

# INTERNATIONAL STANDARD



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

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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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INTERNATIONAL  
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### WIND TURBINES –

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

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International Standard IEC 61400-25-3 has been prepared by IEC technical committee 88: Wind turbines.

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:

- Add subscription and remove subscription services have been removed.
- Tables in Clause 9 indicating expected services have been replaced by tables in a new Annex D including ACSI conformance statements for clients and servers.
- 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<sup>1</sup>.

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 ~~shall be~~ 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).

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<sup>1</sup>~~To be published.~~

## 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,
- ~~publisher/subscriber,~~
- self-description of devices (device data dictionary),
- data typing and discovery of data types.

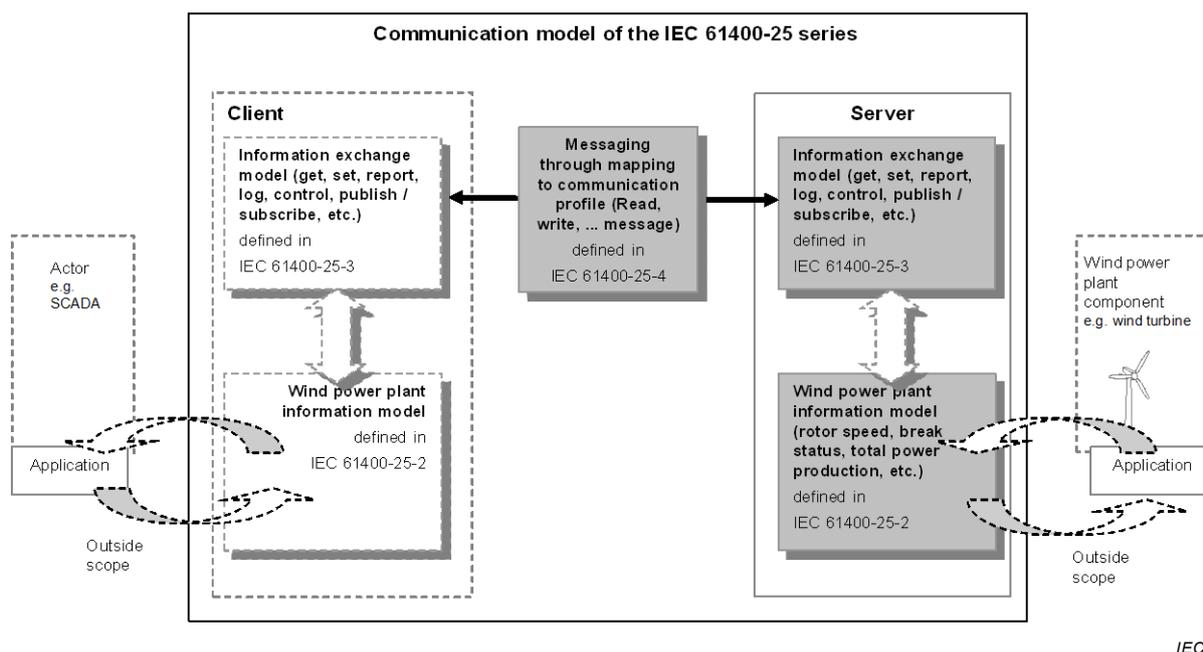


Figure 1 – Conceptual communication model of the IEC 61400-25 series

## 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 (all parts), Wind turbines – Part 25: Communications for monitoring and control of wind power plants~~

~~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 61850-7-2:2003 2010, Communication networks and systems in substations for power utility automation – Part 7-2: Basic information and communication structure for substations and feeder equipment – Abstract communication service interface (ACSI)~~

## 3 Terms and definitions

For the purposes of this document, the following 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 whose `ctlModel` `DataAttribute` is not set to “status-only”

### **3.1**

#### **actor**

~~role a system plays in the context of monitoring and control, while it is not directly involved in wind power plant operation, such as Supervisory Control and Data Acquisition System (SCADA)~~

~~NOTE—There are many other designations, for example, Central Management System, Monitoring and Control System, Remote Control System.~~

### **3.2**

#### **alarm**

~~state information. Statement of safety intervention by the wind turbine control system (i.e. on/off)~~

### **3.3**

#### **command**

~~controllable data for system behaviour (enable/disable, active/deactivate, etc.)~~

### **3.4**

#### **communication function**

~~used by an actor to configure, perform and monitor the information exchange with wind power plants, for example operational and management function~~

### **3.5**

#### **control**

~~operational function used for changing and modifying, intervening, switching, controlling, parameterisation and optimising of wind power plants~~

### **3.6**

#### **data retrieval**

~~operational function used for collecting of wind power plant data~~

### **3.7**

#### **diagnostics**

~~management function used to set up and provide for self-monitoring of the communication system~~

### **3.8**

#### **event**

~~state transition (status, alarm, command)~~

### **3.9**

#### **intelligent Electronic Device**

#### **IED**

~~any device incorporating one or more processors, with the capability to receive data from an external sender or to send data to an external receiver~~

~~NOTE—For example, wind turbine controller. An IED may have connections as a client, or as a server, or both, with other IED.~~

### **3.10**

#### **information**

~~content of communication. Information is defined as data (usually processed and derived data, and information describing other data). The basic element is raw data from the wind power plant component, which should be processed into specified information according to the IEC 61400-25 series~~

~~NOTE—Wind power plant information categories: source information (analogue and state information), control information, derived information (statistical and historical information).~~

**3.11**

**information exchange**

~~communication process between two systems, such as wind power component and actor, with the goal to provide and to get relevant information. Requires specific communication functions, consisting of one or more services~~

**3.12**

**log**

~~historical information. Chronological list of source information for a period of time~~

**3.13**

**logging**

~~operational function The praxis of recording sequential data often chronologically. The result of the logging is a log~~

**3.14**

**logical device**

~~Entity that represent a set of typical wind power plant functions~~

**3.15**

**management function**

~~function required for the administration of the information exchange in a certain level~~

NOTE Management functions are user/access management, time synchronisation, diagnostics, and configuration.

**3.16**

**mandatory**

~~defined content shall be provided in compliance with the IEC 61400-25 series~~

**3.17**

**measured data**

~~sampled value of a process quantity with associated data attributes such as time stamp and quality~~

**3.18**

**meteorological system**

~~component of a wind power plant responsible for the monitoring of the ambient conditions, for example the wind speed, wind direction, pressure, temperature etc. It supplies data for various purposes for example to correlate the meteorological data to the electrical energy output by individual wind turbines to the potentially usable wind energy~~

**3.19**

**monitoring**

~~operational function used for local or remote observation of a system or a process for any changes which may occur over time. The term can also be used for observation of the behaviour of a data value or a group of data values~~

**3.20**

**operational function**

~~function to obtain information and to send instructions for the normal daily operation of wind power plants. Types: monitoring, logging and reporting, data retrieval, control~~

**3.21**

**optional**

~~defined content can be optionally provided in compliance to the IEC 61400-25 series~~

**3.22**

**parameter**

~~controllable information intended for obtaining or correcting system behaviour~~

**3.23****processed value**

~~measured value, with the associated data attributes such as time stamp and quality, which have been processed according the calculation method attribute (10m-average/...)~~

**3.24****report**

~~actual information sent by the function reporting~~

**3.25****reporting**

~~operational function to transfer data from a server to a client, initiated by a server application process~~

**3.26****Supervisory Control and Data Acquisition-SCADA**

~~system based on a processor unit which receives information from IEDs, determines the control requirements and sends commands to IEDs. A computer system that for example the dispatchers use to monitor the power distribution throughout a service or control area~~

**3.27****status**

~~state condition of a component or system (st1/st2/..stn)~~

**3.28****three phase data**

~~measured value in a three phase electrical circuit with associated data attributes such as time stamp, quality and calculation method~~

**3.29****user/access management**

~~management function used for setting up, modifying, deleting users (administratively), assigning access rights (administratively) and monitoring access~~

**3.30****wind power plant**

~~complete system consisting of any number of technical subsystems referred to in the IEC 61400-25 series as wind power plant components, for example one or more wind turbines. The main objective of a wind power plant is to generate electrical energy from the wind~~

**3.31****wind power plant analogue information**

~~continuous information concerning the actual condition or behaviour of a component or system~~

NOTE Types are, for example, measured value, processed value, three phase value, setpoint, parameter.

**3.32****wind power plant component**

~~technical system employed in the operation of wind power plants, such as wind turbine, meteorological, electrical and wind power plant management system~~

**3.33****wind power plant management system**

~~component of a wind power plant, which is responsible to ensure that the complete system adapts itself to the static and dynamic conditions and requirements of the electrical power connection (i.e., interoperation of the WTs with substation and other power network related devices)~~

~~NOTE A wind power plant management system may include other functions (for example shadow control functionality, noise or sound reduction, ice warning, lightning protection) not modelled in the IEC 61400-25 series.~~

### ~~3.34~~

#### ~~wind turbine~~

~~main component of a wind power plant. It is responsible for generating energy and meets the task of using the wind potential of a certain location that converts kinetic wind energy into electric energy~~

## 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.),