

# INTERNATIONAL STANDARD



**Wind turbines –  
Part 25-6: Communications for monitoring and control of wind power plants –  
Logical node classes and data classes for condition monitoring**

Without a VM



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2010 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00

This is a preview - click here to buy the full publication



IEC 61400-25-6

Edition 1.0 2010-11

# INTERNATIONAL STANDARD



**Wind turbines –  
Part 25-6: Communications for monitoring and control of wind power plants –  
Logical node classes and data classes for condition monitoring**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

PRICE CODE



ICS 27.180

ISBN 978-2-88912-230-1

## CONTENTS

FOREWORD.....	4
INTRODUCTION .....	6
1 Scope.....	8
2 Normative references.....	9
3 Terms and definitions.....	10
4 Abbreviated terms .....	11
5 General .....	14
5.1 Overview.....	14
5.2 Condition monitoring information modelling.....	15
5.3 Coordination system applied for identifying direction and angles.....	16
5.4 Active power bin concept .....	16
6 Common data class attributes.....	17
6.1 General.....	17
6.2 Attributes for condition monitoring measurement description.....	17
7 Common data classes for wind turbine condition monitoring.....	23
7.1 General.....	23
7.2 Common data classes defined in IEC 61400-25-2.....	24
7.3 Condition monitoring bin (CMB).....	24
7.4 Condition monitoring measurement description (CMMD) .....	24
7.5 Condition monitoring scalar value (CMSV).....	25
7.6 Scalar value array (SVA).....	26
7.7 Condition monitoring scalar value array (CMSVA).....	27
7.8 Condition monitoring vector value (CMVV).....	27
8 Logical nodes for wind turbine condition monitoring.....	28
8.1 General.....	28
8.2 Logical nodes inherited from IEC 61400-25-2.....	28
8.3 Wind turbine condition monitoring logical node WCON .....	29
9 Data file (DAF).....	29
Figure 1 – Condition monitoring with separated TCD/CMD functions.....	7
Figure 2 – Schematic flow of condition monitoring information.....	8
Figure 3 – Reference coordinates system for the drive train .....	16
Figure 4 – Active power bin concept.....	17
Figure 5 – Sensor angular orientation .....	20
Figure 6 – Sensor motion identification .....	20
Figure 7 – Sensor normal and reverse motion .....	21
Figure 8 – Principle of shaft and bearing numbering along a drive train.....	21
Figure A.1 – Gearbox example – Spectral analysis from an Iss sensor.....	30
Figure B.1 – Wind turbine condition monitoring measurements.....	31
Table 1 – Abbreviated terms applied .....	12
Table 2 – Coordinate system and wind turbine related characteristics.....	16
Table 3 – Attributes used for measurement description.....	18

Table 4 – Sensor identification convention .....	18
Table 5 – Sensor type code .....	19
Table 6 – Reference code for sensor sensitive axis orientation.....	20
Table 7 – Gearbox shaft and bearing identification.....	22
Table 8 – mxType values .....	23
Table 9 – CDC: Condition monitoring bin (CMB) .....	24
Table 10 – CDC: Condition monitoring measurement description (CMMD).....	25
Table 11 – CDC: Condition monitoring scalar value (CMSV) .....	26
Table 12 – CDC: Scalar value array (SVA).....	26
Table 13 – CDC: Condition monitoring scalar value array (CMSVA).....	27
Table 14 – CDC: Condition monitoring vector value (CMVV) .....	28
Table 15 – LN: Wind turbine condition monitoring information (WCON) .....	29

Withdrawal

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### WIND TURBINES –

#### **Part 25-6: Communications for monitoring and control of wind power plants – Logical node classes and data classes for condition monitoring**

#### 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61400-25-6 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
88/377A/FDIS	88/380/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.

A list of all parts in the IEC 61400 series, published 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.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

Withdrawn

## 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 61400-25-4.

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

The definitions in parts IEC 61400-25-1 to IEC 61400-25-5 apply also for this part 6 of the standard series.

The purpose of this part of IEC 61400 is to define an information model for condition monitoring information and to define how to use the existing definitions of IEC 61400-25-2 and to define 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 standard may represent information provided by sensors or by calculation.

In the context of this standard, 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 in approximately the same conditions, this standard introduces a concept of sorting production or power levels of a wind turbine into power bins. The power bins 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:

- vibration measurements and analysis;
- oil debris measurement and analysis;
- temperature measurement and analysis;
- strain gauge measurement and analysis;
- acoustic measurement and analysis.

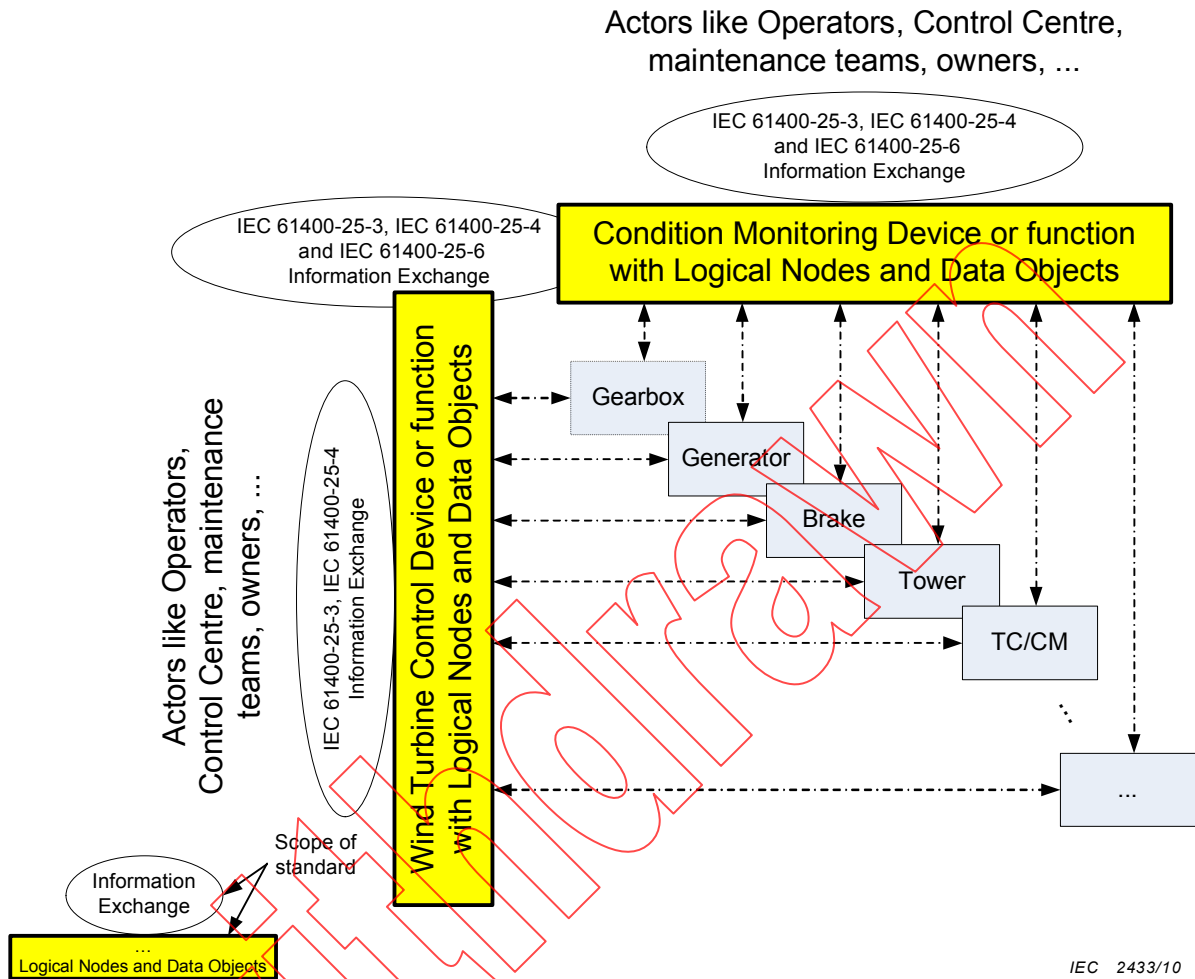
Components and structures can be monitored by using automatic measurement retrieval or via a manual process.

### **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 and the additional required exchange services specified in this part 6. A summary of the above is depicted in Figure 1.



**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 must be perceived as an extension of the IEC 61400-25 series of standards with the focus on condition monitoring.

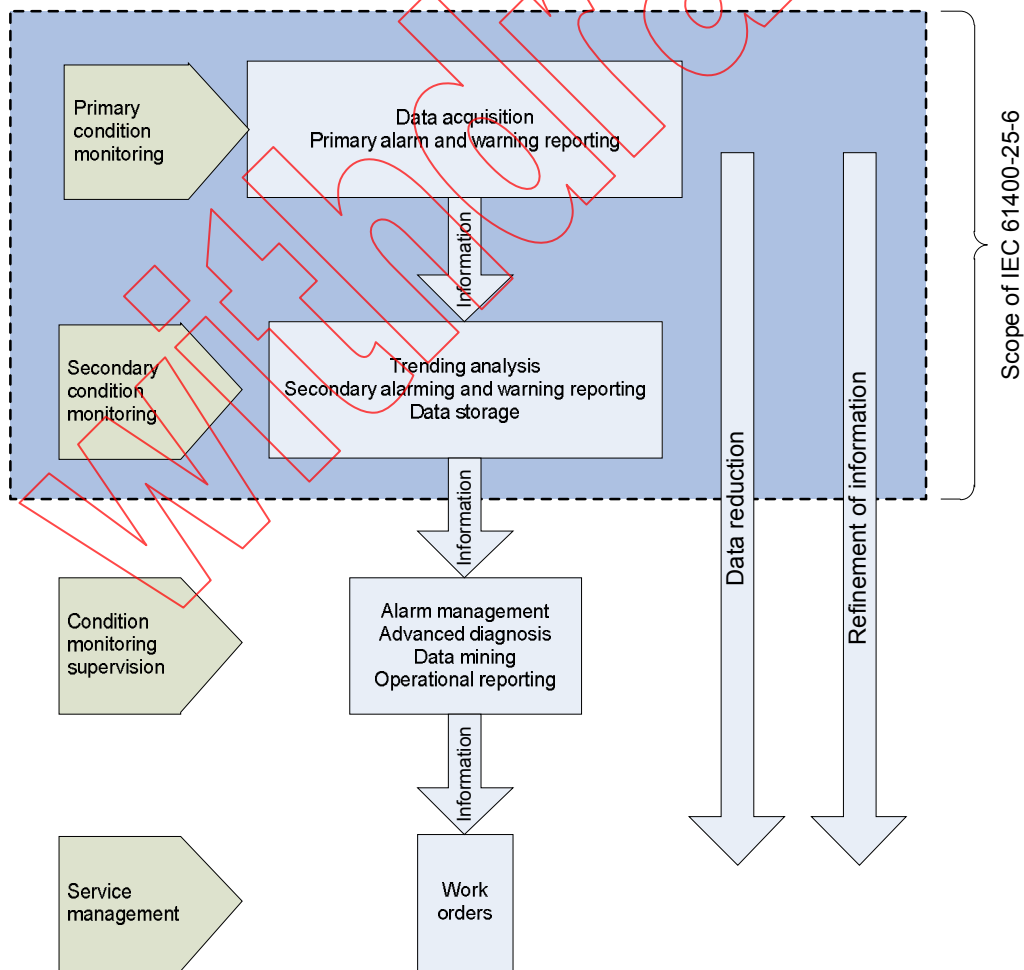
## WIND TURBINES –

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

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.



IEC 2434/10

Figure 2 – Schematic flow of condition monitoring information

Condition monitoring is mainly based on the following kinds of information.

- Time waveform records (samples) of a specific time interval to be exchanged in real-time or by files for analysis (e.g. acceleration, position detection, speed, stress detection).
- Status information and measurements (synchronized with the waveform records) representing the turbine operation conditions.
- Results of time waveform record analysis of vibration data (scalar values, array values, statistical values, historical (statistical) values, counters and status information).
- Results of, for example, oil debris analysis.

It is the purpose of this standard to model condition monitoring information by using the information modelling approach as described in 6.2.2 of IEC 61400-25-1 and by extending the existing information model as specified in Clause 6 of IEC 61400-25-2, the information exchange models specified in Clause 9 of IEC 61400-25-3 and the mapping to communication profiles as specified in IEC 61400-25-4.

## 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 61400-25-1:2006, *Wind turbines – Communications for monitoring and control of wind power plants – Overall description of principles and models*

IEC 61400-25-2:2006, *Wind turbines – Communications for monitoring and control of wind power plants – Information models*

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

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

IEC 61400-25-5, *Communications for monitoring and control of wind power plants – Conformance testing*

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

ISO 10816 (all parts), *Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts*

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