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First edition
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Wind turbines –

Part 25-1: Communications for monitoring and control of wind power plants – Overall description of principles and models

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND TURBINES –

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

FOREWORD

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International Standard IEC 61400-25-1 has been prepared by IEC technical committee 88: Wind turbines.

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

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

FDIS	Report on voting
88/274/FDIS	88/280/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.

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 maintenance result 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- withdrawn,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
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INTRODUCTION

The IEC 61400-25 series addresses vendors (manufacturers, suppliers), operators, owners, planners, and designers of wind power plants as well as system integrators and utility companies operating in the wind energy market. The IEC 61400-25 series is intended to be accepted and to be used world-wide as the international standard for communications in the domain of wind power plants.

The IEC 61400-25 series has been developed in order to provide a uniform communications basis for the monitoring and control of wind power plants. It defines wind power plant specific information, the mechanisms for information exchange and the mapping to communication protocols. In this regard, the IEC 61400-25 series defines details required to exchange the available information with wind power plant components in a manufacturer-independent environment. This is done by definitions made in this part of the IEC 61400-25 series or by reference to other standards.

The wind power plant specific information describes the crucial and common process and configuration information. The information is hierarchically structured and covers for example common information found in the rotor, generator, converter, grid connection and the like. The information may be simple data (including timestamp and quality) and configuration values or more comprehensive attributes and descriptive information, for example engineering unit, scale, description, reference, statistical or historical information. All information of a wind power plant defined in the IEC 61400-25 series is name tagged. A concise meaning of each data is given. The standardised wind power plant information can be extended by means of a name space extension rule. All data, attributes and descriptive information can be exchanged by corresponding services.

The implementation of the IEC 61400-25 series allows SCADA systems (supervisory control and data acquisition) to communicate with wind turbines from multiple vendors. The standardised self-description (contained either in a XML file or retrieved online from a device) can be used to configure SCADA applications. Standardisation of SCADA applications are excluded in the IEC 61400-25 series but standardised common wind turbine information provides means for re-use of applications and operator screens for wind turbines from different vendors. From a utility perspective unified definitions of common data minimise conversion and re-calculation of data values for evaluation and comparison of all their wind power plants.

The IEC 61400-25 series can be applied to any wind power plant operation concept, i.e. both individual wind turbines, clusters and more integrated groups of wind turbines. The application area of the IEC 61400-25 series covers components required for the operation of wind power plants, i.e. not only the wind turbine generator, but also the meteorological system, the electrical system, and the wind power plant management system. The wind power plant specific information in the IEC 61400-25 series excludes information associated with feeders and substations. Substation communication is covered within the IEC 61850 series of standards.

The intention of the IEC 61400-25 series is to enable components from different vendors to communicate with other components, at any location. Object-oriented data structures can make the engineering and handling of large amounts of information provided by wind power plants less time-consuming and more efficient. The IEC 61400-25 series supports scalability, connectivity, and interoperability.

The IEC 61400-25 series is a basis for simplifying the contracting of the roles the wind turbine and SCADA systems have to play. The crucial part of the wind power plant information, the information exchange methods, and the communication stacks are standardised. They build a basis to which procurement specifications and contracts could easily refer.

The IEC 61400-25 series is organised in several parts. IEC 61400-25-1 offers an introductory orientation, crucial requirements, and a modelling guide.

NOTE 1 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).

NOTE 2 IEC 61400-25-4 is, at the time of the publication of IEC 61400-25-1 (this part), still to be published. With IEC 61400-25-4 the mapping of the information and information exchange models to a specific communication profile will be described/defined in detail. IEC 61400-25-4 may consist of more than one normative mapping but at least one of the optional mappings has to be selected in order to be in conformance with the IEC 61400-25 series. IEC 61400-25-4 is expected to include the following mappings:

Webservices

IEC 61850-8-1 MMS

OPC XML DA

IEC 60870-5-104

DNP3

Each of the different mappings specifies individually which and how information models (IEC 61400-25-2) and information exchange models (IEC 61400-25-3) will be supported. The mapping will only reflect the information model and the information exchange services given in IEC 61400-25-2 and IEC 61400-25-3. The individual selected mapping will as a minimum support the mandatory data and data attributes, and the associated services. A specific mapping may, for implementation reasons or due to underlying properties of the communication protocol used, need to extend and clarify individual information or individual services in IEC 61400-25-2 and IEC 61400-25-3. IEC 61400-25-4 will in this sense have the highest priority of the ranking order in regards of implementation.

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WIND TURBINES –

Part 25-1: Communications for monitoring and control of wind power plants – Overall description of principles and 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 beyond 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, for example, '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.

IEC 61400-25-1 gives an overall description of the principles and models used in the IEC 61400-25 series of standards.

NOTE The IEC 61400-25 series focuses on the common, non-vendor-specific information. Those information items that tend to vary greatly between vendor-specific implementations can for example be specified in bilateral agreements, in user groups, or in amendments to the IEC 61400-25 series.

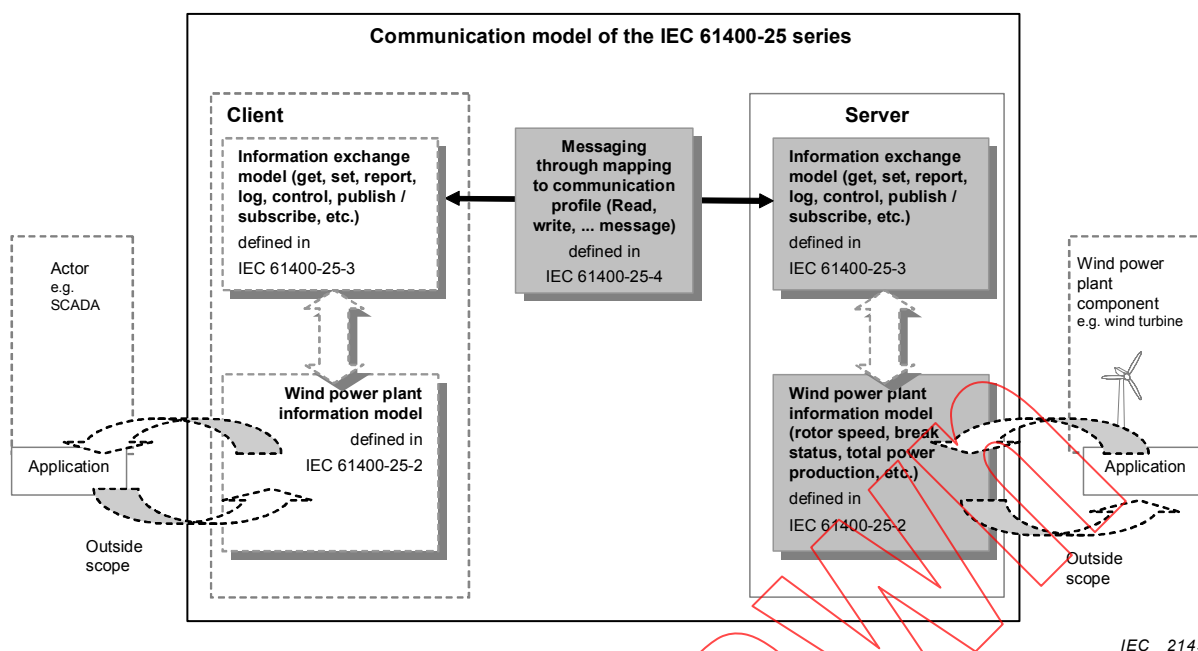


Figure 1 – Conceptual communication model of the IEC 61400-25 series

2 Normative references

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

IEC 61400-12-1, *Wind turbines – Part 12-1: Power performance measurements of electricity producing wind turbines*

IEC 61400-25 (all parts), *Wind turbines – Part 25: Communications for monitoring and control of wind power plants*

IEC 61850-7-1:2003, *Communication networks and systems in substations – Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models*

IEC 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3:2003, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

IEC 61850-7-4:2003, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes*

IEC 61850-8-1:2004, *Communication networks and systems in substations – Part 8-1: Specific Communication Service Mapping (SCSM) – Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3*

ISO 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model*

3 Terms and definitions

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

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

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

3.3

characteristic values

properties of analogue information (min, max, avg, dev, etc.)

3.4

command

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

3.5

communication function

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

3.6

control

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

3.7

counting value

total number of occurrences of a specific event

3.8

data retrieval

operational function used for collecting of wind power plant data

3.9

diagnostics

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

3.10

electrical system

component of a wind power plant responsible for collecting and transmitting the energy produced in wind turbines

3.11

event

state transition (status, alarm, command)