CHANGE message sent with an updated *Material Lot* status of "OK" may return a RESPOND with a different status of "OUT OF SPEC" because of business rules in the receiver of the CHANGE message.	PUSH
SHOW	Response to a GET message.	PULL

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Verb	Description	Transaction model
SYNC ADD	Request from the owner of the object to add information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUBLISH
SYNC CHANGE	Request from the owner of the object to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes of the noun shall be changed.	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information. The specified noun shall be cancelled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be cancelled.	PUBLISH

NOTE 1 The processes on either side of the messages are not defined in this document.

NOTE 2 The mechanism to set up the one-to-one association of the PUSH model is not included in this part. Configuration and set up are implementation specific and would be defined in conforming specifications.

NOTE 3 The mechanism to set up the one-to-one association of the PULL model is not included in this part. Configuration and set up are implementation specific and would be defined in conforming specifications.

NOTE 4 The mechanism used for subscribing in the PUBLISH model is not included in this part. Subscribing mechanisms are implementation specific and would be defined in conforming specifications.

NOTE 5 Contained elements are object properties or other contained elements as described in 6.2.

NOTE 6 Different methods are possible to specify objects. Such methods depend on the specific noun as well as on the specific verb used, and are specified in the subclauses for each object type.

NOTE 7 The entity receiving the PROCESS message may perform further processing of the added information.

NOTE 8 There is no ability defined in this part of the standard to add or remove object attributes; IEC 62264-2 and IEC 62264-4 define the object attributes.

NOTE 9 Additional information returned in a SHOW message, (as a response to a GET message) (e.g. IDs of referenced objects) is specified in the subclauses for each object type.

NOTE 10 Additional information changed by the CHANGE and SYNC CHANGE messages (e.g. IDs of referenced objects) is specified in the subclauses for each object type.

NOTE 11 Objects can be specified by specific values of their ID or by using wildcards.

5.2 GET verb

The GET verb shall be used in a GET message to communicate a request for information on an object or list of objects.

The response to the GET message is a SHOW message. Figure 5 illustrates the GET/SHOW transaction.

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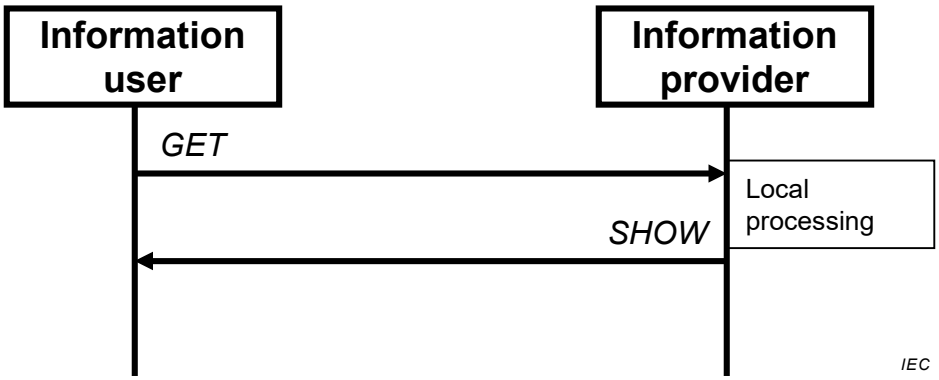

Figure 5 – GET and SHOW transaction

The GET verb is designed to retrieve one or more objects and any contained elements by using the ID attribute.

Within a GET message, the ID of the requested object is passed to the provider of the information. Where a single ID is not sufficient identification to identify the subset of information requested, such as when only a property of an object is needed, then the ID of the top level object, and the ID or value of the encapsulated object (the property) is passed to the provider of the data. The identifying IDs are specified in the ID sections for each object type.

When a wildcard definition is used in the ID, then the GET returns a list of objects matching the wildcard specification.

EXAMPLE The GET verb may retrieve multiple objects such as all of the personnel classes.

NOTE A GET verb with a wildcard provides a very limited query capability. The transactions are not intended to provide a complete query/reporting capability as normally seen in a database system. If additional query capability is needed, then the GET/SHOW transaction can be used to create copies of all data, and that copy can then be queried locally.

5.3 SHOW verb

The SHOW verb shall be used in a SHOW message when responding to a GET message.

5.4 PROCESS verb

The PROCESS verb shall be used in a PROCESS message to request processing of the associated noun by the receiving application. A PROCESS message is sent to an entity that can process the object. In a typical exchange scenario a PROCESS message is considered to be the equivalent of a formal command.

NOTE A PROCESS verb is often the equivalent of a command to add an object, but usually the receiving entity does further processing of the information. The PROCESS verb is sent to the owner of the information. A SYNC ADD message is usually sent out by the receiver of the PROCESS message, after processing, to inform any other users of the information that there has been new information added.

EXAMPLE 1 The sending of a *PROCESS Operations Schedule* message to a site indicates that the schedule is to be executed.

EXAMPLE 2 The sending of a *PROCESS Equipment* message indicates that a new equipment item is to be added to a master equipment database. The receiver of the PROCESS message may then send out a *SYNC ADD Equipment* message to indicate that the master equipment database was updated.

A PROCESS verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 2). If the optional element is not specified, then it defaults to Never.

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Table 2 – Acknowledge request options

Name	Description
Never	No ACKNOWLEDGE message requested.
Always	Always send an ACKNOWLEDGE message.

5.5 ACKNOWLEDGE verb

The ACKNOWLEDGE verb shall be used in an ACKNOWLEDGE message to indicate an application's receipt of a PROCESS request. The response to a PROCESS message is an ACKNOWLEDGE message. The ACKNOWLEDGE message may return the original or modified data. Figure 6 illustrates a PROCESS message with the "acknowledge always" option, and with a response ACKNOWLEDGE message.

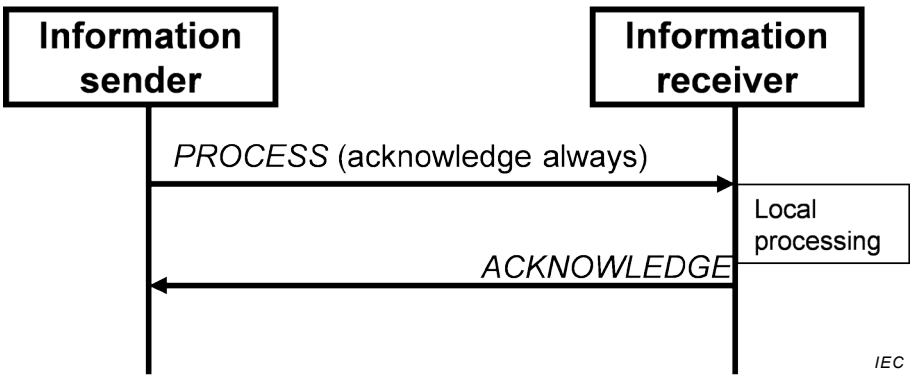

Figure 6 – PROCESS/ACKNOWLEDGE transaction with an "acknowledge always" option

EXAMPLE 1 Sending of an *ACKNOWLEDGE Operations Schedule* message, where a *PROCESS Operations Schedule* message has been received and the corresponding business application acknowledges the receipt of the *Operations Schedule* and responds with an acceptance.

An ACKNOWLEDGE verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified (see Table 3).

Table 3 – Acknowledge element

Acknowledge element value	Definition
ACCEPTED	The information was accepted by the receiver of the information and was processed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not processed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing; the modified data shall be returned with the ACKNOWLEDGE. The message data area shall contain an identification of the type of modification.

EXAMPLE 2 Figure 7 shows a message sequence from a scheduling system to an execution system. The initial PROCESS message with an *Operations Schedule* is received and an ACKNOWLEDGE message with a MODIFIED flag was returned with a new proposed schedule. The scheduling system re-generates a schedule and resends to the execution system. The execution system accepts the *Operations Schedule* and returns an ACKNOWLEDGE message with an ACCEPTED flag.

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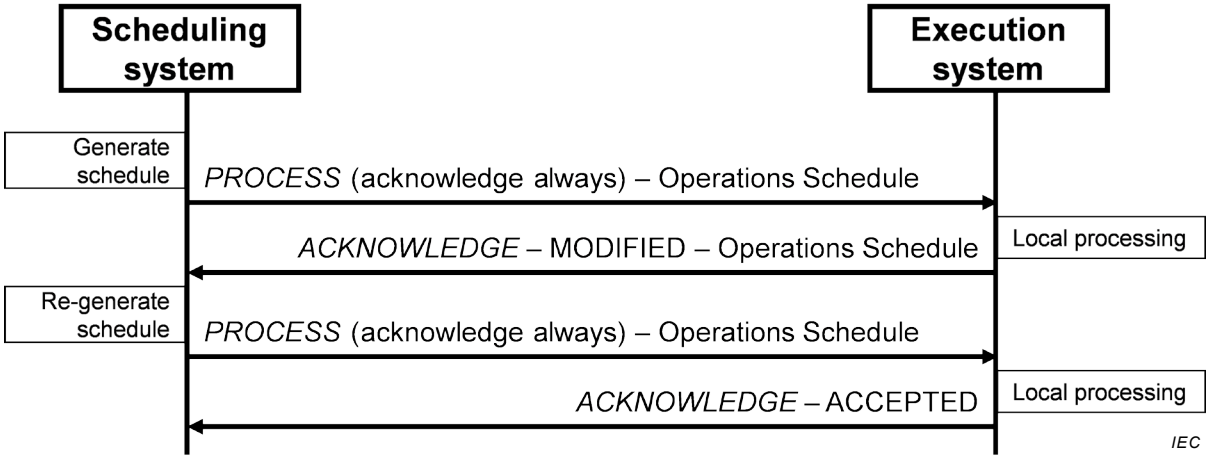

Figure 7 – Example of ACKNOWLEDGE to a PROCESS message

5.6 CHANGE verb

The CHANGE verb shall be used in a CHANGE message when the sender of the message is sending a request for the data to be changed. The noun area contains the new data. Figure 8 illustrates a CHANGE message with a "respond always" option and with a RESPOND message.

EXAMPLE Sending of a *CHANGE Person* message, where the personnel information, such as a qualification test, is changed by a system that is not the owner of the personnel model data.

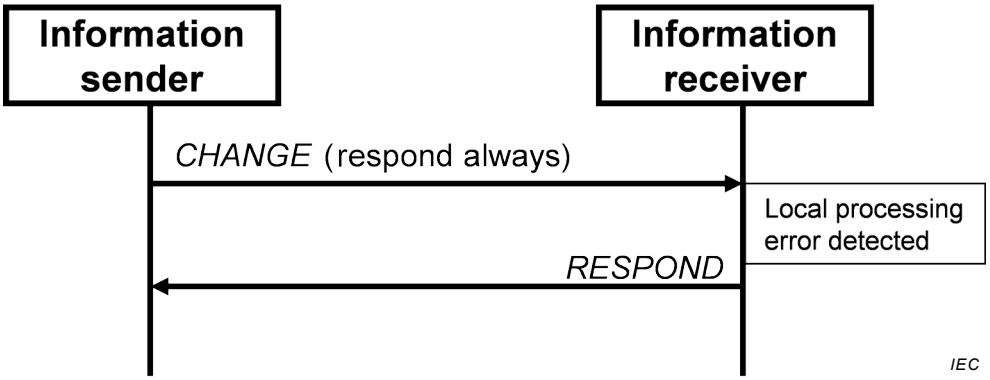

Figure 8 – CHANGE/RESPOND transaction with a "respond always" option

A CHANGE verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 4). If the optional element is not specified, then it defaults to Never.

Table 4 – Respond options

Name	Description
Never	No RESPOND message requested.
Always	Always send a RESPOND message.

5.7 CANCEL verb

The CANCEL verb shall be used in a CANCEL message when the sender of the CANCEL message is sending a request for the data to be cancelled.

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EXAMPLE Sending of a *CANCEL Material Lot* message, where an application indicates that a *Material Lot* is no longer valid (or available), but the application that is sending the CANCEL message is not the owner of the material model data.

NOTE Because the CANCEL is not sent by the owner of the data, the data are not necessarily deleted. The sender is indicating that the sender no longer needs the data.

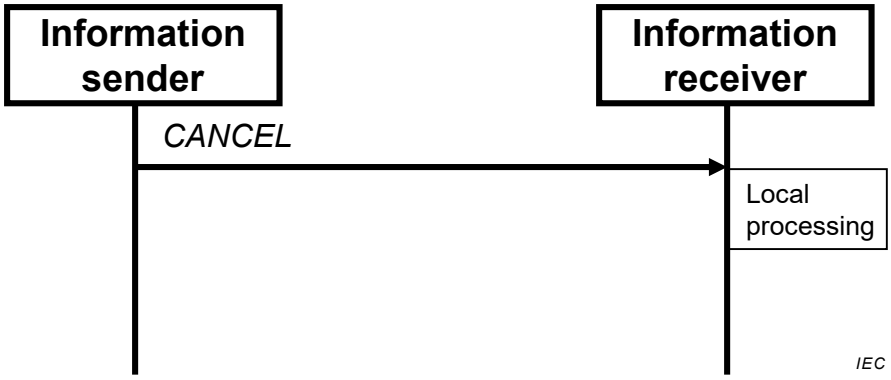

Figure 9 – CANCEL message

5.8 CONFIRM verb

A CONFIRM verb shall be used in a CONFIRM message for confirmation of receipt and processing of any message other than the CONFIRM, RESPOND, or ACKNOWLEDGE messages. See Figure 11 for an example of confirmation with detected errors.

Figure 10 illustrates a transaction with a GET message followed by a SHOW message and a CONFIRM message (because of the “confirm always” option specified with the GET message).

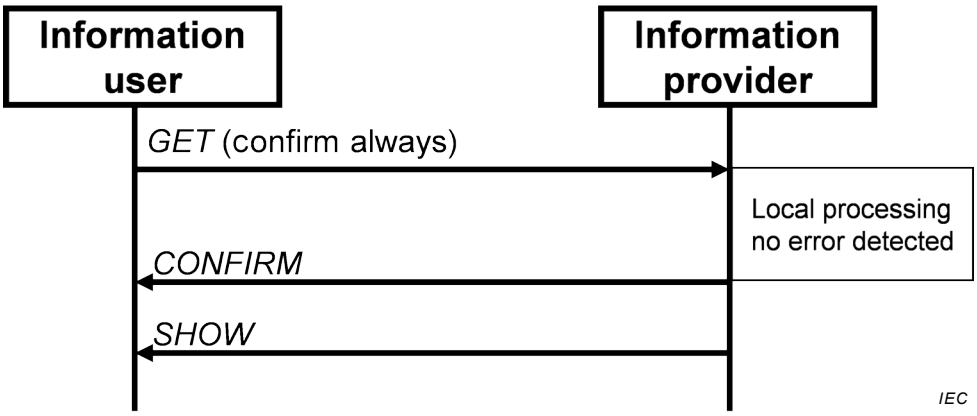

Figure 10 – GET and SHOW transaction with a "confirm always"

NOTE 1 The order of arrival of the CONFIRM message, SHOW message, and any other response message is not defined in this standard.

Confirmation is an option controlled by the sending business application. It is a request to the receiving application to send back a confirmation message to the sender of the initiating message. If the optional element is not specified, then it defaults to Never.

A confirmation request, specified in the application identification area, has the values defined in Table 5.

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Table 5 – Confirmation request options

Name	Description
Never	No confirmation requested.
OnError	Send back a confirmation only if an error has occurred.
Always	Always send a confirmation regardless of the local processing.

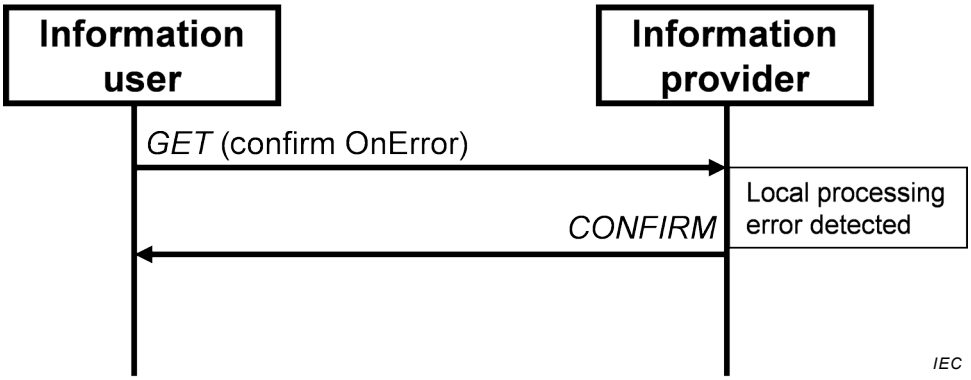

Figure 11 – Example of a GET message with "confirm OnError"

NOTE 2 The order of arrival of the CONFIRM message and any other response message is not defined in this standard.

The CONFIRM message:

1) identifies the initiating message being confirmed;
2) indicates the status of the processing of the message;
3) includes a description of the error if the status indicates a processing error if requested.

If an error occurs in the processing of the initiating message by the receiving application and the sender sets the confirmation element to either OnError or Always, then the receiving application shall provide a CONFIRM message.

Error handling at the application layer is through the confirmation element in the application identification area. Specific error codes or error text are not defined in this part and are implementation specific.

The application error handling is in addition to any communication layer error handling that may be provided by the infrastructure framework, web service, or middleware.

Additional error description, code, or text associated with objects in the noun area may be contained in the noun area, as shown in Figure 12.

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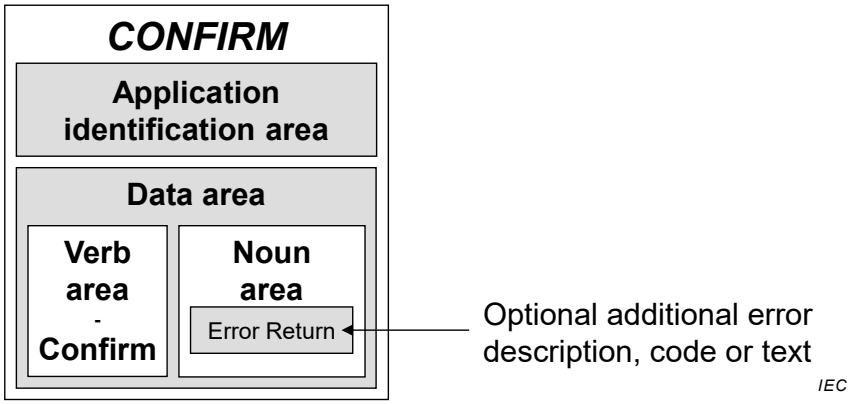

Figure 12 – CONFIRM message

5.9 RESPOND verb

The RESPOND verb shall be used in a RESPOND message to signify the application receipt and processing of a CHANGE message. The RESPOND message is used when responding to a CHANGE message. The RESPOND message may return the original or modified data.

A RESPOND verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified (see Table 6).

Table 6 – Respond element

Respond element value	Definition
ACCEPTED	The information was accepted by the receiver of the information and was changed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not changed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing and the modified data were returned with the RESPOND. The message data area shall contain an identification of the type of modification.

5.10 SYNC verb

The SYNC verb shall be used in a SYNC message when the owner of the data is publishing the information or change in information to subscribers.

NOTE SYNC is short for synchronize, and implies synchronized or aligned data; it does not mean synchronous communications.

There should only be one application that sends SYNC messages for any specific element of information.

EXAMPLE 1 A human resources system can provide *Personnel Capability* information; however, a training system can provide the *Qualification Test Specification* pertaining to the *Personnel Capability*.

The owner of the information sends the SYNC message.

The SYNC message shall contain one of the following modifiers in the verb area: ADD, CHANGE, or DELETE.

EXAMPLE 2 This verb is commonly used when mass changes are necessary, such as when an ERP publishes an item master to multiple MES systems, or when a publish and subscribe mechanism is used as a company's integration architecture.

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5.11 SYNC ADD verb

A SYNC ADD verb shall be sent by the owner of the information and indicates that the owner of the information has added new information. The SYNC ADD message shall include the object instances added and the values of all attributes of these objects. The specific elements to be added are defined in Clause 6. See Figure 13 for an example of a SYNC ADD with a CONFIRM response.

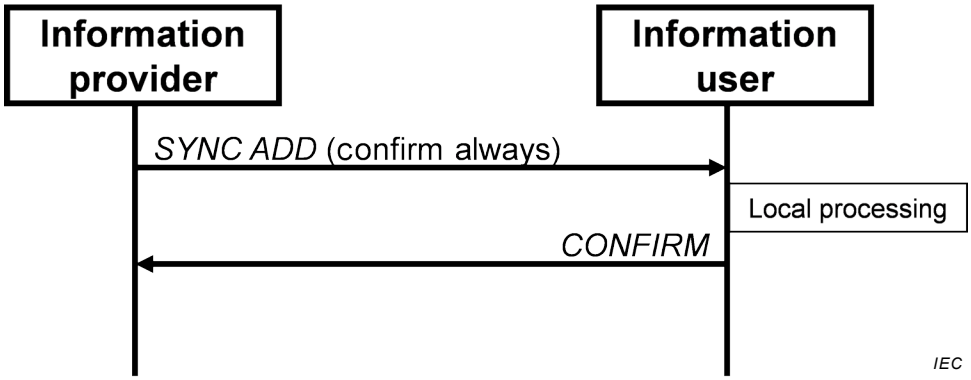

Figure 13 – SYNC ADD transaction with confirmation

EXAMPLE A SYNC ADD on a *Material Test Specification* noun indicates the definition of a new *Material Test Specification* object.

5.12 SYNC CHANGE verb

A SYNC CHANGE verb is sent by the owner of the information and is used to disseminate information on changed objects to subscribed users. The SYNC CHANGE message shall include the object instances changed with the values of the attributes changed. The specific elements to be changed are defined in Clause 6.

EXAMPLE A SYNC CHANGE message with a *Material Class* object indicates a change in the *Material Class* or a property of the *Material Class* and the new value.

5.13 SYNC DELETE verb

A SYNC DELETE verb is sent by the owner of the information and indicates that the provider of the information has deleted the information. The SYNC DELETE message shall include the object instances deleted.

See Figure 14 for an example of a SYNC DELETE with no response. The specific elements to be deleted are defined in Clause 6.

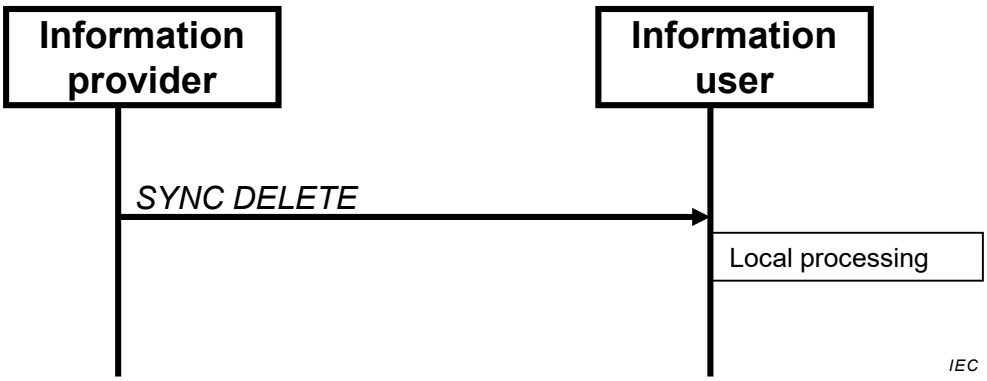

Figure 14 – SYNC DELETE transaction with no confirmation

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NOTE A SYNC DELETE message only indicates that the provider has deleted the information from publication. The information can still be archived or retained in accordance with business policies, but just not available for further publishing. The information user has the responsibility to determine the correct action, such as retaining or archiving their information.

5.14 Verb actions and the use of IDs

The verbs GET, CHANGE, CANCEL, PROCESS, and SYNC, have different meaning and responses based on the values of ID attributes in the noun object. The specific rules for each verb/noun combination are defined in Clause 6. IDs may be specified, not specified, or contain wildcard values. The action in each case is defined in the noun's verb action clause. Where there are multiple IDs in a noun/object, each row in the noun's verb action table defines one valid combination of ID values.

6 Message nouns

6.1 General

Clause 6 defines the contents of the noun area in a message that shall be used by verbs to identify information exchanged.

6.2 Defined message contents

6.2.1 Equipment

The *Equipment* noun can contain the following objects as defined in IEC 62264-2:

- Equipment
- Equipment Property
- Equipment Capability Test Result
- Equipment Asset Mapping

6.2.2 Equipment Capability Test Specification

The *Equipment Capability Test Specification* noun contains the following object as defined in IEC 62264-2:

- Equipment Capability Test Specification

6.2.3 Equipment Class

The *Equipment Class* noun can contain the following objects as defined in IEC 62264-2:

- Equipment Class
- Equipment Class Property

6.2.4 Job List

The *Job List* noun can contain the following objects as defined in IEC 62264-4:

- Job Order
- Job List
- Job Order Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement

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- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.5 Job Response

The *Job Response* noun contains the following objects as defined in IEC 62264-4:

- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.6 Job Response List

The Job Response List noun contains the following objects as defined in IEC 62264-4:

- Job Response List
- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.7 Material Class

The *Material Class* noun can contain the following objects as defined in IEC 62264-2:

- Material Class
- Material Class Property

6.2.8 Material Definition

The *Material Definition* noun can contain the following objects as defined in IEC 62264-2:

- Material Definition
- Material Definition Property

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6.2.9 Material Lot

The *Material Lot* noun can contain the following objects as defined in IEC 62264-2:

- Material Lot
- Material Lot Property
- Material Test Result

6.2.10 Material Sublot

The *Material Sublot* noun can contain the following objects as defined in IEC 62264-2:

- Material Sublot
- Material Lot Property
- Material Test Result

EXAMPLE Sublot specific properties may be unique RFIDs (radio frequency ID) for each sublot or maximum temperature indicators for each sublot.

6.2.11 Material Test Specification

The *Material Test Specification* noun can contain the following object as defined in IEC 62264-2:

- Material Test Specification

6.2.12 Operations Capability

The *Operations Capability* noun can contain the following objects as defined in IEC 62264-2:

- Operations Capability
- Process Segment Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.13 Operations Definition

The *Operations Definition* noun can contain the following objects as defined in IEC 62264-2:

- Operations Definition
- Operations Segment
- Operations Segment Dependency
- Operations Material Bill
- Operations Material Bill Item
- Parameter Specification
- Personnel Specification
- Equipment Specification

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- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property
- Material Specification Property

6.2.14 Operations Schedule

The *Operations Schedule* noun can contain the following objects as defined in IEC 62264-2:

- Operations Schedule
- Operations Request
- Segment Requirement
- Requested Segment Response
- Segment Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.15 Operations Performance

The *Operations Performance* noun can contain the following objects as defined in IEC 62264-2:

- Operations Performance
- Operations Response
- Segment Response
- Segment Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.16 Person

The *Person* noun can contain the following objects as defined in IEC 62264-2:

- Person

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- Person Property
- Qualification Test Result

6.2.17 Personnel Class

The *Personnel Class* noun can contain the following objects as defined in IEC 62264-2:

- Personnel Class
- Personnel Class Property

6.2.18 Physical Asset

The *Physical Asset* noun can contain the following objects as defined in IEC 62264-2:

- Physical Asset
- Physical Asset Property
- Physical Asset Capability Test Result
- Equipment Asset Mapping

6.2.19 Physical Asset Class

The *Physical Asset Class* noun can contain the following objects as defined in IEC 62264-2:

- Physical Asset Class
- Physical Asset Class Property

6.2.20 Physical Asset Capability Test Specification

The *Physical Asset Capability Test Specification* noun contains the following object as defined in IEC 62264-2:

- Physical Asset Capability Test Specification

6.2.21 Process Segment

The *Process Segment* noun can contain the following objects as defined in IEC 62264-2:

- Process Segment
- Process Segment Parameter
- Personnel Segment Specification
- Equipment Segment Specification
- Physical Asset Segment Specification
- Material Segment Specification
- Process Segment Dependency
- Personnel Segment Specification Property
- Equipment Segment Specification Property
- Physical Asset Segment Specification Property
- Material Segment Specification Property

6.2.22 Resource Relationship Network

The *Resource Relationship Network* noun can contain the following objects as defined in IEC 62264-4:

- Resource Relationship Network

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- Resource Network Connection
- Resource Network Connection Property
- To Resource Reference
- To Resource Reference Property
- From Resource Reference
- From Resource Reference Property

6.2.23 Resource Relationship Network Connection Type

The *Resource Relationship Network Connection Type* noun can contain the following objects as defined in IEC 62264-4:

- Resource Network Connection Type
- Resource Network Connection Type Property

6.2.24 Qualification Test Specification

The *Qualification Test Specification* noun contains the following object as defined in IEC 62264-2:

- Qualification Test Specification

6.2.25 Transaction Profile

The message contents of a *Transaction Profile* returns all supported verb/noun combinations, if the combination is supported as a receiver, if it is supported as a sender, and if wildcards are supported. See 6.20 and Clause 7 for the definition of the object and compliance information.

NOTE The *Transaction Profile* is a method to interactively determine what verbs and nouns are supported by an application.

6.2.26 Work Alert Definition

The *Work Alert Definition* noun can contain the following objects as defined in IEC 62264-4:

- Work Alert Definition
- Work Alert Definition Property

6.2.27 Work Alert

The *Work Alert* noun can contain the following objects as defined in IEC 62264-4:

- Work Alert
- Work Alert Property

6.2.28 Work Calendar Definition

The *Work Calendar Definition* noun can contain the following objects in IEC 62264-4:

- Work Calendar Definition
- Work Calendar Definition Entry
- Work Calendar Definition Property

6.2.29 Work Calendar

The *Work Calendar* noun can contain the following objects in IEC 62264-4:

- Work Calendar

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- Work Calendar Entry
- Work Calendar Property

6.2.30 Work Capability

The *Work Capability* noun contains the following objects as defined in IEC 62264-4:

- Work Capability
- Work Master Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.31 Work Directive

The *Work Directive* noun contains the following objects as defined in IEC 62264-4:

- Work Directive
- Workflow Specification
- Parameter Specification
- Personnel Specification
- Equipment Specification
- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property
- Material Specification Property

6.2.32 Work Master

The *Work Master* noun contains the following objects as defined in IEC 62264-4:

- Work Master
- Workflow Specification
- Parameter Specification
- Personnel Specification
- Equipment Specification
- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property

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- Material Specification Property

6.2.33 Work Performance

The *Work Performance* noun contains the following objects as defined in IEC 62264-4:

- Work Performance
- Work Response
- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.34 Work Record

The *Work Record* noun contains the following objects as defined in IEC 62264-4:

- Work Record
- All subobjects in a Work Record as defined in IEC 62264-4

6.2.35 Work Schedule

The *Work Schedule* noun contains the following objects as defined in IEC 62264-4:

- Work Schedule
- Work Request
- Job Order Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.36 Workflow Specification

The *Workflow Specification* noun contains the following objects as defined in IEC 62264-4:

- Workflow Specification
- Workflow Specification Node
- Workflow Specification Node Property
- Workflow Specification Connection

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- Workflow Specification Connection Property

6.2.37 Workflow Specification Type

The *Workflow Specification Type* noun contains the following objects as defined in IEC 62264-4:

- Workflow Specification Type
- Workflow Specification Node Type
- Workflow Specification Node Type Property
- Workflow Specification Connection Type
- Workflow Specification Connection Type Property

6.2.38 Production specific models

6.2.38.1 Production models

Production specific information is described in IEC 62264-2:2013, Annex A. The transaction definitions of the production specific information are defined in Annex A of this part. Subclauses 6.2.38.2 to 6.2.38.5 define the set of message nouns that should be used by verbs to identify information exchanged between Level 4 and Level 3 systems as defined in the production object models of IEC 62264-2.

The production specific models are specialized subsets of the operations models with alternative object names for purposes of backward compatibility. New implementations should use the operations models.

6.2.38.2 Production Capability

The *Production Capability* noun contains the following objects as defined in IEC 62264-2:

- Production Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Process Segment Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.38.3 Product Definition

The *Product Definition* noun may contain the following objects as defined in IEC 62264-2:

- Product Definition
- Product Segment
- Product Segment Dependency
- Manufacturing Bill
- Parameter Specification
- Personnel Specification
- Equipment Specification

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- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property
- Material Specification Property

6.2.38.4 Production Schedule

The *Production Schedule* noun may contain the following objects as defined in IEC 62264-2:

- Production Schedule
- Production Request
- Segment Requirement
- Requested Segment Response
- Production Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property
- Product Parameter
- Process Parameter

6.2.38.5 Production Performance

The *Production Performance* noun may contain the following objects as defined in IEC 62264-2:

- Production Performance
- Production Response
- Segment Response
- Production Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

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6.3 Personnel model

6.3.1 Personnel model elements

The message definitions assume that information may be accessed from any of three starting points: *Personnel Class*, *Person*, or *Qualification Test Specification*, as identified by the dotted collections in Figure 15, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined in ISO/IEC 19501.

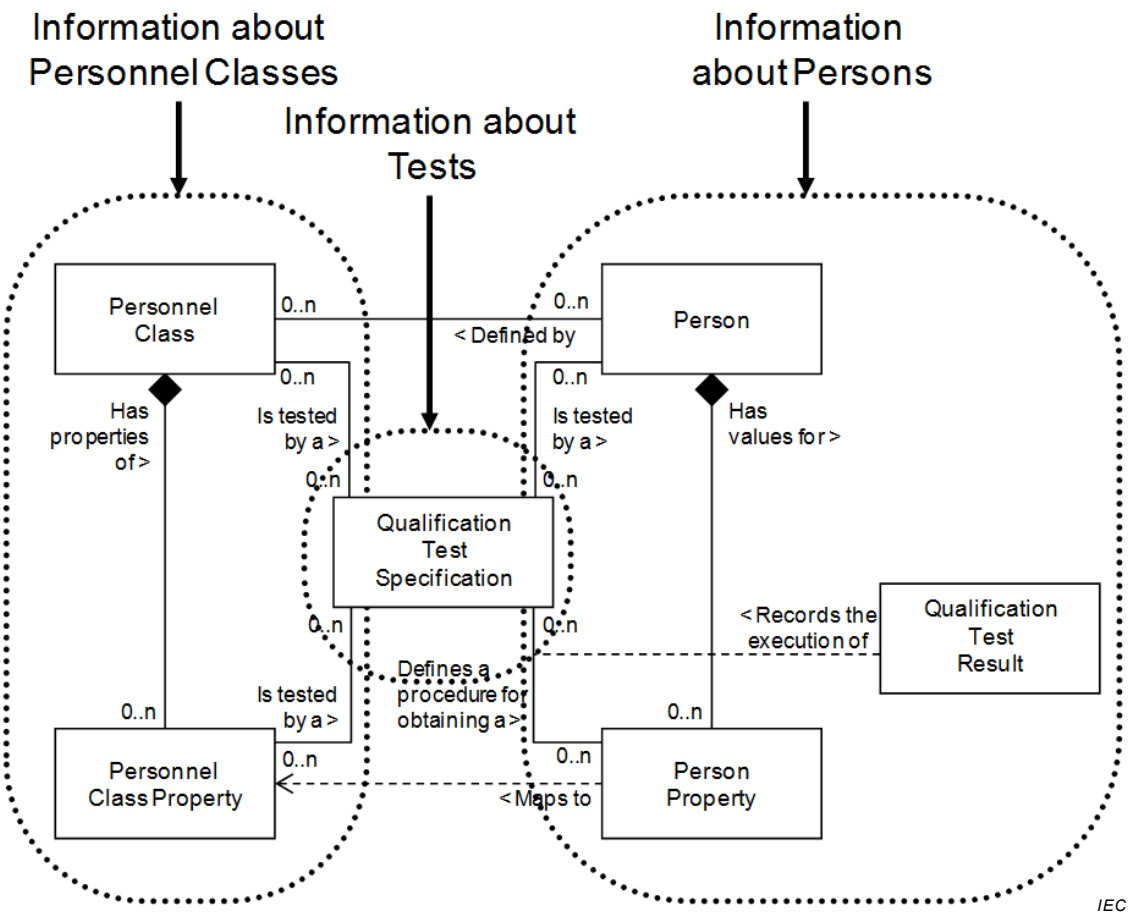

Figure 15 – Object grouping for the personnel model

EXAMPLE Messages can be: *GET Personnel Class*, *GET Person*, *GET Qualification Test Specification*.

6.3.2 Personnel Class verbs

All verbs shall be valid for a *Personnel Class* noun.

A *Personnel Class* message contains information about *Personnel Classes*, or *Personnel Classes* and their *Personnel Class Properties*. The returned information does not contain the *person* objects associated with the *Personnel Class*, but does contain the IDs of the persons belonging to the class.

6.3.3 Personnel Class verb actions

Table 7 defines verb actions and the use of IDs and values for the *Personnel Class*.

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Table 7 – Personnel Class verb actions

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes*, all properties and their attributes, and the list of *Person IDs* of the *Personnel Classes*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The IDs define suggested IDs for the *Personnel Classes*. The receiver adds the *Personnel Classes* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Personnel Classes* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Personnel Classes*. SYNC ADD: Shall define a request that the receiver is to add the specified *Personnel Classes*. SYNC CHANGE: The specified attributes of the specified *Personnel Classes* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Personnel Classes*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes*, all of the specified *Personnel Class* properties, and the list of *Person IDs* of the *Personnel Classes*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The ID defines suggested IDs for the *Personnel Classes* and list of properties. The receiver adds the *Personnel Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Personnel Classes*. SYNC ADD: Shall define a request that the receiver is to add the *Personnel Classes* and list of *Personnel Class Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Personnel Class Properties*.

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Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes* where the *Personnel Class Property* value matches the specified property value, all of the specified *Personnel Class properties*, and the list of *Person IDs*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The IDs define suggested IDs for the *Personnel Classes* and properties, and values for the properties. The receiver adds the *Personnel Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Personnel Classes* to the property values specified. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Personnel Classes* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Personnel Classes*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Personnel Classes* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Personnel Class Properties* of the specified *Personnel Classes* that have the specified property values.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Personnel Classes* that match the wildcard and the list of *Person IDs* of each *Personnel Class*. EXAMPLE To return all *Personnel Classes*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Personnel Classes* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Personnel Classes* matching the wildcard.

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Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Personnel Classes* that match the wildcard, and for each class return all *Personnel Class Properties* that match the property wildcards, and the list of *Person IDs* of to the class. EXAMPLE 1 To return a single property, the single *Personnel Class Property* ID can be specified in the property wildcard. EXAMPLE 2 To return all *Personnel Class* properties, a "*" can be specified as the property wildcard. EXAMPLE 3 To return a single *Personnel Class*, the *Personnel Class ID* can be specified in the wildcard. EXAMPLE 4 To return all *Personnel Classes*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all properties matching the property wildcard of all *Personnel Classes* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the property wildcard of all *Personnel Classes* that match the wildcard.

6.3.4 Person verbs

All verbs shall be valid for a *Person* noun.

NOTE This contains information about *persons* and their *Person Properties*. The returned information does not contain the *Personnel Class* objects associated with the person, but does contain the IDs of the *Personnel Classes* the person belongs to.

6.3.5 Person verb actions

The actions performed on a *Person* noun are defined in Table 8.

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Table 8 – Person verb actions

Value of Person ID	Value of Person Property ID	Person Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons*, all properties and their attributes, and the list of *Personnel Class IDs* of the *Persons*. PROCESS: Shall define a request that the receiver is to add *Persons*. The message defines suggested IDs for the *Persons*. The receiver adds the *Persons* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Persons* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Persons*. SYNC ADD: Shall define a request that the receiver is to add the specified *Persons*. SYNC CHANGE: The specified attributes of the specified *Persons* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Persons*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons*, all of the specified *Person Properties*, and the list of *Personnel Class IDs* of the *Persons*. PROCESS: Shall define a request that the receiver is to add *Persons*. The ID defines suggested IDs for the *Persons* and list of properties. The receiver adds the *Persons* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Persons*. SYNC ADD: Shall define a request that the receiver is to add the *Persons* and list of *Person Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Person Properties*.

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Value of Person ID	Value of Person Property ID	Person Property value	Verb action on noun
IDs specified	IDs specified	Property Value Specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons* where the *Person Property* value matches the specified property value, all of the specified *Person* properties, and the list of *Personnel Class IDs*. PROCESS: Shall define a request that the receiver is to add *Persons*. The ID defines suggested IDs for the *Persons* and properties, and values for the properties. The receiver adds the *Persons* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Persons* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Persons* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Persons*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Persons* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Person Properties* of the specified *Persons* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Persons* that match the wildcard and the list of *Personnel Class IDs* of each *Person*. EXAMPLE To return all *Persons*, a “*” can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Persons* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Persons* matching the wildcard.

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