IEC 61400-25-3

Edition 2.0 2015-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Wind turbines –
Part 25-3: Communications for monitoring and control of wind power plants – Information exchange models

Eoliennes –
Partie 25-3: Communications pour la surveillance et la commande des centrales éoliennes – Modèles d'échange d'information

IEC 61400-25-3:2015-06(en-fr)

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIND TURBINES –

Part 25-3: Communications for monitoring and control of wind power plants – Information exchange models

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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The text of this standard is based on the following documents:

FDIS	Report on voting
88/540/FDIS	88/552/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

This second edition cancels and replaces the first edition published in 2006.

The scope of revision includes:

- Harmonization with service models in Edition 2 of IEC 61850-7-2.
- Reduction of overlap between standards and simplification by increased referencing.

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

a) Add subscription and remove subscription services have been removed.
b) Tables in Clause 9 indicating expected services have been replaced by tables in a new Annex D including ACSI conformance statements for clients and servers.
c) Technical issues (“Tissues”) for IEC 61850-7-2 edition 2 have been considered and changes have been made accordingly.

Technical issues (“Tissues”), as collected by the IEC 61400-25 users group USE61400-25, have been considered, but no technical issues were registered for edition 1.

A list of all parts of the IEC 61400 series, under the general title *Wind turbines,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

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INTRODUCTION

The IEC 61400-25 series defines communications for monitoring and control of wind power plants. The modeling approach of the IEC 61400-25 series has been selected to provide abstract definitions of classes and services such that the specifications are independent of specific protocol stacks, implementations, and operating systems. The mapping of these abstract classes and services to a specific communication profile is not inside the scope of this part (IEC 61400-25-3) but inside the scope of IEC 61400-25-4.

This part of IEC 61400-25 defines services of the model of the information exchange of intelligent electronic devices in wind power plants. The services are referred to as the abstract communication service interface (ACSI). The ACSI has been defined so as to be independent of the underlying communication systems.

The information exchange model is defined in terms of

– a hierarchical class model of all information that can be accessed,

– information exchange services that operate on these classes,

– parameters associated with each information exchange service.

The ACSI description technique abstracts away from all the different approaches to implement the cooperation of the various devices.

These abstract service definitions are mapped into concrete object definitions that are to be used for a particular protocol. Mapping to specific protocol stacks is specified in IEC 61400-25-4.

NOTE 1 Abstraction in ACSI has two meanings. Firstly, only those aspects of a real device (for example, a rotor) or a real function that are visible and accessible over a communication network are modelled. This abstraction leads to the hierarchical class models and their behaviour defined in IEC 61400-25-2. Secondly, the ACSI abstracts from the aspect of concrete definitions on how the devices exchange information; only a conceptual cooperation is defined. The concrete information exchange is defined in IEC 61400-25-4.

NOTE 2 Performance of the IEC 61400-25 series implementations are application specific. The IEC 61400-25 series does not guarantee a certain level of performance. This is beyond the scope of the IEC 61400-25 series. However, there is no underlying limitation in the communications technology to prevent high speed application (millisecond level responses).

WIND TURBINES –

Part 25-3: Communications for monitoring and control of wind power plants – Information exchange models

1 Scope

The focus of the IEC 61400-25 series is on the communications between wind power plant components such as wind turbines and actors such as SCADA systems. Internal communication within wind power plant components is outside the scope of the IEC 61400-25 series.

The IEC 61400-25 series is designed for a communication environment supported by a client-server model. Three areas are defined, that are modelled separately to ensure the scalability of implementations: (1) wind power plant information models, (2) information exchange model, and (3) mapping of these two models to a standard communication profile.

The wind power plant information model and the information exchange model, viewed together, constitute an interface between client and server. In this conjunction, the wind power plant information model serves as an interpretation frame for accessible wind power plant data. The wind power plant information model is used by the server to offer the client a uniform, component-oriented view of the wind power plant data. The information exchange model reflects the whole active functionality of the server. The IEC 61400-25 series enables connectivity between a heterogeneous combination of client and servers from different manufacturers and suppliers.

As depicted in Figure 1, the IEC 61400-25 series defines a server with the following aspects:

– information provided by a wind power plant component, e. g., “wind turbine rotor speed” or “total power production of a certain time interval” is modelled and made available for access. The information modelled in the IEC 61400-25 series is defined in IEC 61400-25-2;

– services to exchange values of the modelled information defined in IEC 61400-25-3;

– mapping to a communication profile, providing a protocol stack to carry the exchanged values from the modelled information (IEC 61400-25-4).

The IEC 61400-25 series only defines how to model the information, information exchange and mapping to specific communication protocols. The IEC 61400-25 series excludes a definition of how and where to implement the communication interface, the application program interface and implementation recommendations. However, the objective of the IEC 61400-25 series is that the information associated with a single wind power plant component (such as a wind turbine) is accessible through a corresponding logical device.

This part of IEC 61400-25 specifies an abstract communication service interface describing the information exchange between a client and a server for:

– data access and retrieval,

– device control,

– event reporting and logging,

– self-description of devices (device data dictionary),

– data typing and discovery of data types.

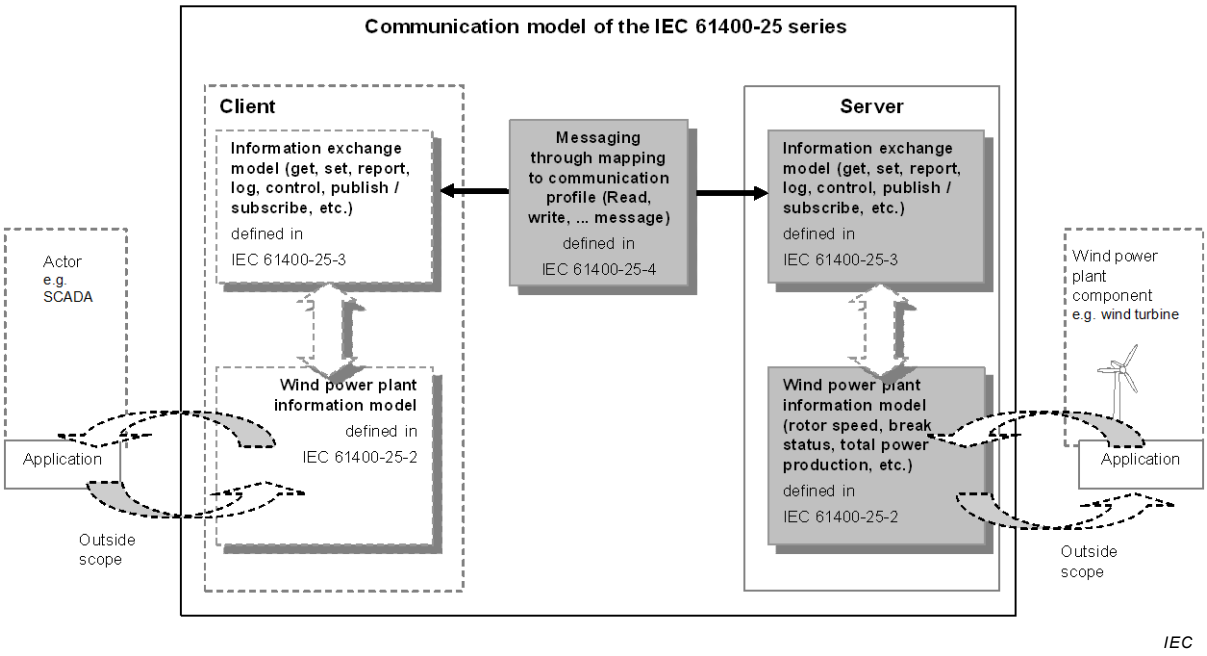

Figure 1 – Conceptual communication model of the IEC 61400-25 series

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 61400-25-1, *Wind turbines – Part 25-1: Communications for monitoring and control of wind power plants – Overall description of principles and models*

IEC 61400-25-2:2015, *Wind turbines – Part 25-2: Communications for monitoring and control of wind power plants – Information models*

IEC 61400-25-4:2008, *Wind turbines – Part 25-4: Communications for monitoring and control of wind power plants – Mapping to communication profile*

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61400-25-1 as well as the following apply.

3.1
control object
data object instance of a controllable data object class who's ctlModel DataAttribute is not set to "status-only"

4 Abbreviated terms

ACSI	Abstract Communication Service Interface (defined for example in IEC 61850-7-2)
FCD	Functionally Constrained Data
FCDA	Functionally Constrained Data Attribute
IED	Intelligent Electronic Device
IEM	Information Exchange Model
LCB	Log Control Block
LD	Logical Device
LN	Logical Node
LOG	Log
LPHD	Logical Node Physical Device
RCB	Report Control Block
SCADA	Supervisory Control and Data Acquisition
SCSM	Specific Communication Service Mapping (defined for example in IEC 61850-8-1)
SG	Setting Group
WPP	Wind Power Plant
WT	Wind Turbine
XML	Extensible Mark-up Language
GUI	Graphical User Interface

5 General

This part of IEC 61400-25 provides the information exchange models that can be applied by a client and a server to access the content and structure of the wind power plant information model defined in IEC 61400-25-2.

Clause 6 gives an overview of the information exchange models for operational functions and management functions.

Clause 7 introduces the information exchange models for operational functions: authorisation, control, monitoring, and reporting and logging.

Clause 8 gives an overview of the information exchange models for management functions.

Clause 9 provides the details of the services for the following service model classes:

- Application association,
- Server class,
- Logical Device class (retrieve the self-description, etc.),
- Logical Node class (retrieve the self-description, etc.),
- Data class (get values, set values, retrieve the self-description, etc.),
- DataSet class (get values, set values, create data sets, retrieve the self-description, etc.),
- Report Control Block class (get attributes, set attributes, report, etc.),
- Log Control Block and Log classes (get attributes, set attributes, retrieve log entries, etc.),
- Control class (select, operate, etc.).

Annex A provides examples of the reporting and logging services required.

Annex B provides relationship between ACSI services and functional Constraints.

Annex C provides relationship between ACSI defined in IEC 61850-7-2 and IEC 61400-25-3.

Annex D provides ACSI conformance statements for clients and servers.

6 Information exchange models overview

The information exchange models provide services for communication functions that are grouped as follows:

- Operational functions,
- Management functions.

These two groups are introduced and described in more detail in Clause 7 and 8.

The mandatory services for each information exchange model are indicated in the corresponding service tables in Clause D.4.

An instance of the wind power plant information model of a wind power plant (logical device, logical node, data, data attributes and control block objects) shall be accessed by instances of the information exchange models listed in Table 1. The first two columns of the table enumerate the functional groups and their information exchange models, which are summarily described in the third column. The fourth and fifth columns identify which data kinds and transfer principles are applicable for each information exchange model. The last column indicates the ACSI service models used for the corresponding information exchange models.

Table 1 – Information exchange models

Functional group	Information exchange model	Short description	Information categories	Transfer principles	ACSI service models
Operational (see Clause 7)	Authorisation (see 7.2)	Authentication and restriction of access to operational and management functions	Short text messages	Data transfer on demand Command transfer	ASSOCIATION
	Control (see 7.3)	Control of operational devices	Setpoints Commands Parameters	Command transfer Set point transfer Parameters transfer	CONTROL
	Monitoring (see 7.4)	Monitoring of current data and change of data of operational devices	Measured Data Processed data (Average Values, Min/Max) Status Alarms Events Timer Counter Setpoints Parameters Time Series Data (i.e. Alarm/Event Log, Command Log, Setpoint Log) (Analogue Values, Binary Values)	Periodic data transfer (all data or only data that has changed since last transfer) Data transfer on demand Event driven data transfer (spontaneous)	LOGICAL-DEVICE LOGICAL-NODE DATA DATA-SET BUFFERED-REPORT-CONTROL UNBUFFERED-REPORT-CONTROL LOG LOG-CONTROL (see Clause 9 for details of the ACSI services)
	Reporting and logging (see 7.4)	Trigger controlled continuous scanning and recording of values and events	Histories (Logs) Reports Statistics Curves Trends Events Short text messages		
Management (see Clause 8)	Diagnostics (see 8.5)	Self-monitoring of devices	*Monitoring, and reporting and logging information categories apply*		
	User and access management (see 8.2)	Setting up users, access rights and monitoring access	*System specific*		
	Setup (see 8.3)	Device configuration management	*System specific*		
	Time synchronisation (see 8.4)	Synchronization of device clocks	*SCSM specific*		

The information exchange models shall be realised by the corresponding ACSI models and associated services (as depicted in the last column in Table 1). The intent of the table is to give an overview applying the commonly used terminology of the wind power plant domain.

7 Operational functions

7.1 General

The information exchange models for operational functions described in Clause 7 are as follows:

- association and authorisation model,
- control model,
- monitoring, reporting and logging model.

Functional constraints of the ACSI services are specified in Annex B.

7.2 Association and authorisation model

The intention of the association and authorisation model is to provide a secure information exchange via an association between a client and a server. The model provides client authentication and controls the access to server functions. The conceptual mechanism is shown in Figure 2.

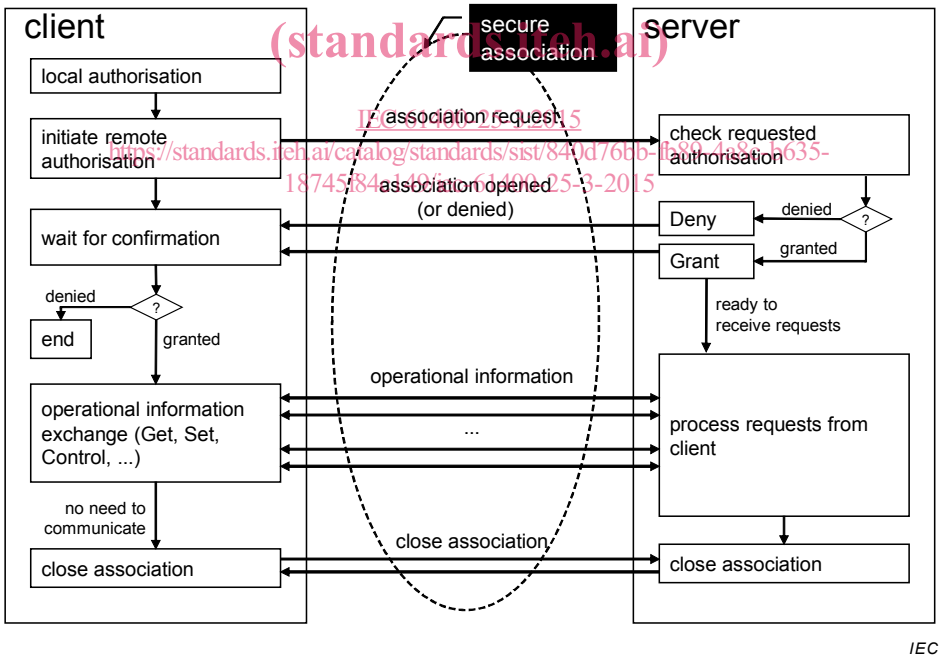

Figure 2 – Association and authorisation model (conceptual)

The requirements to be fulfilled by an association between a client and a server are as follows:

– **authentication:** determining the identity of the users/client,

– **authorisation and access control:** ensure that the entity has the proper access rights (a minimum is to provide a user name and a password),

– **integrity:** messages and the computer infrastructure are protected against unauthorised modification or destruction,

– **confidentiality:** objects of the wind power plant information model are protected and only disclosed to appropriate users/clients,

– **non-repudiation:** preventing a user/client involved in a data exchange from denying that it participated in the exchange,

– **prevention of denial of device:** preventing a client/server from blocking access to authorised users.

The real services of the authorisation model are provided by the specific mappings given in IEC 61400-25-4. Based on the specific mapping selected, the actual level of security and the specific services supported might be different.

7.3 Control model

7.3.1 General

The control model defines the information exchange for operating commands. The control model can only be applied to control objects, i.e. to data object instances of a controllable common data class (e.g. SPC, INC) whose DataAttribute “ctlModel” is not set to “status-only”. The control model is mainly used to change the status of a device (e.g. stop/start Turbine) or to change the value of a set point or parameter. The conceptual mechanism of the control model is shown in Figure 3.

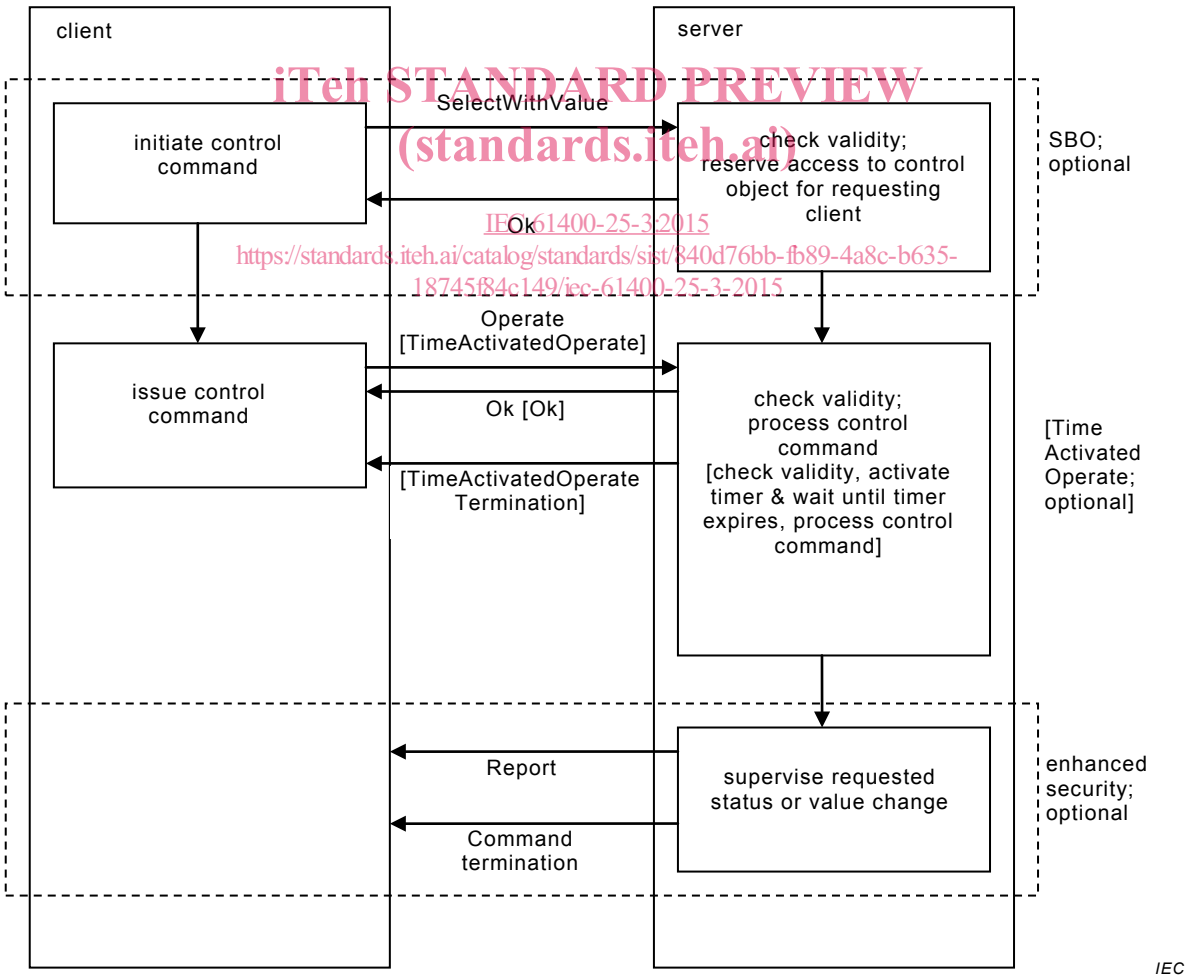

Figure 3 – Control model (conceptual)

NOTE The control model with its state transitions and services is described in more detail in IEC 61850-7-2:2010 (Clause 20).