

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 61400-25-6:2017 sisaldab Euroopa standardi EN 61400-25-6:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 61400-25-6:2017 consists of the English text of the European standard EN 61400-25-6:2017.
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 07.04.2017.	Date of Availability of the European standard is 07.04.2017.
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 25-6: Communications for monitoring and
control of wind power plants - Logical node classes and data
classes for condition monitoring
(IEC 61400-25-6:2016)

Systèmes de production d'énergie éolienne -
Partie 25-6: Communications pour la surveillance et la
commande des centrales éoliennes - Classes de nœuds
logiques et classes de données pour la surveillance d'état
(IEC 61400-25-6:2016)

Windenergieanlagen -
Teil 25-6: Kommunikation für die Überwachung und
Steuerung von Windenergieanlagen - Klassen logischer
Knoten und Datenklassen für die Zustandsüberwachung
(IEC 61400-25-6:2016)

This European Standard was approved by CENELEC on 2017-01-20. 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: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 88/606/FDIS, future edition 2 of IEC 61400-25-6, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61400-25-6:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-10-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-01-20

This document supersedes EN 61400-25-6:2011.

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

Endorsement notice

The text of the International Standard IEC 61400-25-6:2016 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 61400-25 NOTE Harmonized in EN 61400-25 series.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references	10
3 Terms and definitions	10
4 Abbreviated terms	12
5 General	14
5.1 Overview	14
5.2 Condition monitoring information modelling.....	14
5.3 Coordinate system applied for identifying direction and angles	15
5.4 Operational state bin concept	16
5.4.1 General	16
5.4.2 Example of how to use active power as an operational state.....	16
6 Logical nodes for wind turbine condition monitoring.....	16
6.1 General.....	16
6.2 Logical nodes inherited from IEC 61400-25-2.....	17
6.3 Wind turbine condition monitoring logical node WCON	17
6.3.1 General	17
6.3.2 CDCs applicable for the logical node WCON	18
7 Common data classes for wind turbine condition monitoring	18
7.1 General.....	18
7.2 Common data classes defined in IEC 61400-25-2	18
7.3 Conditions for data attribute inclusion	18
7.4 Common data class attribute name semantic	19
7.5 Condition monitoring bin (CMB)	20
7.6 Condition monitoring measurement (CMM)	21
7.7 Scalar value array (SVA).....	22
7.8 Complex measurement value array (CMVA).....	23
8 Common data class CMM attribute definitions	24
8.1 General.....	24
8.2 Attributes for condition monitoring measurement description.....	25
8.2.1 General	25
8.2.2 Condition monitoring sensor (trd).....	25
8.2.3 Shaft identification (shfld) and bearing position (brgPos)	30
8.2.4 Measurement type (mxType)	31
Annex A (informative) Recommended mxType values	33
A.1 General about tag names and datanames of the WCON Class.....	33
A.2 Mapping of measurement tags to mxTypes	33
A.2.1 General	33
A.2.2 Scalar values (MV)(Descriptors)	33
A.2.3 Array measurements (SVA) – Frequency domain.....	33
A.2.4 Array measurements (SVA) – Time domain	33
A.3 mxType values.....	33
Annex B (informative) Application of data attributes for condition monitoring measurement description for measurement tag naming.....	37

B.1	General.....	37
B.2	Naming principle using the data attributes in CMM CDC	37
B.3	Examples	38
Annex C (informative)	Condition monitoring bins examples	39
C.1	Example 1: One dimensional bins	39
C.2	Example 2: Two dimensional bins	40
C.3	Example 3: Two dimensional bins with overlap	42
Annex D (informative)	Application example	45
D.1	Overview of CDCs essential to IEC 61400-25-6	45
D.2	How to apply data to CDCs	45
D.3	How to apply an alarm	47
Bibliography.....		49
Figure 1	– Condition monitoring with separated TCD/CMD functions.....	8
Figure 2	– Schematic flow of condition monitoring information	9
Figure 3	– Reference coordinates system for the drive train.....	15
Figure 4	– Active power bin concept	16
Figure 5	– Sensor angular orientation as seen from the rotor end	29
Figure 6	– Sensor motion identification	29
Figure 7	– Sensor normal and reverse motion	30
Figure 8	– Principle of shaft and bearing identification along a drive train	31
Figure B.1	– Naming principles for trd data attribute	37
Figure C.1	– Bin configuration example 1.....	40
Figure C.2	– Bin configuration example 2.....	42
Figure C.3	– Bin configuration example 3.....	44
Figure D.1	– Linkage of the CDCs.....	45
Table 1	– Abbreviated terms applied	13
Table 2	– Coordinate system and wind turbine related characteristics.....	15
Table 3	– LN: Wind turbine condition monitoring information (WCON).....	18
Table 4	– Conditions for the presence of a data attribute	19
Table 5	– Common data class attribute name semantic.....	20
Table 6	– CDC: Condition monitoring bin (CMB)	21
Table 7	– CDC: Condition monitoring measurement (CMM)	22
Table 8	– CDC: Scalar value array (SVA).....	23
Table 9	– CDC: Complex measurement value array (CMVA).....	24
Table 10	– Data attributes used for measurement description	25
Table 11	– Sensor identification convention for “trd” attribute.....	25
Table 12	– Abbreviated terms for “trd” – “location” description	26
Table 13	– Sensor type code	28
Table 14	– Reference code for sensor sensitive axis orientation	29
Table 15	– Gearbox shaft and bearing identification.....	31
Table A.1	– Examples of applicable mappings from tag to MxType	34
Table B.1	– Examples of Tag names and corresponding short datanames	38

Table C.1 – CMB example 1	39
Table C.2 – CMB data object example 1	39
Table C.3 – CMB example 2	41
Table C.4 – CMB data object example 2	41
Table C.5 – CMB example 3	43
Table C.6 – CMB data object example 3	43
Table D.1 – Object overview	46
Table D.2 – Name plate (LPL).....	46
Table D.3 – CDC example: Condition monitoring measurement (CMM).....	47
Table D.4 – CDC example: Condition monitoring bin (CMB).....	47
Table D.5 – CDC example: Alarm definition (ALM).....	48
Table D.6 – LN example: Alarm container definition	48

This document is a preview generated by EVS

INTRODUCTION

The IEC 61400-25 series defines information models and information exchange models for monitoring and control of wind power plants. The modelling approach (for information models and information exchange models) of IEC 61400-25-2 and IEC 61400-25-3 uses abstract definitions of classes and services such that the specifications are independent of specific communication protocol stacks, implementations, and operating systems. The mapping of these abstract definitions to specific communication profiles is defined in IEC 61400-25-4¹.

This document defines an information model for condition monitoring information and explains how to use the existing definitions of IEC 61400-25-2 as well as the required extensions in order to describe and exchange information related to condition monitoring of wind turbines. The models of condition monitoring information defined in this document may represent information provided by sensors or by calculation.

In the context of this document, condition monitoring means a process with the purpose of observing components or structures of a wind turbine or wind power plant for a period of time in order to evaluate the state of the components or structures and any changes to it, in order to detect early indications of impending failures. With the objective to be able to monitor components and structures recorded under approximately the same conditions, this document introduces the operational state bin concept. The operational state bin concept is multidimensional in order to fit the purpose of sorting complex operational conditions into comparable circumstances.

Condition monitoring is most frequently used as a predictive or condition-based maintenance technique (CBM). However, there are other predictive maintenance techniques that can also be used, including the use of the human senses (look, listen, feel, smell) or machine performance monitoring techniques. These could be considered to be part of the condition monitoring.

Condition monitoring techniques

Condition monitoring techniques that generate information to be modelled include, but are not limited to, measured or processed values such as:

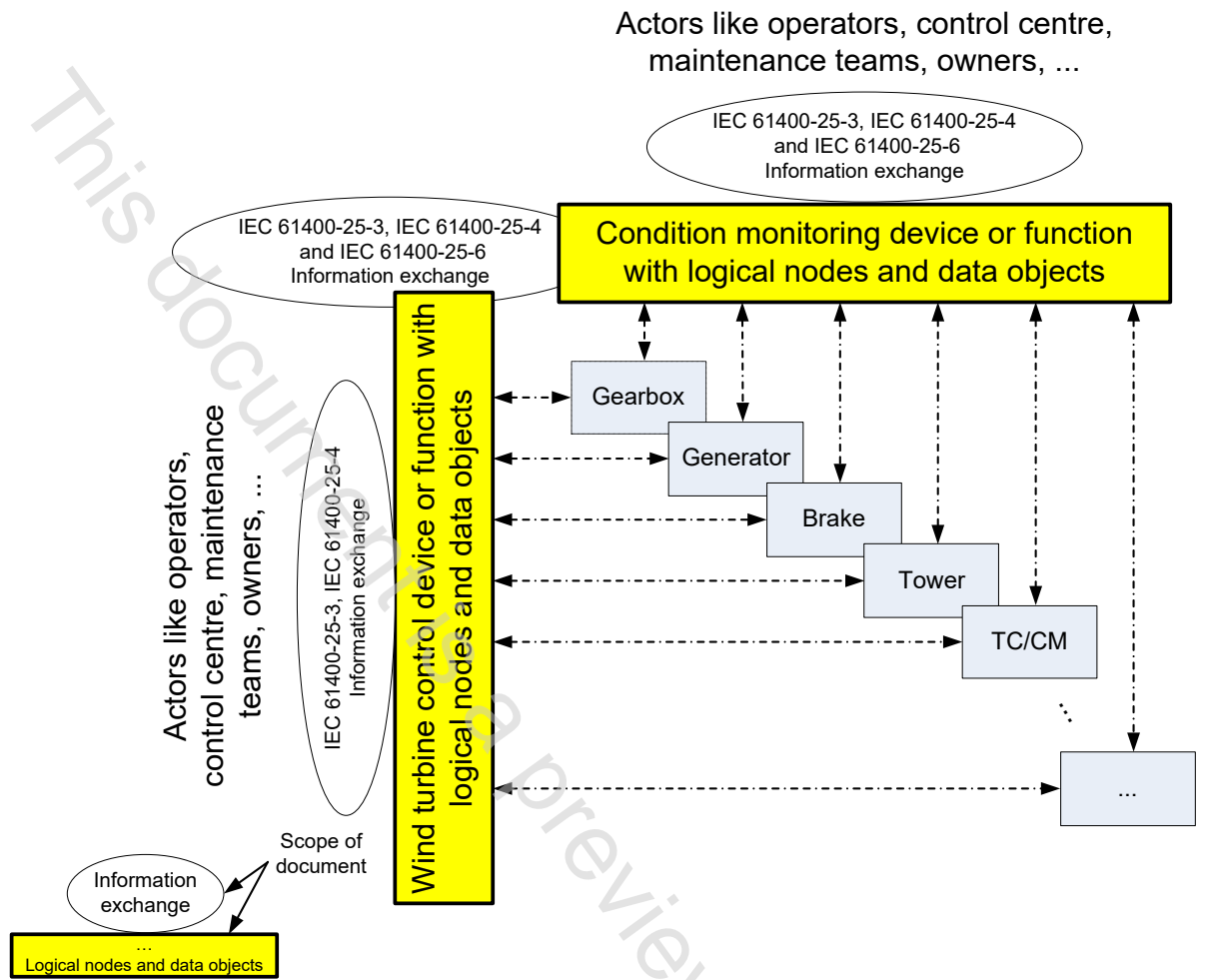
- a) vibration measurements and analysis;
- b) oil debris measurement and analysis;
- c) temperature measurement and analysis;
- d) strain gauge measurement and analysis;
- e) acoustic measurement and analysis.

Components and structures can be monitored by using automatic measurement retrieval or via a manual process.

Condition monitoring devices

The condition monitoring functions may be located in different physical devices. Some information may be exposed by a turbine controller device (TCD) while other information may be exposed by an additional condition monitoring device (CMD). Various actors may request to exchange data values located in the TCD and/or CMD. A SCADA device may request data values from a TCD and/or CMD; a CMD may request data values from a TCD. The information exchange between an actor and a device in a wind power plant requires the use of information exchange services as defined in IEC 61400-25-3. A summary of the above is shown in Figure 1.

¹ To be published.



IEC

Figure 1 – Condition monitoring with separated TCD/CMD functions

The state of the art in the wind power industry is a topology with separated devices for control and condition monitoring applications. Based on this fact, the information and information exchange modelling in the present document is based on a topology with a TCD and a CMD.

IEC 61400-25-6 represents an extension of the IEC 61400-25 series focussing on condition monitoring.

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

1 Scope

This part of IEC 61400-25 specifies the information models related to condition monitoring for wind power plants and the information exchange of data values related to these models.

NOTE Conformance to IEC 61400-25-6 presupposes in principle conformance to IEC 61400-25-2, IEC 61400-25-3 and IEC 61400-25-4.

Figure 2 illustrates the information flow of a system using condition monitoring to perform condition based maintenance. The figure illustrates how data values are refined and concentrated through the information flow, ending up with the ultimate goal of condition based maintenance; actions to be performed via issuing work orders to maintenance teams in order to prevent the wind power plant device to stop providing its intended service.

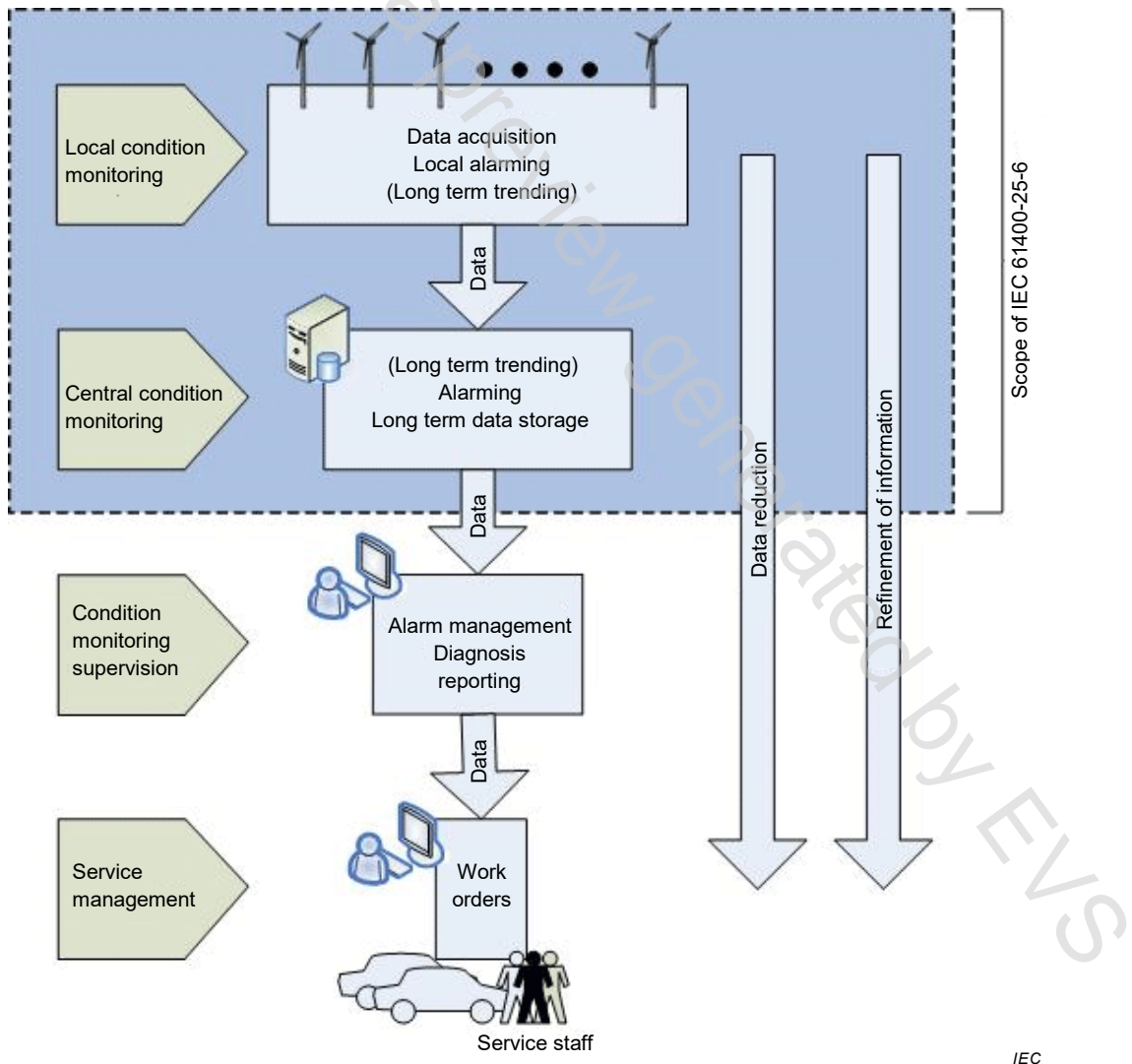


Figure 2 – Schematic flow of condition monitoring information

2 Normative references

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.

IEC 61400-25-1:2006, *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 61400-25-3:2015, *Wind turbines – Part 25-3: Communications for monitoring and control of wind power plants – Information exchange models*

IEC 61400-25-4:2016, *Wind energy generation systems – Part 25-4: Communications for monitoring and control of wind power plants – Mapping to communication profile*

IEC 61400-25-5:—2, *Wind energy generation systems – Part 25-5: Communications for monitoring and control of wind power plants – Conformance testing*

IEC 61850-7-1:2011, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

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)*

IEC 61850-7-3:2010 *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

ISO 13373-1:2002, *Condition monitoring and diagnostics of machines – Vibration condition monitoring – Part 1: General procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61400-25-1, IEC 61400-25-2, IEC 61400-25-3, IEC 61400-25-4 and IEC 61400-25-5 apply.

An exhaustive description of the term "**bin**" has been given in 5.4.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

actor

any entity that receives (sends) data values from (to) another device

Note 1 to entry: Examples of actors could be SCADA systems, maintenance systems, owner, etc.

² To be published.