

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**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**  
**Systemes de generation d'energie eolienne –  
Partie 25-6: Communications pour la surveillance et la commande des centrales  
eoliennes – Classes de noeuds logiques et classes de donnees pour la  
surveillance d'etat**



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éoliennes – Classes de nœuds logiques et classes de données pour la  
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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 27.180

ISBN 978-2-8322-5158-4

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## 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**

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International Standard IEC 61400-25-6 has been prepared by IEC technical committee 88: Wind energy generation systems.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Major restructuring of the datamodel to accommodate needed flexibility.
- b) UFF58 format is no longer used.
- c) Access to data is now using the standard reporting and logging functions.

- d) Recommendations for creating datanames to accommodate needed flexibility have been defined.

This bilingual version (2019-01) corresponds to the monolingual English version, published in 2016-12.

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

FDIS	Report on voting
88/606/FDIS	88/611/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

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

As the title of technical committee 88 was changed in 2015 from *Wind turbines* to *Wind energy generation systems* a list of all parts of the IEC 61400 series, under the general title *Wind turbines* and *Wind energy generation systems* can be found on the IEC website.

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## 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<sup>1</sup>.

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.

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### 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.

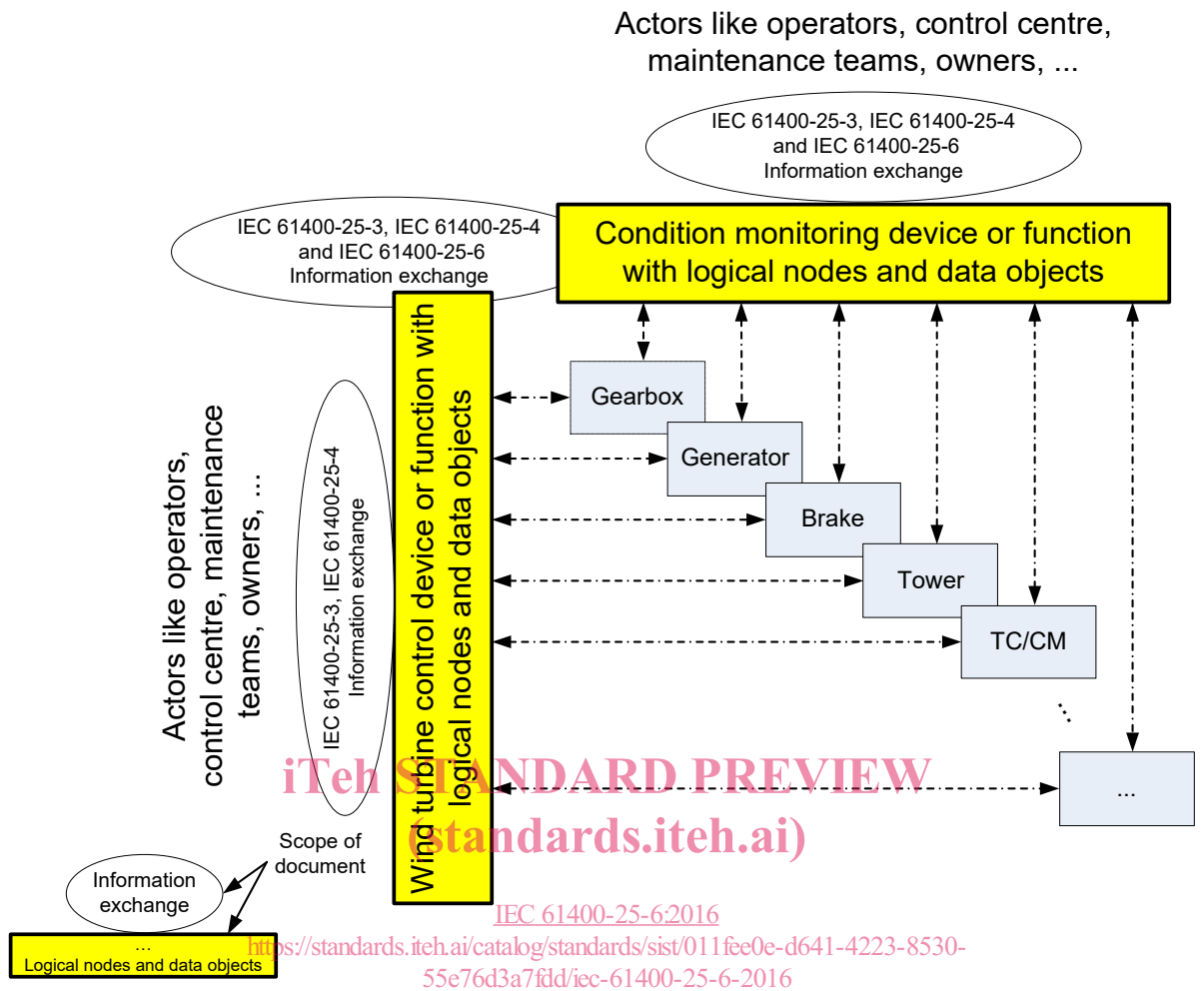
Components and structures can be monitored by using automatic measurement retrieval or via a manual process.

### 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.

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



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**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.

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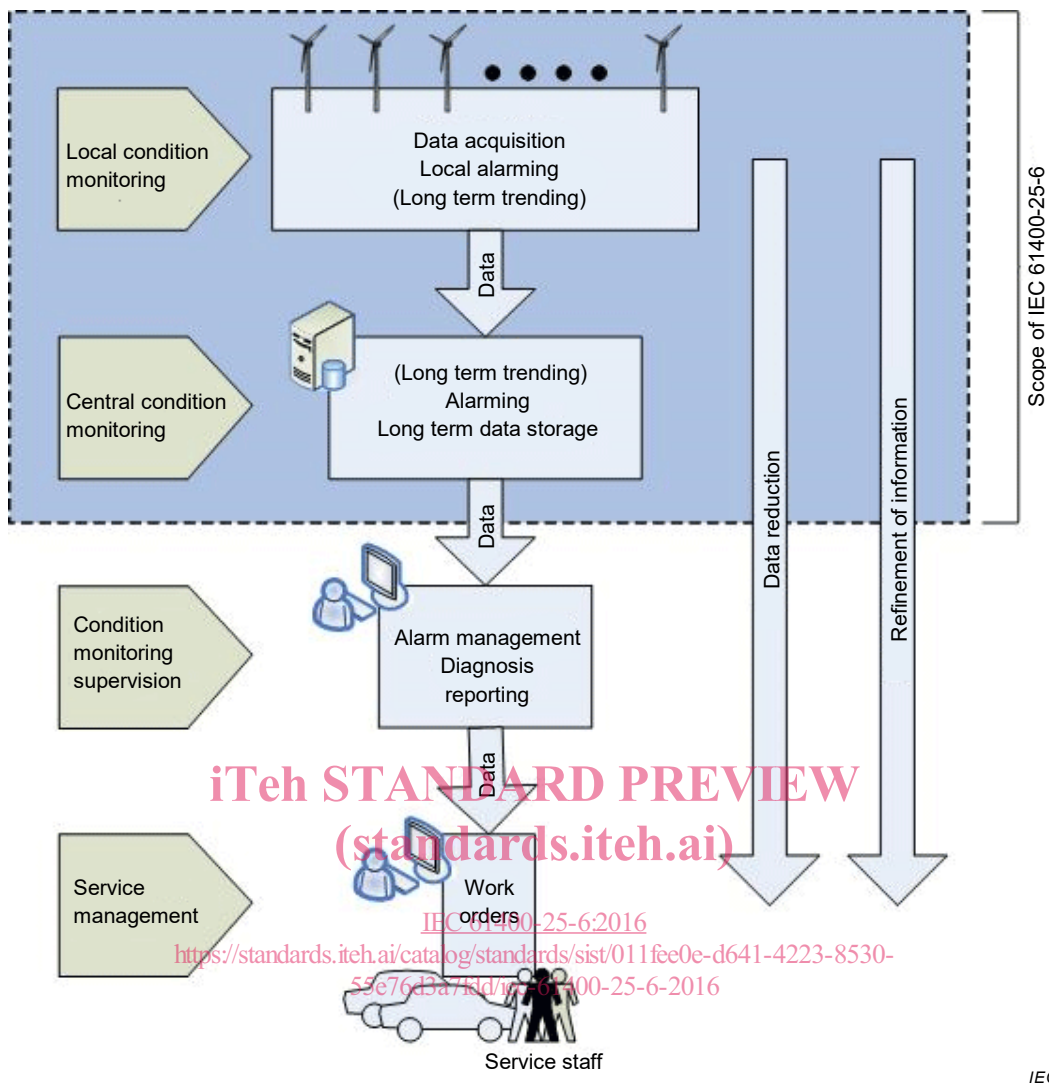


Figure 2 – Schematic flow of condition monitoring information

## 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.

#### 3.2

##### **mandatory**

##### **M**

specific content provided to ensure compliance with this document

#### 3.3

##### **optional**

##### **O**

specific content that can be provided to ensure compliance with this document

#### 3.4

##### **conditional**

##### **C**

depending on stated conditions, specific content defined to ensure compliance with this document

#### 3.5

##### **frequency analysis**

raw time waveforms recorded by the sensor are post processed to measurement types in the frequency domain

---

<sup>2</sup> To be published.

Note 1 to entry: The most common measurement type is the auto spectrum (AUS).

### 3.6

#### scalar value

data type representing a quantity which can be described by a single number, such as a temperature

Note 1 to entry: A scalar value is a post processing of the raw vibration signal into one or more scalar values, also called descriptors (see ISO 13379-1:2012). Each descriptor (scalar) value is used to indicate the presence of a certain failure mode of a monitored machine part. E.g. one descriptor can indicate if a bearing fault is present by measuring the vibration level at the outer ring of a certain bearing, another can indicate the vibration level of the shaft running speed and can indicate misalignment, unbalance or other shaft related faults.

### 3.7

#### time waveform

sampled vibration signal recorded from the transducer

Note 1 to entry: Time waveform recordings have a certain length in time and represent the actual vibration level at any instance during the recording of the waveform.

### 3.8

#### root mean square value

#### RMS

measure of the level of a signal calculated by squaring the instantaneous value of the signal, averaging the squared values over time, and taking the square root of the average value

Note 1 to entry: The RMS value is the value which is used to calculate the energy or power in a signal.

## 4 Abbreviated terms

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CDC	Common data class
CM	Condition monitoring (function)
CMD	Condition monitoring device
DC	Data class
ING	Common data class for integer setting value (see IEC 61850-7-3)
LD	Logical device
LN	Logical node
LPHD	Logical node physical device information
RCB	Report control block
RMS	Root mean square
SAV	Common data class for sampled analogue values (see IEC 61850-7-3)
SHS	Statistical and historical statistical data (as defined in IEC 61400-25-2:2015, Annex A)
SMV	Sampled measured values; sometimes short: SV = sampled values
TC	Turbine controller (function)
TCD	Turbine controller device
TMF	Tooth meshing frequency
TOC	Turbine operation conditions
WPP	Wind power plant
WT	Wind turbine

Abbreviated terms used to build names of data classes found in LNs shall be as listed in Table 1 below and in the table of abbreviated terms in IEC 61400-25-2:2015, Clause 4.

**Table 1 – Abbreviated terms applied**

Term	Description	Term	Description
Acc	Accuracy; Acceleration	Pc	Power class
An	Analogue	Per	Period, periodic
Ane	Anemometer	PF	Power factor
Ang	Angle	Ph	Phase
Av	Average	Plu	Pollution
Ax	Axial	Pos	Position
Azi	Azimuth	Prcd	Processed
Bec	Beacon	Pres	Pressure
Bn	Bin (e.g. Power Bin)	Prod	Production
Cab	Cable	Pwr	Power
Ccw	Counter clockwise	Ra	Radial
Cw	Clockwise	React	Reactive
Dcl	Dc-link	RMS	Root-mean-square
Deb	Debris	Roof	Roof
Dec	Decrease	Sb	Sideband
Dir	Direction	Sdv	Standard deviation
Dsp	Displacement	Smok	Smoke
Dtc	Detection	Snd	Sound pressure
Emg	Emergency	Spd	Speed
En	Energy	Stld	Structural load
Ent	Entrance	Strn	Strain
Ety	Empty	Stop	Stop
Ext	Excitation	Str	Start
Flsh	Flash	Sw	Switch
Gri	Grid	Swf	Swarf
Gs	Grease	Tmp	Temperature
Harm	Harmonic	Torq	Torque
Hi	High	Trd	Transducer
Hor	Horizontal	Trg	Trigger
Hum	Humidity	Trs	Transient
Hz	Frequency	V	Voltage
Ice	Ice	Vbr	Vibration
Idl	Idling	Ver	Vertical
Inl	Inline	Wdp	Wind power
Lev	Level	Wup	Windup
Lft	Lift	Xdir	X-direction
Lo	Low (state or value)	Ydir	Y-direction
Lum	Luminosity		
Max	Maximum		
Met	Meteorological		
Min	Minimum		
Mult	Multiplier		