IEC 61400-25-6

Edition 2.0 2016-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Systèmes de génération 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 61400-25-6:2016-12(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
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.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 61400-25-6

Edition 2.0 2016-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Systèmes de génération 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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.180

ISBN 978-2-8322-5158-4

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

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

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 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.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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.

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[1].

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.

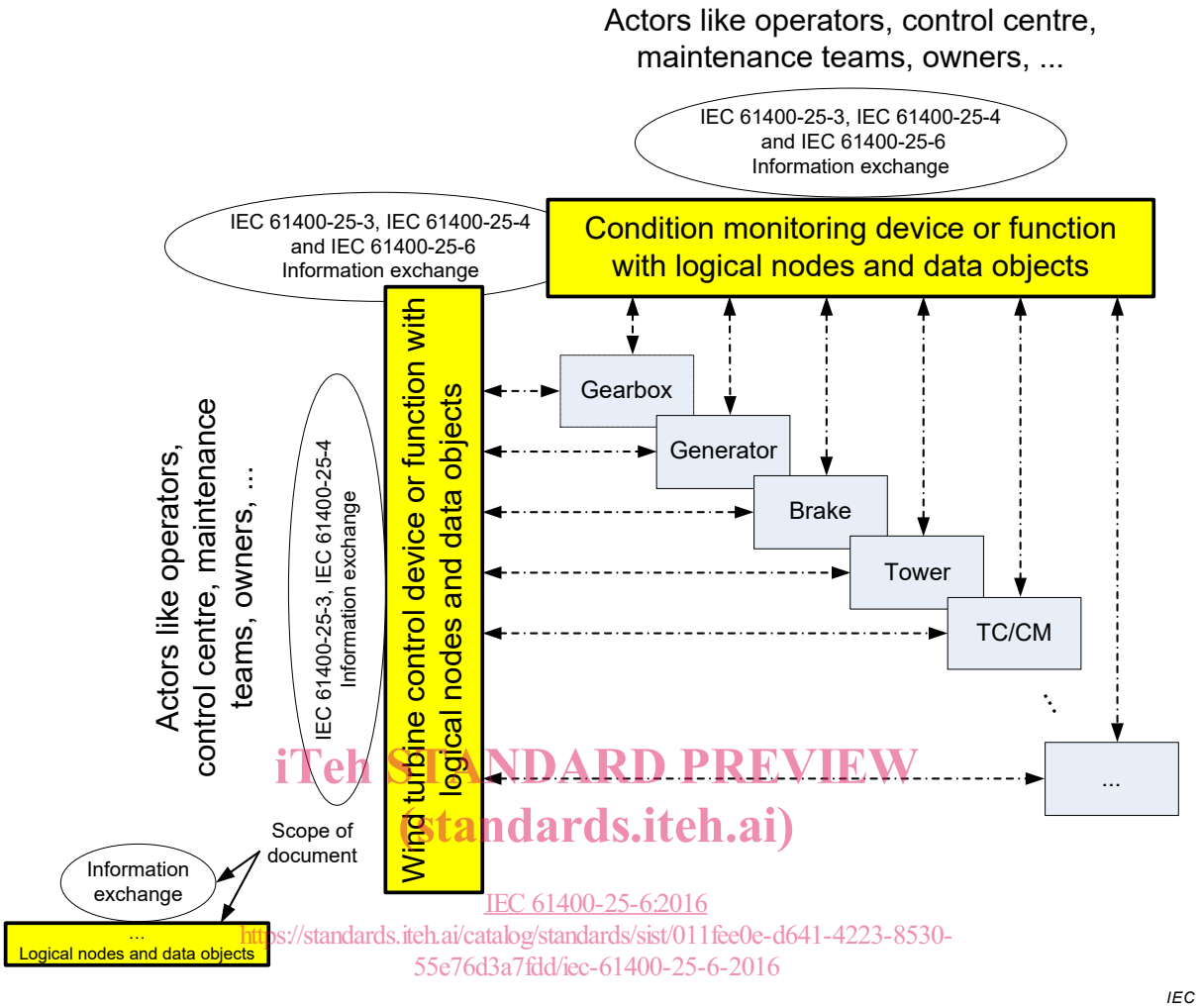

Figure 1 – Condition monitoring with separated TCD/CMD functions

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.

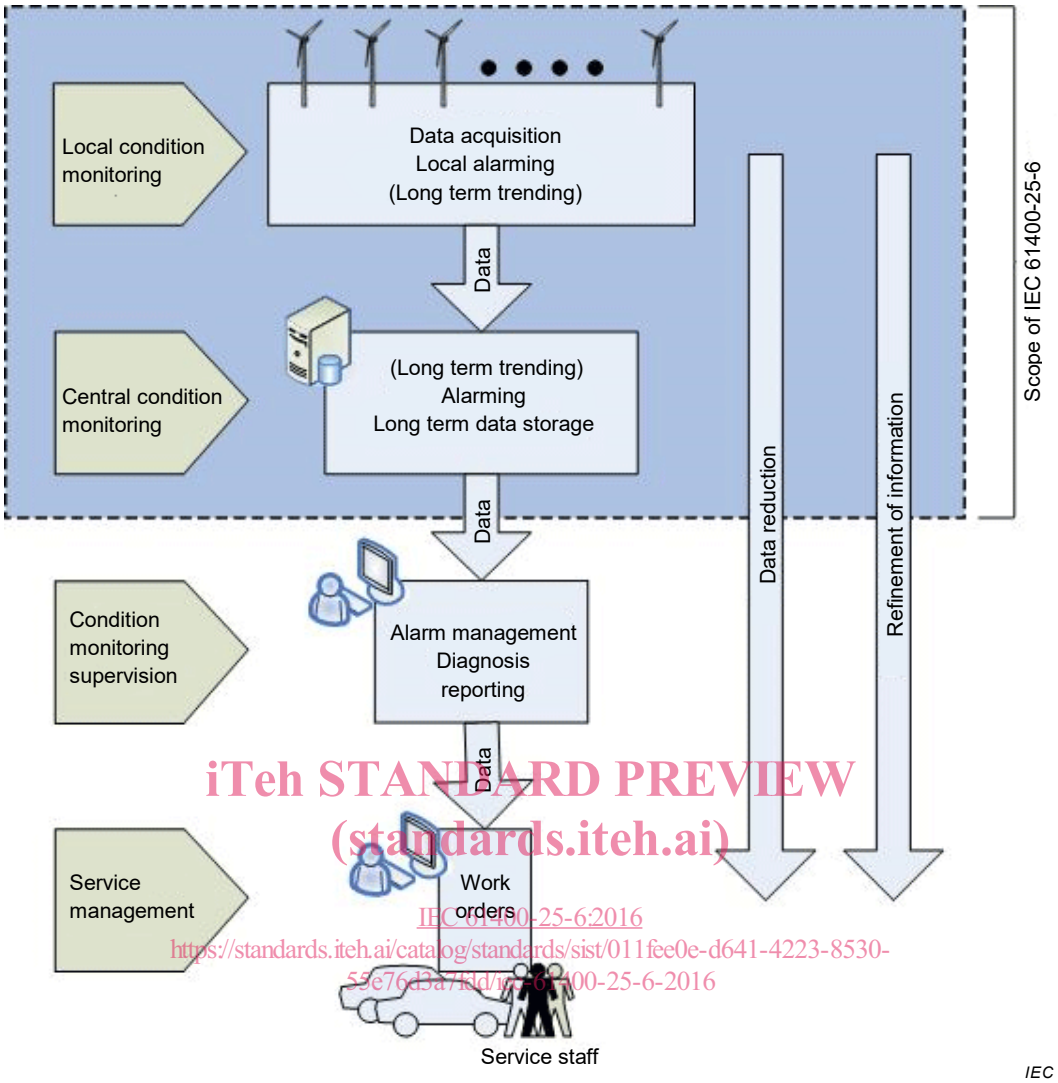

Figure 2 – Schematic flow of condition monitoring information

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.

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

[2] 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

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
Acc	Accuracy; Acceleration
An	Analogue
Ane	Anemometer
Ang	Angle
Av	Average
Ax	Axial
Azi	Azimuth
Bec	Beacon
Bn	Bin (e.g. Power Bin)
Cab	Cable
Ccw	Counter clockwise
Cw	Clockwise
Dcl	Dc-link
Deb	Debris
Dec	Decrease
Dir	Direction
Dsp	Displacement
Dtc	Detection
Emg	Emergency
En	Energy
Ent	Entrance
Ety	Empty
Ext	Excitation
Flsh	Flash
Gri	Grid
Gs	Grease
Harm	Harmonic
Hi	High
Hor	Horizontal
Hum	Humidity
Hz	Frequency
Ice	Ice
Idl	Idling
Inl	Inline
Lev	Level
Lft	Lift
Lo	Low (state or value)
Lum	Luminosity
Max	Maximum
Met	Meteorological
Min	Minimum
Mult	Multiplier

Term	Description
Pc	Power class
Per	Period, periodic
PF	Power factor
Ph	Phase
Plu	Pollution
Pos	Position
Prcd	Processed
Pres	Pressure
Prod	Production
Pwr	Power
Ra	Radial
React	Reactive
RMS	Root-mean-square
Roof	Roof
Sb	Sideband
Sdv	Standard deviation
Smok	Smoke
Snd	Sound pressure
Spd	Speed
Stld	Structural load
Stn	Strain
Stop	Stop
Str	Start
Sw	Switch
Swf	Swarf
Tmp	Temperature
Torq	Torque
Trd	Transducer
Trg	Trigger
Trs	Transient
V	Voltage
Vbr	Vibration
Ver	Vertical
Wdp	Wind power
Wup	Windup
Xdir	X-direction
Ydir	Y-direction