

Wind energy generation systems - Part 25-1:
Communications for monitoring and control of wind
power plants - Overall description of principles and
models

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 61400-25-1:2017 sisaldab Euroopa standardi EN 61400-25-1:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 61400-25-1:2017 consists of the English text of the European standard EN 61400-25-1:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 01.12.2017.	Date of Availability of the European standard is 01.12.2017.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 27.180

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Wind energy generation systems -
Part 25-1: Communications for monitoring and control of wind
power plants - Overall description of principles and models
(IEC 61400-25-1:2017)

Systèmes de génération d'énergie éolienne -
Partie 25-1: Communications pour la surveillance et la
commande des centrales éoliennes - Description globale
des principes et des modèles
(IEC 61400-25-1:2017)

Windenergieanlagen - Teil 25-1: Kommunikation für die
Überwachung und Steuerung von Windenergieanlagen -
Einführende Beschreibung der Prinzipien und Modelle
(IEC 61400-25-1:2017)

This European Standard was approved by CENELEC on 2017-08-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 88/587/CDV, future edition 2 of IEC 61400-25-1, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61400-25-1:2017.

The following dates are fixed:

- latest date by which the document has to be (dop) 2018-06-01
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2020-12-01
standards conflicting with the
document have to be withdrawn

This document supersedes EN 61400-25-1:2007.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61400-25-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61850 Series	NOTE	Harmonized as EN 61850 Series.
------------------	------	--------------------------------

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61400-25	Series	Wind turbines - Part 25: Communications for monitoring and control of wind power plants	EN 61400-25	Series
IEC 61400-25-2	2015	Wind turbines - Part 25-2: Communications for monitoring and control of wind power plants - Information models	EN 61400-25-2	2015
IEC 61400-25-3	2015	Wind turbines - Part 25-3: Communications for monitoring and control of wind power plants - Information exchange models	EN 61400-25-3	2015
IEC 61400-25-4	-	Wind energy generation systems - Part 25-4: Communications for monitoring and control of wind power plants - Mapping to communication profile	EN 61400-25-4	-
IEC 61400-25-6	-	Wind energy generation systems - Part 25-6: Communications for monitoring and control of wind power plants - Logical node classes and data classes for condition monitoring	EN 61400-25-6	-
IEC 61850-7-1	2011	Communication networks and systems for power utility automation - Part 7-1: Basic communication structure - Principles and models	EN 61850-7-1	2011
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)	EN 61850-7-2	2010

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references	10
3 Terms and definitions	11
4 Abbreviated terms	15
5 Overall description of IEC 61400-25 (all parts).....	16
5.1 General.....	16
5.2 Top-down view on wind power plants	16
5.2.1 Definition of wind power plants	16
5.2.2 Wind power plant components	16
5.3 Generic requirements on communication	18
5.3.1 Communication capability	18
5.3.2 Communication content	18
5.3.3 Communication functions.....	19
5.4 Communication model of IEC 61400-25 (all parts)	20
5.4.1 General	20
5.4.2 Information model.....	20
5.4.3 Information exchange model and relation to wind power plant information models	22
5.4.4 Mapping to communication profile.....	23
6 Wind power plant information model	23
6.1 General.....	23
6.2 Information modelling methodology.....	23
6.2.1 Wind power plant information.....	23
6.2.2 Modelling approach	24
6.2.3 Logical devices.....	26
6.2.4 Logical nodes	26
7 Wind power plant information exchange model	27
7.1 General.....	27
7.2 Information exchange modelling methodology.....	27
7.2.1 Wind power plant information exchange.....	27
7.2.2 Service models	28
7.2.3 Abstract communication service interface	29
7.2.4 Service modelling convention	31
8 Mapping to communication protocols	34
8.1 General.....	34
8.2 Architecture of the mappings.....	34
8.3 Mapping of the wind power plant information model	35
Bibliography.....	36
Figure 1 – Conceptual communication model of the IEC 61400-25 series	10
Figure 2 – Data processing by the server (conceptual).....	21
Figure 3 – Modelling approach (conceptual).....	22
Figure 4 – Structure of wind power plant information model	25

Figure 5 – Role of common data classes (CDC) in WPP information model.....	25
Figure 6 – Client and server role	28
Figure 7 – IEM service models.....	28
Figure 8 – Conceptual information exchange model for a wind power plant.....	30
Figure 9 – IEM service model with examples.....	32
Figure 10 – Sequence diagram	33
Figure 11 – ACSI mapping to communication stacks/profiles.....	34
Figure 12 – Communication profiles	35
Table 1 – Operational functions	19
Table 2 – Management functions	20
Table 3 – Wind power plant information categories	24
Table 4 – General table structure of a logical node (LN)	26
Table 5 – Data class attributes in a logical node	27
Table 6 – Service table	32

INTRODUCTION

IEC 61400-25 (all parts) is intended for 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. IEC 61400-25 (all parts) is intended to be accepted and to be used world-wide as the international standard for communications in the domain of wind power plants.

IEC 61400-25 (all parts) 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, IEC 61400-25 (all parts) 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 IEC 61400-25 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 IEC 61400-25 (all parts) is name tagged. A concise meaning of each data is given. The standardized 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 IEC 61400-25 (all parts) allows SCADA systems (supervisory control and data acquisition) to communicate with wind turbines from multiple vendors. The standardized self-description (contained either in an XML file or retrieved online from a device) can be used to configure SCADA applications. Standardization of SCADA applications are excluded in IEC 61400-25 (all parts) but standardized 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 minimize conversion and re-calculation of data values for evaluation and comparison of all their wind power plants.

IEC 61400-25 (all parts) 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 IEC 61400-25 (all parts) 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 IEC 61400-25 (all parts) excludes information associated with feeders and substations. Substation communication is covered within IEC 61850 (all parts).

The intention of IEC 61400-25 (all parts) 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. IEC 61400-25 (all parts) supports scalability, connectivity, and interoperability.

IEC 61400-25 (all parts) 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 standardized. They build a basis to which procurement specifications and contracts could easily refer.

IEC 61400-25 is organized in several parts.

- IEC 61400-25-1 offers an introductory orientation, crucial requirements, and a modelling guide.
- IEC 61400-25-2 and IEC 61400-25-6 contain the description of the information model, a uniform, component-oriented view of the wind power plant data, including extensions for condition monitoring.
- IEC 61400-25-3 describes the information exchange model. It reflects the functionality of the server.
- IEC 61400-25-4 presents five alternative mappings of the information model and information exchange model to a standard communication profile. The choice depends on the application and the functionality and performance needed.
- IEC 61400-25-5 describes test cases for conformance testing of implementations.

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

WIND ENERGY GENERATION SYSTEMS –

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

1 Scope

The focus of IEC 61400-25 (all parts) 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 IEC 61400-25 (all parts).

IEC 61400-25 (all parts) 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. IEC 61400-25 (all parts) enables connectivity between a heterogeneous combination of client and servers from different manufacturers and suppliers.

As depicted in Figure 1, IEC 61400-25 (all parts) 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 IEC 61400-25 (all parts) is defined in IEC 61400-25-2 and IEC 61400-25-6,
- 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).

IEC 61400-25 (all parts) only defines how to model the information, information exchange and mapping to specific communication protocols. IEC 61400-25 (all parts) excludes a definition of how and where to implement the communication interface, the application program interface and implementation recommendations. However, the objective of IEC 61400-25 (all parts) 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 gives an overall description of the principles and models used in IEC 61400-25 (all parts).

NOTE IEC 61400-25 (all parts) 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 IEC 61400-25 (all parts).