INTERNATIONAL STANDARD

IEC 61400-25-2

First edition
2006-12

Wind turbines –

Part 25-2: Communications for monitoring and control of wind power plants – Information models

Reference number
IEC 61400-25-2:2006(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**
- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (www.iec.ch/online_news/ justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

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

INTERNATIONAL STANDARD

IEC 61400-25-2

First edition
2006-12

Wind turbines –

Part 25-2:
Communications for monitoring and control of wind power plants – Information models

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XC

For price, see current catalogue

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND TURBINES –

Part 25-2: Communications for monitoring and control of wind power plants – Information models

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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 61400-25-2 has been prepared by IEC technical committee 88: Wind turbines.

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

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

FDIS	Report on voting
88/275/FDIS	88/281/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.

A list of all parts of the IEC 61400 series, 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 maintenance result 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.

INTRODUCTION

The IEC 61400-25 series defines communication for monitoring and control of wind power plants. The modeling approach of the IEC 61400-25 series has been selected to provide abstract definitions of classes and services such that the specifications are independent of specific protocol stacks, implementations, and operating systems. The mapping of these abstract classes and services to a specific communication profile is not within the scope of this part of the IEC 61400-25 series but within the scope of future IEC 61400-25-4[1].

To reach interoperability, all data in the information model need a strong definition with regard to syntax and semantics. The semantics of the data is mainly provided by names assigned to logical nodes and data they contain, as defined in this part of the IEC 61400-25 series. Interoperability is easiest if as much as possible of the data are defined as mandatory.

It should be noted that data with full semantics is only one of the elements required to achieve interoperability. Since data and services are hosted by devices (IED), a proper device model is needed along with compatible domain specific services (see IEC 61400-25-3).

This part is used to specify the abstract definitions of a logical device class, logical node classes, data classes, and abstract common data classes. These abstract definitions are mapped into concrete object definitions that are to be used for a particular protocol.

The compatible logical node name and data name definitions found in this part and the associated semantics are fixed.

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

[1] To be published.

WIND TURBINES –

Part 25-2: Communications for monitoring and control of wind power plants – Information models

1 Scope

The focus of the IEC 61400-25 series 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 outside the scope of the IEC 61400-25 series.

The IEC 61400-25 series 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. The IEC 61400-25 series enables connectivity between a heterogeneous combination of client and servers from different manufacturers and suppliers.

As depicted in Figure 1, the IEC 61400-25 series 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.
– 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).

The IEC 61400-25 series only defines how to model the information, information exchange and mapping to specific communication protocols. The standard excludes a definition of how and where to implement the communication interface, the application program interface and implementation recommendations. However, the objective of the standard is that the information associated with a single wind power plant component (such as a wind turbine) is accessible through a corresponding logical device.

IEC 61400-25-2 specifies the information model of devices and functions related to wind power plant applications. In particular, it specifies the compatible logical node names, and data names for communication between wind power plant components. This includes the relationship between logical devices, logical nodes and data. The names defined in the IEC 61400-25 series are used to build the hierarchical object references applied for communicating with components in wind power plants.

This part of IEC 61400-25 specifies common attribute types and common data classes related to wind turbine applications. In particular it specifies common data classes for:

- setpoint value,
- status value,
- alarm,
- command,
- event counting,
- state timing,
- alarm set status.

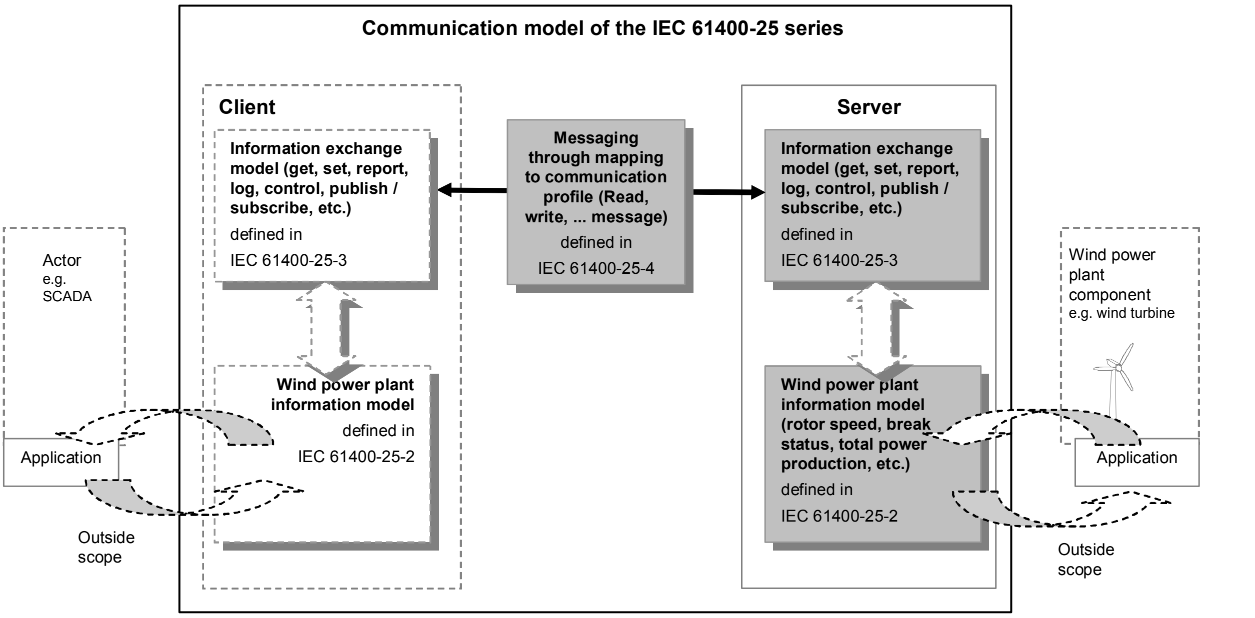


Figure 1 – Conceptual communication model of the IEC 61400-25 series

Devices implementing the information model of this part shall choose one or more logical nodes as required by the application.

NOTE 1 The IEC 61400-25 series 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 or by user groups.

NOTE 2 This part does not provide tutorial material.

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 (all parts), *Wind turbines - Part 25: Communications for monitoring and control of wind power plants*

IEC 61850-5, *Communication networks and systems in substations – Part 5: Communication requirements for functions and device models*

IEC 61850-7-1:2003, *Communication networks and systems in substations – Part 7-1: Basic communication structure for substations and feeder equipment – Principles and models*

IEC 61850-7-2:2003, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substations 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 substations and feeder equipment – Common data classes*

IEC 61850-7-4, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substations and feeder equipment – Compatible logical node classes and data classes*

ISO 639 (all parts), *Codes for the representation of names of languages*

ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 3166 (all parts), *Codes for the representation of names of countries and their subdivisions*

RFC 2445, *Internet Calendaring and Scheduling Core Object Specification (iCalendar)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61400-25-1 as well as the following apply.

3.1
conditional
attribute of a common data class provided by an implementation of the IEC 61400-25 series if a certain condition corresponding with the attribute is true

3.2
mandatory
defined content shall be provided in compliance with the IEC 61400-25 series

3.3
optional
defined content can be optionally provided in compliance with the IEC 61400-25 series

4 Abbreviated terms

CDC	Common Data Class
DC	Data Class
IED	Intelligent Electronic Device
LCB	Log Control Block
LD	Logical Device
LN	Logical Node
LPHD	Logical node Physical Device Information
RCB	Report Control Block
SBO	Select Before Operate
WPP	Wind Power Plant
WT	Wind Turbine
XML	Extensible Markup Language

Abbreviated terms used to build names of data classes found in LNs shall be as listed below.

EXAMPLE RotPos is constructed by using two names "Rot" which stands for Rotor and "Pos" which stands for "Position". Thus the concatenated name represents a "Rotor Position".

Term	Description
A	Current
AC	AC
Ack	Acknowledge
Acs	Access
Act	Actual
Alm	Alarm
An	Analogue
Ane	Anemometer
Ang	Angle
Alt	Altitude
At	Active (real)
Atv	Activate
Av	Average
Avl	Availability
Az	Azimuth
Bec	Beacon
Bl	Blade
Blk	Blocked
Brg	Bearing
Brk	Brake
Cab	Cable
Calc	Calculation
Ccw	Counter clockwise
Ch	Characteristic
Chg	Change
Chk	Check
Chrg	Charge
Cl	Cooling
Cm	Command
Cnv	Converter
Ct	Counting
Ctl	Control
Cw	Clockwise
d	Description
Dat	Data
Db	Deadband
DC	DC (Direct Current)
Dcl	DC-link
Dec	Decrease
Dehum	De-humidifier
Del	Delta
Det	Detection
Dir	Direction
Disp	Displacement
Dly	Daily
Dmd	Demand
Drv	Drive
Dn	Down
Egy	Energy

Term	Description
Elev	Elevator
Emg	Emergency
En	Enable
Ent	Entrance
Ety	Empty
Evt	Event
Ex	External
Exp	Expired
Ext	Excitation
Flsh	Flash
Flt	Fault
Ftr	Filter
Gbx	Gearbox
Gra	Gradient
Gri	Grid
Gn	Generator
Gs	Grease
Hi	High
Hly	Hourly
Hor	Horizontal
Ht	Heating
Htex	Heat-exchanger
Hum	Humidity
Hy	Hydraulic
Hz	Frequency
Ice	Ice
Id	Identifier
Idl	Idling
Inc	Increase
Inj	Injection
Inl	Inline
Inlet	Inlet
Inst	Instantaneous
Intl	Internal
Lev	Level
Log	Log
Lift	Lift
Lim	Limit
Lo	Low
Lu	Lubrication
Lum	Luminosity
Man	Manual
Max	Maximum
Met	Meteorological
Min	Minimum
Mly	Monthly
Mod	Mode
Mthd	Method
Mul	Multiplier

Term	Description
Mx	Measurement
Nac	Nacelle
Num	Number (size)
Of	Off line
Oil	Oil
Op	Operate, Operating
Oper	Operator
Ov	Over
Per	Period, Periodic
PF	Power factor
Ph	Phase
Pmp	Pump
Pl	Plant
Plu	Pollution
Pos	Position
Pres	Pressure
Prod	Production
Pt	Pitch
Ptr	Pointer
Pwr	Power
q	Quality
Rdy	Ready
Rep	Report
Rms	Root-mean-square
Rng	Range
Roof	Roof
Rot	Rotor (windturbine)
Rs	Reset
React	Reactive
Rtr	Rotor (generator)
Sdv	Standard deviation
Sev	Severity
Seq	Sequence
Shf	Shaft
Smk	Smoke
Smp	Sampled
Sp	Setpoint
Spd	Speed
Src	Source
St	Status
Sta	Stator
Stdby	Standby
Stop	Stop
Str	Start
Sw	Switch
Sys	System
t	Timestamp
Tm	Timer
Tmp	Temperature
Tot	Total
Tow	Tower

Term	Description
Tra	Transient
Trf	Transformer
Trg	Trigger
Torq	Torque
Tur	Turbine
Un	Under
Urg	Urgent
V	Voltage
VA	Apparent power
Val	Value
Vals	Values
Ver	Vertical
Vib	Vibration
Vis	Visibility
Wd	Wind (power)
Wly	Weekly
Wup	Windup
Xdir	X-direction
Ydir	Y-direction
Yly	Yearly
Yw	Yaw

5 General

5.1 Overview of logical node classes

The following two groups of common logical node classes are defined:

1) system specific logical nodes,
2) wind power plant specific logical nodes.

System specific logical nodes shall include all common information for physical hosting devices and wind power independent information. Wind power plant specific logical nodes shall inherit at least all mandatory information of system logical nodes.

All logical node classes defined in this part of the IEC 61400-25 series inherit their structure from the abstract logical node class (LN, see Figure 2) defined in 9.1.1 of IEC 61850-7-2. Apart from the logical node class 'Physical Device Information' (LPHD) all logical node classes (LLN0 and wind power plant specific LNs) defined in this part of the IEC 61400-25 series inherit at least the mandatory information of the common logical node (Common LN).

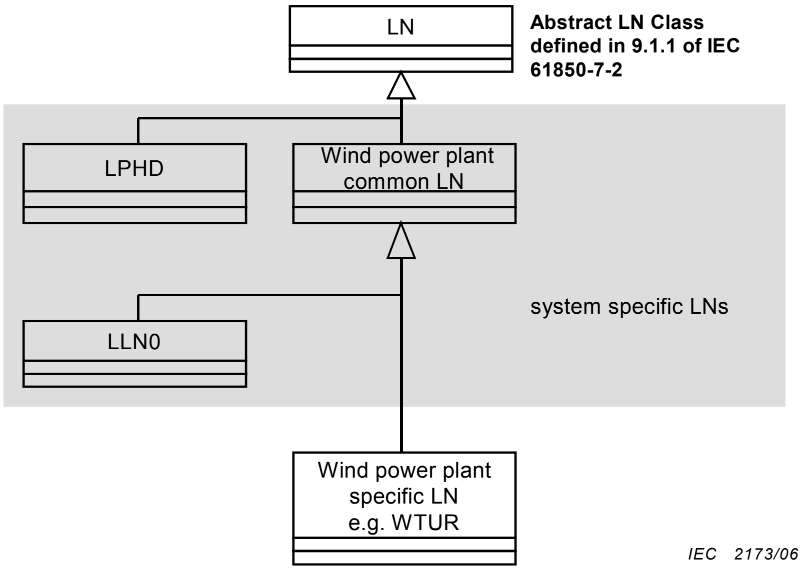


Figure 2 – Relationship of logical nodes

The system specific logical node classes listed in Table 1 are all mandatory. The logical node zero (LLN0) represents common information of the logical device, and the logical node physical device (LPHD) represents common information of the physical devices hosting the logical device (see 8.2 of IEC 61850-7-1).

Table 1 – System specific logical nodes

LN classes	Description	M/O
LLN0	Logical Node Zero	M
LPHD	Physical Device Information	M

Wind power plant information shall be classified in wind power plant specific logical nodes. In principle, classification of wind power plant information in different logical nodes is an arbitrary process and the modelling method offers flexibility. From the viewpoint of standardisation it is preferable that all wind power plant information will be build unambiguously and in a similar way. Table 2 shows the wind power plant information break down into logical nodes.

Table 2 – Wind power plant specific logical nodes

LN classes	Description	M/O
WTUR	Wind turbine general information	M
WALM	Wind power plant alarm information	O
WMET	Wind power plant meteorological information	O
WAPC	Wind power plant active power control information	O
WRPC	Wind power plant reactive power control information	O

A wind power plant consists of several components, including one or more wind turbines. Table 3 shows the breakdown of a wind turbine into logical nodes. Each wind turbine model shall include the mandatory logical nodes listed in Table 3. Despite of the fact that some logical nodes are optional for use, it is highly recommended in the IEC 61400-25 series to deviate as little as possible from the logical nodes as proposed in Table 2 and Table 3.

Table 3 – Wind turbine specific logical nodes

LN classes	Description	M/O
WTUR	Wind turbine general information	M
WROT	Wind turbine rotor information	M
WTRM	Wind turbine transmission information	O
WGEN	Wind turbine generator information	M
WCNV	Wind turbine converter information	O
WTRF	Wind turbine transformer information	O
WNAC	Wind turbine nacelle information	M
WYAW	Wind turbine yawing information	M
WTOW	Wind turbine tower information	O
WALM	Wind power plant alarm information	M
WSLG	Wind turbine state log information	O
WALG	Wind turbine analogue log information	O
WREP	Wind turbine report information	O

As shown in Table 2 and Table 3, information is mainly modelled by a set of LN classes, which are classified by physical turbine decomposition. A useful practical exception involves alarm information; all alarms shall be collected in a separate logical node.

Separate logical nodes for logged events (statuses, alarms, commands, event-counters, state-timers) and logged analogue time series (long period, demands, transient recording), shall model historical logged information.

Besides common information for all turbines (manufacturer independent), most information will, in practice, be determined by the turbine concept, the manufacturer, the site and the state of the art of turbine technology. For this reason, as a modelling guideline, the data class attribute names representing the specific information in the wind power plant specific logical nodes are focussed on the most prevailing modern wind turbine concept, namely 3-bladed, variable speed, active pitch (electric/hydraulic) and gearbox transmission. In case of additional information originated by other wind turbine systems or components, new data classes or specialised data classes to existing LNs could be defined. Additional user-specific LNs could also be defined.

The semantic of the data class names and semantic definitions are alphabetically listed and defined in 6.3. Units and multipliers associated with the data classes are specified in Annex B.

The modelling approach, including the general table structure of a logical node, is described in 6.2.2 of IEC 61400-25-1.

Standardised names for logical node classes are written in capital letters. Data names of the first level in the hierarchy (below the logical node level) start with a capital letter, and attribute names and data names of the second and lower levels in the hierarchy with a small letter.

5.2 Use of logical node classes

The logical node classes defined in this part of the standard, for example, WROT, WTUR, and those referenced from other standards, e. g. XCBR and MMXU from 5.12.1 and 5.10.7 of IEC 61850-7-4, have to be instantiated in real systems. Figure 3 depicts an example of a real wind turbine that uses several instances of logical nodes.

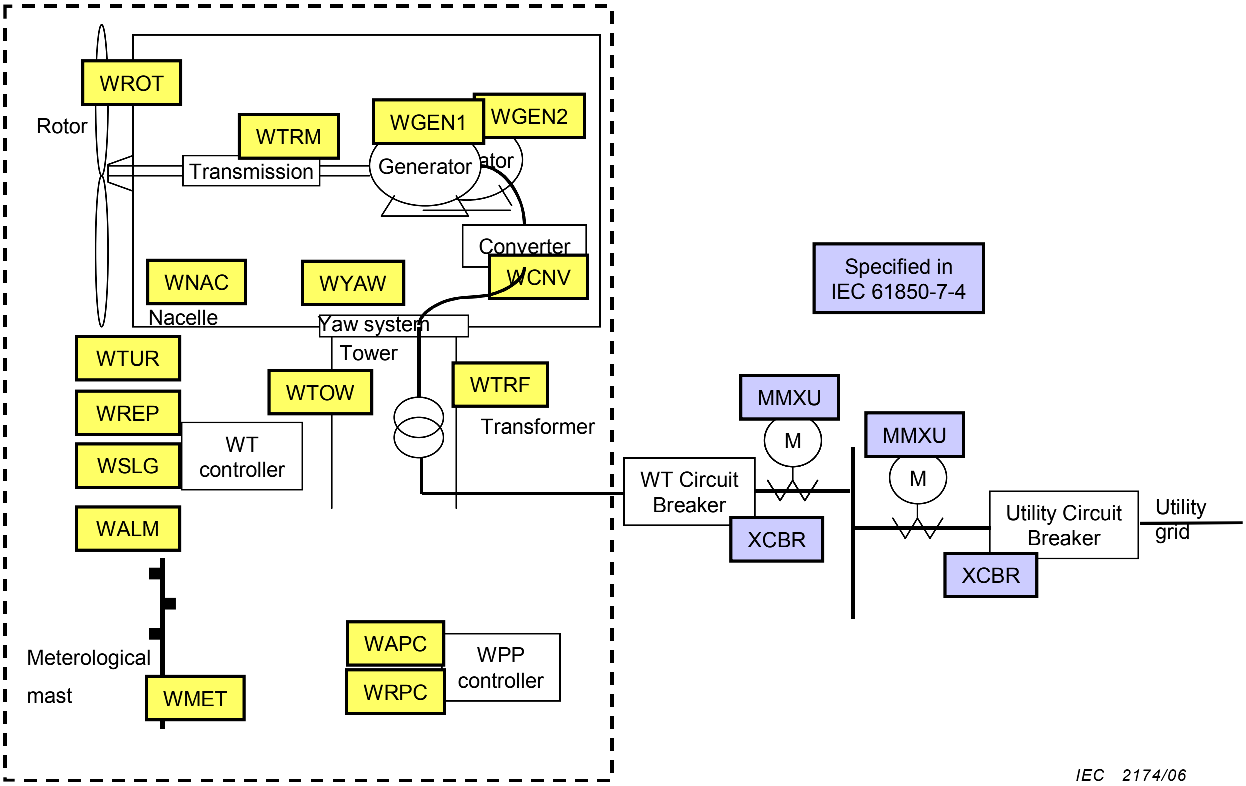


Figure 3 – Use of instances of logical nodes

The logical node instances depicted represent information from wind turbines “WTUR”, yawing system “WYAW”, converter “WCNV”, etc. The instance names, for example of WGEN1 and WGEN2 represent different generators. Figure 3 also illustrates the interfacing electrical system including measurements “MMXU”, circuit breakers “XCBR”, etc. MMXU, XCBR and other logical nodes related to the electrical system are specified in IEC 61850-7-3.

5.3 Extensions of the information model

The information model described in Clause 6 can be extended with additional logical nodes and data for a particular implementation. If a different topology is applied (for example several generators and gearboxes) or more sensors (temperature, current) are used for monitoring purposes, the user is free to assign relevant information to additional data names. Any data can be added to any logical node.

The extension rules for LNs, data classes, and data attributes shall be as defined in Annex A of IEC 61850-7-4. The name space concept defined in Clause 14 of IEC 61850-7-1 allows one to define any extension – the name spaces are differentiated by unique identifiers.

6 Wind power plant logical node classes

6.1 System specific logical nodes

6.1.1 Wind power plant common logical node class

The wind turbine specific compatible logical nodes classes defined in this part of the IEC 61400-25 series are specialisations of the wind turbine common logical node class as defined in Table 4.

Table 4 – Wind power plant common logical node class

Wind power plant common Logical Node class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
LNName		Logical node name. Shall be inherited from Logical-Node Class (see 9.1.1 of IEC 61850-7-2)	
Data			
Mandatory Logical Node Information (Shall be inherited by ALL LN but LPHD)			
NamPlt	LPL	Name plate (inherited from IEC 61850-7-4)	M
Optional Logical Node Information			
Mod	INC	Mode (inherited from IEC 61850-7-4)	O
Beh	INS	Behaviour (inherited from IEC 61850-7-4)	O
Health	INS	Health (inherited from IEC 61850-7-4)	O
Loc	SPS	Local operation (inherited from IEC 61850-7-4)	O
EEHealth	INS	External equipment health (inherited from IEC 61850-7-4)	O
EEName	WDPL	External equipment name plate	O
OpCntRs	INC	Operation counter resetable (inherited from IEC 61850-7-4)	O
OpCnt	INS	Operation counter (inherited from IEC 61850-7-4)	O
OpTmh	INS	Operation time (inherited from IEC 61850-7-4)	O
Information for statistical information			
CalcExp	SPS	Calculation period expired	O
CalcStr	SPC	Start calculation at time operTm (if set) or immediately	O
CalcMthd	ING	Calculation Method of statistical data. Allowed values: PRES | MIN | MAX |TOTMIN | TOTMAX |AVG | SDV	O
CalcPer	ING	Calculation Period of statistical data, shall be in seconds	O
CalcSrc	ORG	Object Reference to Source logical node	O
NOTE All five data for statistical information shall be available if statistical information is supported.			

The data CalcMthd shall be included in any logical node that represents analogue or counting information if the calculation method is unequal PRES. The data CalcExp, CalcStr, CalcPer and CalcSrc shall be included in any logical node that represents statistical data (MIN, MAX, etc.).

A specialisation of this wind power plant Common Logical Node class shall inherit all information required in the wind power plant specific logical nodes (see Table 2). For the optional logical node information, there are three possibilities for specialisation:

- not to inherit a specific information item;
- inherit a specific information item and leave it as optional;

– inherit a specific information item and define it as mandatory.

6.1.2 Logical node zero (LLN0)

The LLN0 class shall be used to address common issues for Logical Devices as defined in Table 5.

Table 5 – Logical node zero class

LLNO class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from wind power plant Common Logical Node Class (see 6.1.1).	M

The LLN0 represents information that is specific for a logical device. The name plate of the LLN0 represents the root name space (logical device namespace, ldNs) for a logical device. The value for the IEC 61400-25 series is “IEC 61400-25:2006”. The name space also applies to names inherited from other standards. Only one logical device name space shall be used for each Logical Device, i.e. only one version can be used for a single Logical Device.

6.1.3 Physical device information (LPHD)

The LPHD class shall model common issues for physical devices as defined in Table 6.

Table 6 – Physical device information class

LPHD class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
LNName		Logical node name. Shall be inherited from Logical-Node Class (see IEC 61850-7-2)	
Data			
PhyNam	WDPL	Physical device name plate (see 7.4.2.2)	M
PhyHealth	INS	Physical device health (inherited from IEC 61850-7-4)	M
OutOv	SPS	Output communications buffer overflow (inherited from IEC 61850-7-4)	O
Proxy	SPS	Indicates if this LD is a proxy (inherited from IEC 61850-7-4)	M
InOv	SPS	Input communications buffer overflow (inherited from IEC 61850-7-4)	O
NumPwrUp	INS	Number of Power ups (inherited from IEC 61850-7-4)	O
WrmStr	INS	Number of Warm Starts (inherited from IEC 61850-7-4)	O
WacTrg	INS	Number of watchdog device resets detected (inherited from IEC 61850-7-4)	O
PwrUp	SPS	Power Up detected (inherited from IEC 61850-7-4)	O
PwrDn	SPS	Power Down detected (inherited from IEC 61850-7-4)	O
PwrSupAlm	SPS	Power supply alarm (inherited from IEC 61850-7-4)	O
RsStat	SPC	Reset device statistics (inherited from IEC 61850-7-4)	O

6.2 Wind power plant specific logical nodes

6.2.1 Wind turbine general information (WTUR)

The logical node comprises the data classes that represent the wind turbine general information as listed in Table 7. This logical node shall be mandatory, which means that at least all mandatory defined data classes shall be available for compliance with this part of the IEC 61400-25 series.

Table 7 – LN: Wind turbine general information (WTUR)

WTUR class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
AvlTmRs	TMS	Turbine availability time (vendor-specific)	O
OpTmRs	TMS	Operation time (vendor-specific)	O
StrCnt	CTE	Number of turbine starts (vendor-specific)	O
StopCnt	CTE	Number of turbine stops (vendor-specific)	O
TotWh	CTE	Total (net) active energy production	M
TotVArh	CTE	Total (net) reactive energy production	O
DmdWh	BCR	Active (real) energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)	O
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)	O
SupWh	BCR	Active (real) energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)	O
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)	O
Status information			
TurSt	STV	Turbine status	M
Analogue information			
W	MV	Active power generation	M
VAr	MV	Reactive power generation	O
Control information			
SetTurOp	CMD	Wind turbine operation command	M
VArOvW	CMD	Windturbine reactive priority over active command	O
VArRefPri	CMD	Windturbine reactive setpoint priority command	O
DmdW	SPV	Turbine active power generation setpoint	O
DmdVAr	SPV	Turbine reactive power generation setpoint	O
DmdPF	SPV	Turbine power factor setpoint	O

6.2.2 Wind turbine rotor information (WROT)

This logical node shall comprise the data classes that represent the wind turbine rotor information. This logical node is mandatory, and at least all mandatory defined data classes in Table 8 shall be available for compliance with the IEC 61400-25 series.

The data classes focus on a three bladed rotor and active electric/hydraulic pitch control. For active pitch control it is highly recommended to model the pitch angle of at least one rotor blade (reference).

In case of a divergent rotor topology (for example tip brakes, two bladed) or different mounted equipment (for example sensors for ice or lightning detection, blade position detection, UPS equipment), the user is free to assign relevant rotor information to additional data names.

Table 8 – LN: Wind turbine rotor information (WROT)

WROT class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
RotSt	STV	Status of rotor	O
BlStBl1	STV	Status of blade 1 (reference)	O
BlStBl2	STV	Status of blade 2	O
BlStBl3	STV	Status of blade 3	O
PtCtlSt	STV	Status of pitch control	O
Analogue information			
RotSpd	MV	Value of rotor speed at rotor side	O
RotPos	MV	Angular rotor position	O
HubTmp	MV	Temperature in the rotor hub	O
PtHyPresBl1	MV	Pressure of hydraulic pitch system for blade 1 (reference)	O
PtHyPresBl2	MV	Pressure of hydraulic pitch system for blade 2	O
PtHyPresBl3	MV	Pressure of hydraulic pitch system for blade 3	O
PtAngSpBl1	MV	Pitch angle set points for blade 1 (reference)	O
PtAngSpBl2	MV	Pitch angle set points for blade 2	O
PtAngSpBl3	MV	Pitch angle set points for blade 3	O
PtAngValBl1	MV	Pitch angle for blade 1 (reference)	O
PtAngValBl2	MV	Pitch angle for blade 2	O
PtAngValBl3	MV	Pitch angle for blade 3	O
Control information			
BlkRot	CMD	Set rotor to blocked position	O
PtEmgChk	CMD	Check emergency pitch system	O

6.2.3 Wind turbine transmission information (WTRM)

This logical node shall comprise the data classes that represent wind turbine (mechanical) transmission information. The logical node is optional. Table 9 shows the data classes for a usual transmission topology, consisting of a slow speed shaft, multistage gearbox, a fast shaft and a (hydraulically driven) mechanical brake.

In case of a divergent transmission topology (for example direct drive, single stage gearbox) or different mounted equipment (for example sensors, electromechanical brake), the user is free to adapt or extend the data classes as shown in Table 9.

Table 9 – LN: Wind turbine transmission information (WTRM)

WTRM class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
BrkOpMod	STV	Status of shaft brake	O
LuSt	STV	Status of gearbox lubrication system.	O
FtrSt	STV	Status of filtration system	O
ClSt	STV	Status of transmission cooling system	O
HtSt	STV	Status of heating system	O
OilLevSt	STV	Status of oil level in gearbox sump	O
OfFltSt	STV	Status of offline filter	O
InlFltSt	STV	Status of inline filter	O
Analogue information			
TrmTmpShfBrg1	MV	Measured temperature of shaft bearing 1	O
TrmTmpShfBrg2	MV	Measured temperature of shaft bearing 2	O
TrmTmpGbxOil	MV	Measured temperature of gearbox oil	O
TrmTmpShfBrk	MV	Measured temperature of shaft brake (surface)	O
VibGbx1	MV	Measured gearbox vibration of gearbox 1	O
VibGbx2	MV	Measured gearbox vibration of gearbox 2	O
GsLev	MV	Grease level for lubrication of main shaft bearing	O
GbxOilLev	MV	Oil level in gearbox sump	O
GbxOilPres	MV	Gear oil pressure	O
BrkHyPres	MV	Hydraulic pressure for shaft brake	O
OfFlt	MV	Offline filter contamination	O
InlFlt	MV	Inline filter contamination	O

6.2.4 Wind turbine generator information (WGEN)

This logical node shall comprise the data classes that represent wind turbine generator information. This logical node shall be mandatory, which means that at least all mandatory defined data classes in Table 10 shall be available for compliance with the IEC 61400-25 series.

The data classes focus on the operation of a variable speed double fed induction generator or on a (dc-excited) synchronous generator.

If a different topology is applied (for example constant speed, two speed, multi-pole, permanent magnet rotor, multi-phase generator) or more sensors (temperature, current, air-gap distances) are used for monitoring purposes, the user is free to assign relevant generator information to additional data names.

In case two generators (low speed, high speed) are installed in a wind turbine, it is recommended to use two logical nodes: WGEN1, WGEN2.

Table 10 – LN: Wind turbine generator information (WGEN)

WGEN class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
OpTmRs	TMS	Generator operation time	O
Status information			
GnOpMod	STV	Operation mode of generator	O
ClSt	STV	Status of generator cooling system	O
Analogue information			
Spd	MV	Generator speed	M
W	WYE	Generator active power	O
VAr	WYE	Generator reactive power	O
GnTmpSta	MV	Temperature measurements for generator stator	O
GnTmpRtr	MV	Temperature measurements for generator rotor	O
GnTmpInlet	MV	Temperature measurement for inlet air/water temperature at generator	O
StaPPV	DEL	Generator stator 3 phase phase-to-phase voltage	O
StaPhV	WYE	Generator stator 3 phase phase-to-ground voltage	O
StaA	WYE	Generator stator 3 phase current	O
RtrPPV	DEL	Generator rotor 3 phase phase-to-phase voltage	O
RtrPhV	WYE	Generator rotor 3 phase-to-ground voltage	O
RtrA	WYE	Generator rotor 3 phase current	O
RtrExtDC	MV	Generator rotor dc excitation	O
RtrExtAC	MV	Generator rotor ac excitation	O

6.2.5 Wind turbine converter information (WCNV)

This logical node shall comprise the data classes that represent the wind turbine converter information. This logical node shall be optional, but if used, the mandatory defined data classes in Table 11 shall be available for compliance with the IEC 61400-25 series.

The data names listed in Table 11 are focussed on a back-to-back converter (AC-DC-AC) for variable speed operation of a (rotor-fed) induction generator or a synchronous generator.

If other converting topologies are used (for example soft-starter for constant speed generator, d.c. rotor excitation) or more equipment mounted for monitoring (for example sensors for temperature, current, voltage), the user is free to add or modify extra data names.

In case of two (parallel) converters, it is recommended to use two logical nodes: WCNV1, WCNV2.

Table 11 – LN: Wind turbine converter information (WCNV)

WCNV class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
OpTmRs	TMS	Converter operation hours	O
Status information			
CnvOpMod	STV	Operation mode of converter	M
ClSt	STV	Status of converter cooling system	O
Analogue information			
Hz	MV	Frequency value	O
Torq	MV	Torque value	O
GnPPV	DEL	Generator side 3 phase phase-to-phase voltage	O
GnPhV	WYE	Generator side 3 phase-to-ground voltage	O
GnA	WYE	Generator side 3 phase current	O
GnPF	WYE	Generator side 3 phase power factor	O
GriPPV	DEL	Grid side 3 phase phase-to-phase voltage	O
GriPhV	WYE	Grid side 3 phase-to-ground voltage	O
GriA	WYE	Grid side 3 phase current	O
GriPF	WYE	Grid side 3 phase power factor	O
CnvTmpGn	MV	Converter - Generator side temperature	O
CnvTmpDclink	MV	Temperature inside the converter	O
CnvTmpGri	MV	Converter - Grid side temperature	O
DclVol	MV	DC-link voltage inside converter	O
DclAmp	MV	DC-link current inside converter	O

6.2.6 Wind turbine transformer information (WTRF)

This logical node shall comprise the data classes that represent the wind turbine transformer information. This logical node shall be optional, but if used, the mandatory defined data classes in Table 12 shall be available for compliance with the IEC 61400-25 series.

Table 12 – LN: Wind turbine transformer information (WTRF)

WTRF class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
TrfOpTmRs	TMS	Transformer operation time (vendor specific)	O
Status information			
TrfClSt	STV	Status of transformer cooling system	O
OilLevSt	STV	Oil level information for oil filled transformers.	O
MTPresSt	STV	Gas pressure of main tank for oil filled transformers.	O
Analogue information			
TrfTurPPV	DEL	Transformer turbine side 3 phase phase-to-phase voltage	O
TrfTurPhV	WYE	Transformer turbine side 3 phase-to-ground voltage	O
TrfTurA	WYE	Transformer turbine side 3 phase current	O
TrfGriPPV	DEL	Transformer grid side 3 phase phase-to-phase voltage	O
TrfGriPhV	WYE	Transformer grid side 3 phase-to-ground voltage	O
TrfGriA	WYE	Transformer grid side 3 phase current	O
TrfTmpTrfTur	MV	Transformer temperature on turbine side	O
TrfTmpTrfGri	MV	Transformer temperature on grid side	O
Control information			
AtvGriSw	CMD	Activation command to main grid switch	O

6.2.7 Wind turbine nacelle information (WNAC)

This logical node shall comprise the data classes that represent information concerning the wind turbine nacelle. Table 13 shows the data classes for common equipment in or at the nacelle: vibration measurements and beacon equipment. This logical node is mandatory and at least the mandatory defined data classes in Table 13 shall be available for compliance with the IEC 61400-25 series.

Table 13 – LN: Wind turbine nacelle information (WNAC)

WNAC class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
BecTmRs	TMS	Operation hours of beacon	O
Status information			
BecBulbSt	STV	Status of beacon	O
WdHtSt	STV	Status of heater for wind sensor.	O
IceSt	STV	Status of ice detection	O
AneSt	STV	Status of primary anemometer /secondary anemometer.	O
Analogue information			
Dir	MV	Nacelle orientation	O
WdSpd	MV	Wind speed outside nacelle	O
WdDir	MV	Wind direction outside nacelle	O
ExTmp	MV	Temperature outside nacelle	M
IntlTmp	MV	Temperature inside nacelle	O
IntlHum	MV	Humidity inside nacelle	O
BecLumLev	MV	Value of luminosity level of beacon	O
Vis	MV	Visibility outside nacelle	O
Ice	MV	Thickness of ice	O
DispXdir	MV	Tower displacement (longitudinal direction)	O
DispYdir	MV	Tower displacement (lateral direction)	O
Control information			
SetBecMod	CMD	Set modus of beacon	O
SetBecLev	SPV	Set bulb light level of beacon	O
SetFlsh	SPV	Set value of flash duty cycle of beacon	O

6.2.8 Wind turbine yawing information (WYAW)

This logical node shall comprise the data classes that represent the wind turbine yawing information. This logical node shall be mandatory, which means that at least all mandatory defined data classes in Table 14 shall be available for compliance with the IEC 61400-25 series.

The listed data classes of Table 14 focus on hydraulically or electrically driven nacelle yawing and cable wind up detection.

If different equipment is installed (for example multiple drives or hydraulic cylinders, speed controllers), the user is free to assign relevant generator information to additional data names.

Table 14 – LN: Wind turbine yawing information (WYAW)

WYAW class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
CwTm	TMS	Clockwise yawing operation hours	O
CcwTm	TMS	Counter clockwise yawing operation hours	O
Status information			
YwSt	STV	Mode of yaw system	O
YwBrakeSt	STV	Mode of the yaw brake	O
Analogue information			
YwSpd	MV	Yawing speed	O
Tmp	MV	Yawing motor/gear temperature	O
YawAng	MV	Yaw bearing rotation angle relative to nominal true North	M
CabWup	MV	Cable windup	M
SysGsLev	MV	Grease level for lubrication of yaw system	O
BrkPres	MV	Yaw brake pressure	O
Control information			
AtvYw	CMD	Command to yaw	O

6.2.9 Wind turbine tower information (WTOW)

This logical node shall comprise the data classes that represent information concerning the wind turbine tower structure. Table 15 shows the data classes for common equipment related to the tower. This logical node shall be optional; but when used, at least the mandatory defined data classes shall be available for compliance with the IEC 61400-25 series.

Table 15 – LN: Wind turbine tower information (WTOW)

WTOW class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
LiftSt	STV	Status of lift system	O
DehumSt	STV	Status of de-humidifier	O
HtexSt	STV	Status of heat-exchanger	O
Analogue information			
LiftPos	MV	Lift position	O
IntlHum	MV	Humidity inside tower	O

6.2.10 Wind power plant meteorological information (WMET)

This logical node shall comprise the data classes that represent meteorological information.

The data classes as shown in Table 16 focus on met station meteorological information.

If meteorological equipment has been installed at more than one altitude at a Met Station, this logical node can be extended by additional groups MetAlt2, MetAlt3, etc.

If additional or divergent measurement equipment (for example ice growth, rainfall, wave elevation, lightning) have been installed, this logical node can be extended by additional data names.

In case of different met stations, it is recommended to use more logical nodes: WMET1, WMET2 etc.

Table 16 – LN: Wind power plant meteorological information (WMET)

WMET class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Analogue information			
MetAlt1Alt	MV	Meteorological altitude 1 - Sensor altitude	O
MetAlt1HorWdSpd	MV	Meteorological altitude 1 - Horizontal wind speed	O
MetAlt1VerWdSpd	MV	Meteorological altitude 1 - Vertical wind speed	O
MetAlt1HorWdDir	MV	Meteorological altitude 1 - Horizontal wind direction	O
MetAlt1VerWdDir	MV	Meteorological altitude 1 - Vertical wind direction	O
MetAlt1Tmp	MV	Meteorological altitude 1 - Temperature	O
MetAlt1Hum	MV	Meteorological altitude 1 - Humidity	O
MetAlt1Pres	MV	Meteorological altitude 1 - Pressure	O

6.2.11 Wind power plant alarm information (WALM)

This logical node shall comprise the data classes that represent alarm information of a wind power plant. This logical node shall be mandatory, which means that at least all mandatory defined data classes in Table 17 shall be available for compliance with the IEC 61400-25 series.

If discrimination between alarm groups, alarm levels, warnings, events is favourable, the logical node WALM can be differentiated into several alarm logical nodes: WALM1, WALM2, etc.

Only data of the type ASS can be used for a dedicated application of LN WALM.

Table 17 – LN: Wind power plant alarm information (WALM)

WALM class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
AlmSt	ASS	Alarm set status	O
EvtTm	TMS	Timestamp for oldest active alarm	O

6.2.12 Wind turbine state log information (WSLG)

This logical node shall comprise the data classes that represent all logged historical data attributes of state information. This logical node class shall be defined as shown in Table 18.

The logs for status DATA shall comprise the DATA classes that represent all logged historical data attributes of status information. This logical node class shall be optional, but if used, at least all mandatory defined DATA and DATA-SET classes in Table 18 shall be available for compliance with the IEC 61400-25 series.

The DATA in the log can be fixed and determined by the manufacturer or changeable and controllable by the client. The user is free to split up logged information in different logs.

The LOG classes for status DATA shall be as defined in Table 18. The corresponding DATA-SETs shall reference all DATA classes as defined in the column "Explanation".

Table 18 – LN: Wind turbine state log information (WSLG)

WSLG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Data Sets (see Note)			
TurCmLog		Data set of all logged (historical) turbine commands. The following DATA-ATTRIBUTES of DATA instances derived from common data class CMD of all logical nodes of a logical device shall be logged: ActSt[CO] ActSt[ST]	O
TurStLog		Data set of all logged (historical) turbine status The following DATA-ATTRIBUTES of DATA instances derived from common data class STV of all logical nodes of a logical device shall be logged: ActSt[ST] (all the elements included in) datSetMx	O

WSLG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
HiUrgAlm		Data set of all high urgent alarms The following DATA-ATTRIBUTES of DATA instances derived from common data class ALM of all logical nodes of a logical device shall be logged: AlmAck[CO] ActSt[ST] (all the elements included in) datSetMx (all the elements included in) datSetSt	O
LoUrgAlm		Data set of all low urgent alarms The following DATA-ATTRIBUTES of DATA instances derived from common data class ALM of all logical nodes of a logical device shall be logged: AlmAck[CO] actSt[ST] (all the elements included in) datSetMx (all the elements included in) datSetSt	O
TurCtLog		Data set of all counting information The following DATA-ATTRIBUTES of DATA instances derived from common data class CTE of all logical nodes of a logical device shall be logged: actCtVal[ST] ctTot dly mly yly	O
TurTmLog		Data set of all event timing information The following DATA-ATTRIBUTES of DATA instances derived from common data class TMS of all logical nodes of a logical device shall be logged: actTmVal[ST] tmTot dly mly yly	O
LOGs (see Note)			
TurCmLog		The log for command DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical analogue information specified by the TurCmLog DATA-SET.	O
TurStLog		The log for status DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical status information specified by the TurStLog DATA-SET.	O
HiUrgAlm		The log for alarm DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical alarm information specified by the HiUrgAlm DATA-SET.	O
LoUrgAlm		The log for alarm DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical alarm information specified by the LoUrgAlm DATA-SET.	O
TurCtLog		The log for event counting DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical status information specified by the TurCtLog DATA-SET.	O
TurTmLog		The log for timing DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical status information specified by the TurTmLOg DATA-SET.	O
Log Control Blocks (see Note)			

WSLG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
TurCmLog			O
TurStLog			O
HiUrgAlm			O
LoUrgAlm			O
TurCtLog			O
TurTmLog			O
NOTE The model of Logs and Log Control Blocks is described in 14.1 and 14.3 of IEC 61850-7-2 and Data Sets in Clause 11. This note gives a brief introduction to the concept. The data to be logged are referenced by a data set. The log is the place where the individual log entries (the data values provided at a certain event) are stored in time sequence order. The query log services allow retrieving the log entries later on. The query has parameters like start time and stop time and a filter. The association between the data set and the log is build by the log control block that "links" the data values to the log. The log control block can be enabled/disabled to control the stream into a log. By defining standardised names for data sets, logs, and log control blocks a high degree of standardised semantic is provided. The data set name "TurCmLog" gives a precise indication of what is meant: Data set of all logged (historical) turbine commands.			

6.2.13 Wind turbine analogue log information (WALG)

This logical node shall comprise the data classes that represent all logged historical data attributes of analogue information. This logical node class shall be defined as shown in Table 19.

The logs for analogue DATA shall comprise the DATA classes that represent all logged historical data attributes of analogue information. This logical node class shall be optional, but if used, at least all mandatory defined DATA and DATA-SET classes in Table 19 shall be available for compliance with the IEC 61400-25 series.

The DATA in the log can be fixed and determined by the manufacturer or changeable and controllable by the client. It's free for the user to split up logged information in different logs.

The LOG classes for analogue DATA shall be as defined in Table 19. The corresponding DATA-SETs shall reference all DATA classes as defined in the column "Explanation".

Table 19 – LN: Wind turbine analogue log information (WALG)

WALG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Data Sets			
TurAnLog		Data set of all logged (historical) turbine analogue time series The following DATA-ATTRIBUTES of DATA instances derived from common data class MV of all logical nodes of a logical device shall be logged: mag range q	O
TurPhLog		Data set of all logged (historical) turbine three phase time series The following DATA-ATTRIBUTES of DATA instances derived from common data class WYE of all logical nodes of a logical device shall be logged: cVal range q	O

WALG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
HiAcsSp		Data set of all logged (historical) turbine set points. High access protected. The following DATA-ATTRIBUTES of DATA instances derived from common data class SPV of all logical nodes of a logical device shall be logged: actVal[CO] actVal[ST] incRate decRate minVal maxVal	O
LoAcsSp		Data set of all logged (historical) turbine set points. Low access protected. The following DATA-ATTRIBUTES of DATA instances derived from common data class SPV of all logical nodes of a logical device shall be logged: actVal[CO] actVal[ST] incRate decRate minVal maxVal	O
TrgEmgStop		Data set of all transient log triggered at emergency shut down The following DATA-ATTRIBUTES of DATA instances derived from common data class MV of all logical nodes of a logical device shall be logged: mag range q The following DATA-ATTRIBUTES of DATA instances derived from common data class SPV (setpoint) of all logical nodes of a logical device shall be logged: actVal[CO] actVal[MX] incRate decRate minVal maxVal The following DATA-ATTRIBUTES of DATA instances derived from common data class STV (status) of all logical nodes of a logical device shall be logged: actSt[ST] (all the elements included in) datSetMx The following DATA-ATTRIBUTES of DATA instances derived from common data class ALM (alarm) of all logical nodes of a logical device shall be logged: almAck[CO] actSt[ST] (all the elements included in) datSetMx (all the elements included in) datSetSt The following DATA-ATTRIBUTES of DATA instances derived from common data class CMD (command) of all logical nodes of a logical device shall be logged: actSt[CO] actSt[ST]	O

WALG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
TrgProdGri		Data set of all transient turbine loggings. Transient log triggered at grid connection The following DATA-ATTRIBUTES of DATA instances derived from common data class MV of all logical nodes of a logical device shall be logged: mag range q The following DATA-ATTRIBUTES of DATA instances derived from common data class SPV (setpoint) of all logical nodes of a logical device shall be logged: actVal[CO] actVal[MX] incRate decRate minVal maxVal The following DATA-ATTRIBUTES of DATA instances derived from common data class STV (status) of all logical nodes of a logical device shall be logged: actSt[ST] (all the elements included in) datSetMx The following DATA-ATTRIBUTES of DATA instances derived from common data class ALM (alarm) of all logical nodes of a logical device shall be logged: almAck[CO] actSt[ST] (all the elements included in) datSetMx (all the elements included in) datSetSt The following DATA-ATTRIBUTES of DATA instances derived from common data class CMD (command) of all logical nodes of a logical device shall be logged: actSt[ST]	O
LOGs			
TurAnLog		The log for analogue DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical analogue information specified by the TurAnLog DATA-SET.	M
TurPhLog		The log for three phase DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical three phase information specified by the TurPhLog DATA-SET.	O
HiAcsSp		The log for setpoint DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical setpoint information specified by the HiAcsSp DATA-SET.	O
LoAcsSp		The log for setpoint DATA shall comprise DATA-ATTRIBUTE values that represent a chronological list of a group of historical setpoint information specified by the LoAcsSp DATA-SET.	O
TrgEmgStop		The log for transient DATA shall comprise DATA-ATTRIBUTE values that represent a high-resolution time synchronised list of a group of historical information of different categories with a common time reference specified by the TrgEmgStop DATA-SET.	O
TrgProdGri		The log for transient DATA shall comprise DATA-ATTRIBUTE values that represent a high-resolution time synchronised list of a group of historical information of different categories with a common time reference specified by the TrgProdGri DATA-SET.	O
Log Control Blocks			
TurAnLog			M
TurPhLog			O
HiAcsSp			O
LoAcsSp			O
TrgEmgStop			O

WALG class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
TrgProdGri			O

6.2.14 Wind turbine report information (WREP)

This logical node shall comprise the DATA that represent periodical stored information containing statistical values of analogue DATA, counted events and time duration of states. This logical node shall be optional, but if used, at least all mandatory defined DATA and DATA-SET classes in Table 20 shall be available for compliance with the IEC 61400-25 series.

The DATA-SETs representing these DATA shall be as shown in Table 20.

Table 20 – LN: Wind turbine report information (WREP)

WREP class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Data Sets			
TurRpCh		Turbine report analogue characteristics The following DATA-ATTRIBUTES of DATA instances derived from common data class MV of all logical nodes of a logical device shall be reported: mag values from corresponding historical LNs	O
TurRpTm		Turbine report time durations The following DATA-ATTRIBUTES of DATA instances derived from common data class TMS of all logical nodes of a logical device shall be reported: dly values from corresponding statistics LNs mly values from corresponding statistics LNs yly values from corresponding statistics LNs tot values from corresponding statistics LNs	O
TurRpCt		Turbine report event counts The following DATA-ATTRIBUTES of DATA instances derived from common data class CTE of all logical nodes of a logical device shall be reported: dly values from corresponding statistics LNs mly values from corresponding statistics LNs yly values from corresponding statistics LNs tot values from corresponding statistics LNs	O

6.2.15 Wind power plant active power control (WAPC)

This logical node shall comprise the data classes that represent information concerning wind power plant active power control. This logical node shall be optional; but when used, at least the mandatory defined data classes shall be available for compliance with the IEC 61400-25 series. Table 21 represents and visualises the different data class attributes in the WAPC logical node.

Table 21 – LN: Wind power plant active power control information (WAPC)

WAPC class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
NumOpTur	INS	Actual number of wind turbines in operation	O
PlWLimEn	STV	Active Power Limitation Mode Enabled	O
PlVAEn	STV	Active Power Control Mode Enabled controlling apparent power	O
PlGraEn	STV	Gradient Function Enabled	O
PlDelEn	STV	Delta Function Enabled	O
Analogue information			
PlWCap	MV	Wind Power Plant active power output capability	O
PlW	MV	Wind Power Plant active power output	M
PlVA	MV	Wind Power Plant apparent power	O
PlGra	MV	Wind Power Plant Gradient	O
PlWDel	MV	Wind Power Plant active power reserve utilizing the Delta function – the difference between active power generation capability and active power generated	O
Control information			
PlWAtv	CMD	Activate active power control function	O
PlVAAtv	CMD	Activate apparent power control function	O
PlGraAtv	CMD	Activate gradient control function	O
PlDelAtv	CMD	Activate delta control function	O
SetPlW	SPV	Set reference value for the wind power plant active power output	M
SetPlVA	SPV	Set reference value for the wind power plant apparent power output	O
SetPlWUpGra	SPV	Set reference value for gradient ramping up the wind power plant active power output	O
SetPlWDoGra	SPV	Set reference value for gradient ramping down the wind power plant active power output	O
SetPlDel	SPV	Set reference value for the wind power plant active power reserve – also named as "spinning reserve"	O

6.2.16 Wind power plant reactive power control (WRPC)

This logical node shall comprise the data classes that represent information concerning wind power plant reactive power control. This logical node shall be optional; but when used at least the mandatory defined data classes shall be available for compliance with the IEC 61400-25 series. Table 22 represents and visualises the different data class attributes in the WRPC logical node. All aspects concerning reactive power are following the generator convention. Positive values imply increase of voltage and production of reactive power. Negative values imply decrease of voltage and consumption of reactive power.

Table 22 – LN: Wind power plant reactive power control information (WRPC)

WRPC class			
Attribute name	**Attribute type**	**Explanation**	**M/O**
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
Common information			
Status information			
NumOpTur	INS	Actual number of wind turbines in operation	O
PlVArMode	STV	Reactive power control mode	O
Analogue information			
PlVAr	MV	Wind power plant reactive power output	O
PlVArCapImp	MV	Wind power plant reactive power import (demand) capability	O
PlVArCapExp	MV	Wind power plant reactive power export (supply) capability	O
PlPF	MV	Wind Power Plant actual Power Factor	O
PlV	MV	Wind Power Plant output voltage at the external grid connection point	O
Control information			
PlVArAtv	CMD	Activate reactive power control function	O
SetPlVAr	SPV	Set reference value of wind power plant reactive power output	O
SetPlVArUpGra	SPV	Set reference value for gradient for ramping up the wind power plant reactive power output	O
SetPlVArDoGra	SPV	Set reference value for gradient for ramping down the wind power plant reactive power output	O
SetPlV	SPV	Set reference value for wind power plant voltage output	O
SetPlVUpGra	SPV	Set reference value for wind power plant voltage ramping up	O
SetPlVDoGra	SPV	Set reference value for wind power plant voltage ramping down	O
SetPlDrp	SPV	Set reference value for slope of voltage control droop	O
SetPlPF	SPV	Set reference value for wind power plant power factor – negative: consuming reactive power; positive: producing reactive power	O

6.3 Data name semantic

The wind power plant specific data classes given in subclause 6.2 are listed in Table 23. Data class names are built as mnemonics and based consistently on abbreviations of Clause 4. Extensions of data names shall comply with conventions as described in Annex A of IEC 61850-7-4.

The length of a DataName is not constrained by the IEC 61400-25 series as it is in Clause 19 of IEC 61850-7-2. The limit will be the length of the ObjectReference with all its diffent levels in the hierarchy.

If a data in a logical node class is optional, then all status values are optional.

Table 23 – Data name semantic

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>AlmSt</td><td>Alarm set status. It contains information about the actual status value of a set of the alarms included in a WALM logical node</td></tr>
<tr><td>Alt</td><td>Altitude</td></tr>
<tr><td>AMx</td><td>Current measurements</td></tr>
<tr><td>AneSt</td><td>Status of primary anemometer /secondary anemometer:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Auto</td><td>1</td><td>Anemometers in Auto mode</td></tr>
<tr><td>Ane1</td><td>2</td><td>Primary anemometer in operation</td></tr>
<tr><td>Ane2</td><td>3</td><td>Secondary anemometer in operation</td></tr>
<tr><td>Off</td><td>4</td><td>Anemometers in Off</td></tr>
<tr><td>Flt</td><td>5</td><td>Anemometers faulty</td></tr>
</table></td></tr>
<tr><td>AtvGriSw</td><td>Activation command to main grid switch:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Operate switch to On</td></tr>
<tr><td>Off</td><td>2</td><td>Operate switch to Off</td></tr>
<tr><td>Auto</td><td>3</td><td>Operate switch to Auto mode</td></tr>
</table></td></tr>
<tr><td>AtvYw</td><td>Command to yaw:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Cw</td><td>1</td><td>Operate yaw to clock wise</td></tr>
<tr><td>Off</td><td>2</td><td>Operate yaw to Off</td></tr>
<tr><td>Ccw</td><td>3</td><td>Operate yaw to counter clock wise</td></tr>
<tr><td>Auto</td><td>4</td><td>Operate yaw to Auto mode</td></tr>
</table></td></tr>
<tr><td>AvlTmRs</td><td>Availability time. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.</td></tr>
<tr><td>BecBulbSt</td><td>Status of beacon:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Auto</td><td>1</td><td>Beacon in Auto mode</td></tr>
<tr><td>Bulb1</td><td>2</td><td>Beacon at bulb1</td></tr>
<tr><td>Bulb2</td><td>3</td><td>Beacon at bulb2</td></tr>
<tr><td>Off</td><td>4</td><td>Beacon in Off</td></tr>
<tr><td>Flt</td><td>5</td><td>Beacon is faulty</td></tr>
</table></td></tr>
<tr><td>BecLumLev</td><td>Value of luminosity level of beacon</td></tr>
<tr><td>BecTmRs</td><td>Operation time of beacon</td></tr>
<tr><td>Beh</td><td>Behaviour (defined in Clause 6 of IEC 61850-7-4)</td></tr>
<tr><td>BlkRot</td><td>Set rotor to blocked position:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Block rotor position</td></tr>
<tr><td>Off</td><td>2</td><td>Unblock rotor position</td></tr>
<tr><td>Auto</td><td>3</td><td>Automatic control of rotor position</td></tr>
</table></td></tr>
<tr><td>BlSt</td><td>Status of blades:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Blk</td><td>1</td><td>Blade is blocked</td></tr>
<tr><td>Stop</td><td>2</td><td>Blade is stopped</td></tr>
<tr><td>Pt</td><td>3</td><td>Blade is pitching</td></tr>
</table></td></tr>
<tr><td>BrkHyPres</td><td>Hydraulic pressure for shaft brake</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>BrkOpMod</td><td>Status of shaft brake:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Brk</td><td>1</td><td>Shaft has stopped by brake</td></tr>
<tr><td>Rdy</td><td>2</td><td>Brake is ready</td></tr>
<tr><td>OvHt</td><td>3</td><td>Brake disk is overheated</td></tr>
<tr><td>Flt</td><td>4</td><td>Brake system is faulty</td></tr>
</table></td></tr>
<tr><td>CabWup</td><td>Cable windup. Number of windings from calibration point.</td></tr>
<tr><td>CalcExp</td><td>See Table A.1.</td></tr>
<tr><td>CalcMthd</td><td>See Table A.1.</td></tr>
<tr><td>CalcPer</td><td>See Table A.1.</td></tr>
<tr><td>CalcSrc</td><td>See Table A.1.</td></tr>
<tr><td>CalcStr</td><td>See Table A.1.</td></tr>
<tr><td>CcwTm</td><td>Counter clockwise yawing operation time</td></tr>
<tr><td>ClSt</td><td>Status of cooling system:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Inact</td><td>1</td><td>Cooling system is inactive</td></tr>
<tr><td>Actv</td><td>2</td><td>Cooling system is active</td></tr>
<tr><td>Flt</td><td>3</td><td>Cooling system is faulted</td></tr>
</table></td></tr>
<tr><td>CnvOpMod</td><td>Operation mode of converter:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Chrg</td><td>1</td><td>Converter is currently charging</td></tr>
<tr><td>Rdy</td><td>2</td><td>Converter is ready</td></tr>
<tr><td>Run</td><td>3</td><td>Converter is running</td></tr>
<tr><td>Flt</td><td>4</td><td>Converter is faulted</td></tr>
</table></td></tr>
<tr><td>CnvTmpGn</td><td>Converter - generator side temperature</td></tr>
<tr><td>CnvTmpDclink</td><td>Temperature inside the converter</td></tr>
<tr><td>CnvTmpGri</td><td>Converter - grid side temperature</td></tr>
<tr><td>CwTm</td><td>Clockwise yawing operation time</td></tr>
<tr><td>DclAmp</td><td>DC-link current inside converter</td></tr>
<tr><td>DclVol</td><td>DC-link voltage inside converter</td></tr>
<tr><td>DehumSt</td><td>Status of de-humidifier:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>De-humidifier is on</td></tr>
<tr><td>Off</td><td>2</td><td>De-humidifier off</td></tr>
<tr><td>Flt</td><td>3</td><td>De-humidifier in faulty condition</td></tr>
</table></td></tr>
<tr><td>Dir</td><td>Nacelle orientation</td></tr>
<tr><td>DispXdir</td><td>Nacelle displacement (longitudinal direction)</td></tr>
<tr><td>DispYdir</td><td>Nacelle displacement (lateral direction)</td></tr>
<tr><td>DmdPF</td><td>Power factor setpoint</td></tr>
<tr><td>DmdVAr</td><td>Reactive power generation setpoint</td></tr>
<tr><td>DmdVArh</td><td>Reactive energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)</td></tr>
<tr><td>DmdW</td><td>Active power generation setpoint</td></tr>
<tr><td>DmdWh</td><td>Active (real) energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)</td></tr>
<tr><td>Drv</td><td>Drive</td></tr>
<tr><td>Drv</td><td>Yawing drives</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>EmgStop</td><td>Emergency stop</td></tr>
<tr><td>EvtCt</td><td>Number of active events</td></tr>
<tr><td>EvtId</td><td>Event Id</td></tr>
<tr><td>EvtSev</td><td>Event severity</td></tr>
<tr><td>EvtSt</td><td>Event status (active/inactive)</td></tr>
<tr><td>EvtTm</td><td>Timestamp for oldest active event</td></tr>
<tr><td>ExTmp</td><td>Temperature outside nacelle</td></tr>
<tr><td>FtrSt</td><td>Status of filtration system:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Inact</td><td>1</td><td>Filtration system is inactive</td></tr>
<tr><td>Actv</td><td>2</td><td>Filtration system is active</td></tr>
<tr><td>Flt</td><td>3</td><td>Filtration system is faulted</td></tr>
</table></td></tr>
<tr><td>Gbx</td><td>Gearbox</td></tr>
<tr><td>GbxOil</td><td>Gearbox oil</td></tr>
<tr><td>GbxOilLev</td><td>Oil level in gearbox sump</td></tr>
<tr><td>Gn</td><td>Converter generator side</td></tr>
<tr><td>GnA</td><td>Generator side 3 phase current</td></tr>
<tr><td>GnPF</td><td>Generator side 3 phase power factor</td></tr>
<tr><td>GnPhV</td><td>Generator side 3 phase-to-ground voltage</td></tr>
<tr><td>GnPPV</td><td>Generator side 3 phase phase-to-phase voltage</td></tr>
<tr><td>GnClSt</td><td>Status of generator cooling system:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Cl</td><td>1</td><td>Cooling in operation</td></tr>
<tr><td>Stdby</td><td>2</td><td>Cooling in standby</td></tr>
<tr><td>Off</td><td>3</td><td>Cooling off</td></tr>
<tr><td>Flt</td><td>4</td><td>Cooling in faulty condition</td></tr>
</table></td></tr>
<tr><td>GnHz</td><td>Frequency value for generator</td></tr>
<tr><td>GnOpMod</td><td>Operation mode of generator:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Ht</td><td>1</td><td>Generator in operation</td></tr>
<tr><td>Run</td><td>2</td><td>Generator running</td></tr>
<tr><td>Rdy</td><td>3</td><td>Generator ready</td></tr>
<tr><td>Flt</td><td>4</td><td>Generator in faulty condition</td></tr>
</table></td></tr>
<tr><td>GnRtr</td><td>Generator rotor</td></tr>
<tr><td>GnRtrExt</td><td>Generator rotor excitation</td></tr>
<tr><td>GnTmp</td><td>Generator temperature measurements</td></tr>
<tr><td>GnTmpInlet</td><td>Temperature measurement for inlet air/water temperature at generator</td></tr>
<tr><td>GnTmpRtr</td><td>Temperature measurement for generator rotor</td></tr>
<tr><td>GnTmpSta</td><td>Temperature measurement for generator stator</td></tr>
<tr><td>GnTrq</td><td>Torque value for generator</td></tr>
<tr><td>GriA</td><td>Grid side 3 phase current</td></tr>
<tr><td>GriPF</td><td>Grid side 3 phase power factor</td></tr>
<tr><td>GriPhV</td><td>Grid side 3 phase-to-ground voltage</td></tr>
<tr><td>GriPPV</td><td>Grid side 3 phase phase-to-phase voltage</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>GsLev</td><td>Grease level for lubrication of main shaft bearing</td></tr>
<tr><td>Health</td><td>Health (defined in Clause 6 of IEC 61850-7-4).
Reflects the state of the logical node related hardware and software</td></tr>
<tr><td>HiAcsSp</td><td>High access protected set points</td></tr>
<tr><td>HiUrgAlm</td><td>High urgent alarms</td></tr>
<tr><td>HorWdDir</td><td>Horizontal wind direction</td></tr>
<tr><td>HorWdSpd</td><td>Horizontal wind speed</td></tr>
<tr><td>HtexSt</td><td>Status of heat-exchanger:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Heat-exchanger is on</td></tr>
<tr><td>Off</td><td>2</td><td>Heat-exchanger off</td></tr>
<tr><td>Flt</td><td>3</td><td>Heat-exchanger in faulty condition</td></tr>
</table></td></tr>
<tr><td>HtSt</td><td>Status of heating system:
<table>
<tr><th>value</th><th>numeric value1</th><th>semantic</th></tr>
<tr><td>Inact</td><td>1</td><td>Transmission heating system is inactive</td></tr>
<tr><td>Actv</td><td>2</td><td>Transmission heating system is active</td></tr>
<tr><td>Flt</td><td>3</td><td>Transmission heating system is faulted</td></tr>
</table></td></tr>
<tr><td>HubTmp</td><td>Temperature in the rotor hub</td></tr>
<tr><td>Hum</td><td>Humidity value</td></tr>
<tr><td>HyPmp</td><td>Hydraulic pump for yawing system</td></tr>
<tr><td>HyPres</td><td>Hydraulic pressure of yaw system</td></tr>
<tr><td>Hz</td><td>Frequency value</td></tr>
<tr><td>Ice</td><td>Thickness of ice</td></tr>
<tr><td>IceSt</td><td>Status of ice detection:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Ice detection is on</td></tr>
<tr><td>Off</td><td>2</td><td>Ice detection is off</td></tr>
<tr><td>Flt</td><td>3</td><td>Ice detection is faulty</td></tr>
</table></td></tr>
<tr><td>InletTmp</td><td>Inlet air temperature at generator</td></tr>
<tr><td>InlFlt</td><td>Inline filter contamination</td></tr>
<tr><td>InlFltSt</td><td>Status of inline filter contamination:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>HiHi</td><td>1</td><td>Filter contamination above high-high level</td></tr>
<tr><td>Hi</td><td>2</td><td>Filter contamination above high level</td></tr>
<tr><td>Nor</td><td>3</td><td>Filter contamination is normal</td></tr>
<tr><td>Lo</td><td>4</td><td>Filter contamination below low level</td></tr>
<tr><td>LoLo</td><td>5</td><td>Filter contamination below low-low level</td></tr>
<tr><td>OutRng</td><td>6</td><td>Filter contamination value out of range</td></tr>
</table></td></tr>
<tr><td>InOv</td><td>Input communications buffer overflow. This Data shall indicate that a buffer overflow occurred for the input buffer and important service requests may be lost (TRUE) in the communication. Clients should take appropriate actions as required by their applications.</td></tr>
<tr><td>IntlHum</td><td>Humidity inside component</td></tr>
<tr><td>IntlTmp</td><td>Temperature inside nacelle</td></tr>
<tr><td>LiftPos</td><td>Lift position</td></tr>
</table>

Data name	Wind power plant specific data name semantics
LiftSt	Status of lift system: **value** / **numeric value** / **semantic** Up / 1 / Lift is in Up position Dn / 2 / Lift is in Down position Off / 3 / Lift is in Off position Blk / 4 / Lift is blocked
LiftSt	Status of the lift: **value** / **numeric value** / **semantic** Ht / 1 / Lift in operation Run / 2 / Lift running Rdy / 3 / Lift ready Flt / 4 / Lift in faulty condition
LiftSt	Status of the lift: **value** / **numeric value** / **semantic** Ht / 1 / Lift in operation Run / 2 / Lift running Rdy / 3 / Lift ready Flt / 4 / Lift in faulty condition
LoAcsSP	Low access protected set points
LoUrgAlm	Low urgent alarms
LuSt	Status of gearbox lubrication system: **value** / **numeric value** / **semantic** Inact / 1 / Lubrication system is inactive Actv / 2 / Lubrication system is active Flt / 3 / Lubrication system is faulted
Mod	Mode (defined in Clause 6 of IEC 61850-7-4)
MetAlt1Alt	Meteorological altitude 1 - sensor altitude
MetAlt1HorWdSpd	Meteorological altitude 1 - horizontal wind speed
MetAlt1VerWdSpd	Meteorological altitude 1 - vertical wind speed
MetAlt1HorWdDir	Meteorological altitude 1 - horizontal wind direction
MetAlt1VerWdDir	Meteorological altitude 1 - vertical wind direction
MetAlt1Tmp	Meteorological altitude 1 - temperature
MetAlt1Hum	Meteorological altitude 1 - humidity
MetAlt1Pres	Meteorological altitude 1 - pressure
MTPresSt	Gas pressure of main tank for oil filled transformers: **value** / **numeric value** / **semantic** HiHi / 1 / Gas pressure above high-high level Hi / 2 / Gas pressure above high level Nor / 3 / Gas pressure is normal Lo / 4 / Gas pressure below low level LoLo / 5 / Gas pressure below low-low level OutRng / 6 / Gas pressure value out of range
NamPlt	Name plate of the logical node. In case of the LLNO the name plate represents the name plat information of the logical device.
NumEvt	Number of events
NumOpTur	Actual number of wind turbines in operation
NumPwrUp	Number of Power ups. The number of power up operations of the physical device since the last reset.
ObjId	Object reference

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>OfFlt</td><td>Offline filter contamination</td></tr>
<tr><td>OfFltSt</td><td>Status of offline filter contamination:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>HiHi</td><td>1</td><td>Filter contamination above high-high level</td></tr>
<tr><td>Hi</td><td>2</td><td>Filter contamination above high level</td></tr>
<tr><td>Nor</td><td>3</td><td>Filter contamination is normal</td></tr>
<tr><td>Lo</td><td>4</td><td>Filter contamination below low level</td></tr>
<tr><td>LoLo</td><td>5</td><td>Filter contamination below low-low level</td></tr>
<tr><td>OutRng</td><td>6</td><td>Filter contamination value out of range</td></tr>
</table></td></tr>
<tr><td>OilLev</td><td>Oil level information for oil filled transformers or gearboxes.</td></tr>
<tr><td>OilLevSt</td><td>Status of oil level:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>HiHi</td><td>1</td><td>Oil level above high-high level</td></tr>
<tr><td>Hi</td><td>2</td><td>Oil level above high level</td></tr>
<tr><td>Nor</td><td>3</td><td>Oil level is normal</td></tr>
<tr><td>Lo</td><td>4</td><td>Oil level below low level</td></tr>
<tr><td>LoLo</td><td>5</td><td>Oil level below low-low level</td></tr>
<tr><td>OutRng</td><td>6</td><td>Oil level value out of range</td></tr>
</table></td></tr>
<tr><td>OpTmRs</td><td>Operation time. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.</td></tr>
<tr><td>OutOv</td><td>Output communications buffer overflow. This Data shall indicate that a buffer overflow occurred for the output buffer of any communication message queue; an important annunciation may have been lost for the communication. A general interrogation is recommended or an integrity scan is started automatically to update the client's data base.</td></tr>
<tr><td>PFMx</td><td>Power factor measurements</td></tr>
<tr><td>PhyHealth</td><td>Physical device health represents the physical health information of the physical device in which the logical device resides. More detailed information related to the source of the problem may be provided by specific data.
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Ok</td><td>1</td><td>Ok ("green") – no problems, normal operation</td></tr>
<tr><td>Warning</td><td>2</td><td>Warning ("yellow") – minor problems, but in safe operation mode</td></tr>
<tr><td>Alarm</td><td>3</td><td>Alarm ("red") – severe problem, no operation possible</td></tr>
</table>
Health states 1 ("green") and 3 ("red") are unambiguous by definition. The detailed meaning of Health state 2 ("yellow") is a local issue depending from the dedicated function/device.</td></tr>
<tr><td>PhyNam</td><td>Physical device name plate represents the name plate information of the physical device in which the logical device resides.</td></tr>
<tr><td>PlDelAtv</td><td>Activate delta control function: ON | OFF</td></tr>
<tr><td>PlDelEn</td><td>Delta Function Enabled</td></tr>
<tr><td>PlGra</td><td>Wind Power Plant Gradient</td></tr>
<tr><td>PlGraAtv</td><td>Activate gradient control function: ON | OFF</td></tr>
<tr><td>PlGraEn</td><td>Gradient Function Enabled</td></tr>
<tr><td>PlPF</td><td>Wind power plant actual Power Factor</td></tr>
<tr><td>PlV</td><td>Wind power plant output voltage at the external grid connection point</td></tr>
<tr><td>PlVA</td><td>Wind Power Plant apparent power</td></tr>
<tr><td>PlVAAtv</td><td>Activate apparent power control function: ON | OFF</td></tr>
<tr><td>PlVAEn</td><td>Apparent Power Control Mode Enabled controlling apparent power</td></tr>
<tr><td>PlVAr</td><td>Wind power plant reactive power output</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>PlVArAtv</td><td>Activate reactive power control function: VAr ON | VOC ON | PF ON | OFF</td></tr>
<tr><td>PlVArCapExp</td><td>Wind power plant reactive power export (supply) capability</td></tr>
<tr><td>PlVArCapImp</td><td>Wind power plant reactive power import (demand) capability</td></tr>
<tr><td>PlVArMod</td><td>Reactive power control mode</td></tr>
<tr><td>PlW</td><td>Wind Power Plant active power output</td></tr>
<tr><td>PlWAtv</td><td>Activate active power control function: ON | OFF</td></tr>
<tr><td>PlWCap</td><td>Wind Power Plant active power output capability</td></tr>
<tr><td>PlWDel</td><td>Wind Power Plant active power reserve utilizing the Delta function – the difference between active power generation capability and active power generated</td></tr>
<tr><td>PlWLimEn</td><td>Active Power Limitation Mode Enabled</td></tr>
<tr><td>Pres</td><td>Pressure</td></tr>
<tr><td>Proxy</td><td>TRUE shall indicate that the LD is a proxy. A proxy is an aggregation of data from different logical nodes. A client can access the data both at the proxy or at the original location.</td></tr>
<tr><td>PtAngSpBl1</td><td>Pitch angle set points for blade 1 (reference)</td></tr>
<tr><td>PtAngSpBl2</td><td>Pitch angle set points for blade 2</td></tr>
<tr><td>PtAngSpBl3</td><td>Pitch angle set points for blade 3</td></tr>
<tr><td>PtAngValBl1</td><td>Pitch angle for blade 1 (reference)</td></tr>
<tr><td>PtAngValBl2</td><td>Pitch angle for blade 2</td></tr>
<tr><td>PtAngValBl3</td><td>Pitch angle for blade 3</td></tr>
<tr><td>PtCtlSt</td><td>Status of pitch control:<table><tr><th>value</th><th>numeric value</th><th>semantic</th></tr><tr><td>Op</td><td>1</td><td>Pitch is in operation</td></tr><tr><td>Flt</td><td>2</td><td>Pitch is faulty</td></tr></table></td></tr>
<tr><td>PtEmgChk</td><td>Command to check emergency pitch system:<table><tr><th>value</th><th>numeric value</th><th>semantic</th></tr><tr><td>On</td><td>1</td><td>Start to check</td></tr><tr><td>Off</td><td>2</td><td>Stop to check</td></tr></table>NOTE The result of the check – if it needs to be exposed – should be described.</td></tr>
<tr><td>PtHyPresBl1</td><td>Pressure of hydraulic pitch system for blade 1 (reference)</td></tr>
<tr><td>PtHyPresBl2</td><td>Pressure of hydraulic pitch system for blade 2</td></tr>
<tr><td>PtHyPresBl3</td><td>Pressure of hydraulic pitch system for blade 3</td></tr>
<tr><td>PwrDn</td><td>Power down detected. TRUE shall indicate that a device power down has been detected.</td></tr>
<tr><td>PwrSupAlm</td><td>Power supply alarm. TRUE shall indicate an alarm from power supply. It refers always to the local power supply of the IED modelled by LPHD and not to the health (EEHealth) of the complete external supply system.</td></tr>
<tr><td>PwrUp</td><td>Power up detected. TRUE shall indicate that a device power up has been detected.</td></tr>
<tr><td>RoofEnt</td><td>Hatch contact at turbine roof entry</td></tr>
<tr><td>RotPos</td><td>Angular rotor position</td></tr>
<tr><td>RotSpd</td><td>Value of rotor speed at rotor side</td></tr>
<tr><td>RotSt</td><td>Status of rotor:<table><tr><th>value</th><th>numeric value</th><th>semantic</th></tr><tr><td>Blk</td><td>1</td><td>Rotor is blocked</td></tr><tr><td>Stop</td><td>2</td><td>Rotor is stopped</td></tr><tr><td>Idl</td><td>3</td><td>Rotor is in idle</td></tr><tr><td>Run</td><td>4</td><td>Rotor is rotating</td></tr></table></td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>RsStat</td><td>Setting this value to TRUE shall reset all device statistics data of this LN, for example, the data NumPwrUp, WrmStr, WacTrg.</td></tr>
<tr><td>Rtr</td><td>Generator rotor electrical measurements</td></tr>
<tr><td>RtrA</td><td>Generator rotor 3 phase current</td></tr>
<tr><td>RtrExtAC</td><td>Generator rotor ac excitation</td></tr>
<tr><td>RtrExtDC</td><td>Generator rotor dc excitation</td></tr>
<tr><td>RtrPhV</td><td>Generator rotor 3 phase phase-to-ground voltage</td></tr>
<tr><td>RtrPPV</td><td>Generator rotor 3 phase phase-to-phase voltage</td></tr>
<tr><td>SetBecLev</td><td>Set bulb light level of beacon</td></tr>
<tr><td>SetBecMod</td><td>Set modus of beacon:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Auto</td><td>1</td><td>Beacon Auto mode</td></tr>
<tr><td>Bulb1</td><td>2</td><td>Beacon bulb1 on</td></tr>
<tr><td>Bulb2</td><td>3</td><td>Beacon bulb2 on</td></tr>
</table></td></tr>
<tr><td>SetFlsh</td><td>Set value of flash duty cycle of beacon</td></tr>
<tr><td>SetPlDel</td><td>Set reference value for the wind power plant active power reserve – also named as “spinning reserve”</td></tr>
<tr><td>SetPlDrp</td><td>Set reference value for slope of voltage control droop</td></tr>
<tr><td>SetPlPF</td><td>Set reference value for wind power plant power factor – negative: consuming reactive power; positive: producing reactive power</td></tr>
<tr><td>SetPlV</td><td>Set reference value for wind power plant voltage output</td></tr>
<tr><td>SetPlVA</td><td>Set reference value for wind power plant apparent power output</td></tr>
<tr><td>SetPlVAr</td><td>Set reference value of wind power plant reactive power output</td></tr>
<tr><td>SetPlVArDoGra</td><td>Set reference value for gradient for ramping down the wind power plant reactive power output</td></tr>
<tr><td>SetPlVArUpGra</td><td>Set reference value for gradient for ramping up the wind power plant reactive power output</td></tr>
<tr><td>SetPlVArW</td><td>Set reference value of wind power plant reactive power output</td></tr>
<tr><td>SetPlVDoGra</td><td>Set reference value for wind power plant voltage ramping down</td></tr>
<tr><td>SetPlVDrp</td><td>Set reference value for slope of voltage control droop</td></tr>
<tr><td>SetPlVUpGra</td><td>Set reference value for wind power plant voltage ramping up</td></tr>
<tr><td>SetPlW</td><td>Set reference value for the wind power plant active power output</td></tr>
<tr><td>SetPlWDoGra</td><td>Set reference value for gradient ramping down the wind power plant active power output</td></tr>
<tr><td>SetPlWUpGra</td><td>Set reference value for gradient ramping up the wind power plant active power output</td></tr>
<tr><td>SetTurOp</td><td>Wind turbine operation command:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Str</td><td>1</td><td>Start turbine</td></tr>
<tr><td>Stop</td><td>2</td><td>Stop turbine</td></tr>
</table></td></tr>
<tr><td>ShfBrg</td><td>Shaft Bearing</td></tr>
<tr><td>ShfBrk</td><td>Shaft brake (surface)</td></tr>
<tr><td>StaA</td><td>Generator stator 3 phase current</td></tr>
<tr><td>StaPhV</td><td>Generator stator 3 phase phase-to-ground voltage</td></tr>
<tr><td>StaPPV</td><td>Generator stator 3 phase phase-to-phase voltage</td></tr>
<tr><td>StopCnt</td><td>Number of stops. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>Str</td><td>Start command to converter: On | Off | Auto
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Operate converter to On</td></tr>
<tr><td>Off</td><td>2</td><td>Operate converter to Off</td></tr>
<tr><td>Auto</td><td>3</td><td>Operate converter to Auto mode</td></tr>
</table></td></tr>
<tr><td>StrCnt</td><td>Number of starts. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.</td></tr>
<tr><td>SupVArh</td><td>Reactive energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)</td></tr>
<tr><td>SupWh</td><td>Active (real) energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)</td></tr>
<tr><td>SysGsLev</td><td>Grease level for lubrication of yaw system</td></tr>
<tr><td>Tmp</td><td>Temperature</td></tr>
<tr><td>TmpNacEx</td><td>Temperature outside nacelle</td></tr>
<tr><td>TmpNacIntl</td><td>Temperature inside nacelle</td></tr>
<tr><td>Torq</td><td>Torque value</td></tr>
<tr><td>TotVArh</td><td>Total (net) reactive energy production</td></tr>
<tr><td>TotWh</td><td>Total (net) active energy production</td></tr>
<tr><td>TrfClSt</td><td>Status of transformer cooling system:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Cl</td><td>1</td><td>Transformer cooling is cooling</td></tr>
<tr><td>Stdby</td><td>2</td><td>Transformer cooling is in standby mode</td></tr>
<tr><td>Off</td><td>3</td><td>Transformer cooling is off</td></tr>
<tr><td>Flt</td><td>4</td><td>Transformer cooling is faulty</td></tr>
</table></td></tr>
<tr><td>TrfGri</td><td>Transformer grid side</td></tr>
<tr><td>TrfGriA</td><td>Transformer grid side 3 phase current</td></tr>
<tr><td>TrfGriPhV</td><td>Transformer grid side 3 phase-to-ground voltage</td></tr>
<tr><td>TrfGriPPV</td><td>Transformer grid side 3 phase phase-to-phase voltage</td></tr>
<tr><td>TrfOpTmRs</td><td>Transformer operation time (vendor specific). The precise semantic shall be defined and documented by the manufacturer of the turbine controller.</td></tr>
<tr><td>TrfTmpTrfGn</td><td>Transformer turbine side temperature measurement</td></tr>
<tr><td>TrfTmpTrfGri</td><td>Transformer grid side temperature measurement</td></tr>
<tr><td>TrfTurA</td><td>Transformer turbine side 3 phase current</td></tr>
<tr><td>TrfTurPhV</td><td>Transformer turbine side 3 phase-to-ground voltage</td></tr>
<tr><td>TrfTurPPV</td><td>Transformer turbine side 3 phase phase-to-phase voltage</td></tr>
<tr><td>TrgEmgStop</td><td>Transient log triggered at emergency shut down</td></tr>
<tr><td>TrgProdGri</td><td>Transient log triggered at grid connection</td></tr>
<tr><td>TrmTmpGbxOil1</td><td>Temperature measurement of Gearbox oil</td></tr>
<tr><td>TrmTmpShfBrg1</td><td>Temperature measurement of shaft bearing 1</td></tr>
<tr><td>TrmTmpShfBrg2</td><td>Temperature measurement of shaft bearing 2</td></tr>
<tr><td>TrmTmpShfBrk</td><td>Temperature measurement of Shaft brake (measured at surface)</td></tr>
<tr><td>TurAlLog</td><td>All logged (historical) turbine alarms</td></tr>
<tr><td>TurAnLog</td><td>All logged (historical) turbine analogue time series</td></tr>
<tr><td>TurCmLog</td><td>All logged (historical) turbine commands</td></tr>
<tr><td>TurCtLog</td><td>All logged (historical) turbine counters</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>TurEvtLog</td><td>All logged (historical) state changes</td></tr>
<tr><td>TurPhLog</td><td>All logged (historical) turbine three phase time series</td></tr>
<tr><td>TurRpCh</td><td>Turbine report analogue characteristics</td></tr>
<tr><td>TurRpCt</td><td>Turbine report event counts</td></tr>
<tr><td>TurRpTm</td><td>Turbine report time durations</td></tr>
<tr><td>TurSpLog</td><td>All logged (historical) turbine set points</td></tr>
<tr><td>TurSt</td><td>Turbine status
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Stop</td><td>1</td><td>Turbine stopped</td></tr>
<tr><td>Stdby</td><td>2</td><td>Turbine is in standby</td></tr>
<tr><td>Str</td><td>3</td><td>Turbine is starting</td></tr>
<tr><td>Run</td><td>4</td><td>Turbine is running in normal operation</td></tr>
<tr><td>Free</td><td>5</td><td>Turbine is in freerun with the generator disconnected</td></tr>
<tr><td>Brk</td><td>6</td><td>Turbine is braking</td></tr>
</table></td></tr>
<tr><td>TurStLog</td><td>All logged (historical) turbine statuses</td></tr>
<tr><td>TurTmLog</td><td>All logged (historical) turbine timers</td></tr>
<tr><td>TurTrLog</td><td>All transient turbine loggings</td></tr>
<tr><td>VA</td><td>Apparent Power – S is used as public synonym for apparent power</td></tr>
<tr><td>VAh</td><td>Apparent Energy</td></tr>
<tr><td>VAr</td><td>Reactive Power - Q is used as public synonym for reactive power</td></tr>
<tr><td>VAr</td><td>Reactive power generation</td></tr>
<tr><td>VArh</td><td>Reactive Energy</td></tr>
<tr><td>VArOvW</td><td>Windturbine reactive priority over active command</td></tr>
<tr><td>VArRefPri</td><td>Windturbine reactive setpoint priority command</td></tr>
<tr><td>VerWdDir</td><td>Vertical wind direction</td></tr>
<tr><td>VerWdSpd</td><td>Vertical wind speed</td></tr>
<tr><td>Vib</td><td>Measured gearbox vibration</td></tr>
<tr><td>BrkHyPres</td><td>Hydraulic pressure for shaft brake</td></tr>
<tr><td>VibGbx1</td><td>Measured gearbox vibration of gearbox 1</td></tr>
<tr><td>VibGbx2</td><td>Measured gearbox vibration of gearbox 2</td></tr>
<tr><td>GbxOilLev</td><td>Oil level in gearbox sump</td></tr>
<tr><td>GbxOilPres</td><td>Gear oil pressure</td></tr>
<tr><td>GsLev</td><td>Grease level for lubrication of main shaft bearing</td></tr>
<tr><td>InlFlt</td><td>Inline filter contamination</td></tr>
<tr><td>OfFlt</td><td>Offline filter contamination</td></tr>
<tr><td>Vis</td><td>Visibility</td></tr>
<tr><td>VMx</td><td>Voltage measurements</td></tr>
<tr><td>W</td><td>Active Power – P is used as public synonym for active power</td></tr>
<tr><td>W</td><td>Active power generation</td></tr>
<tr><td>WacTrg</td><td>The number of times the watchdog circuit has reset the device since the counter reset.</td></tr>
<tr><td>WdDir</td><td>Wind direction. The direction from which the wind is blowing. Wind direction shall be reported with reference to true north.</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Wind power plant specific data name semantics</th></tr>
<tr><td>WdHtSt</td><td>Status of heater for wind sensor:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Heater is on</td></tr>
<tr><td>Off</td><td>2</td><td>Heater is off</td></tr>
<tr><td>Dis</td><td>3</td><td>Heater is disabled</td></tr>
</table></td></tr>
<tr><td>WdSpdNac</td><td>Wind speed</td></tr>
<tr><td>Wh</td><td>Active Energy</td></tr>
<tr><td>WrmStr</td><td>The number of warm starts made by the physical device since the last reset.</td></tr>
<tr><td>Xdir</td><td>Longitudinal direction</td></tr>
<tr><td>YawAng</td><td>Yaw bearing rotation angle relative to nominal true North</td></tr>
<tr><td>YawSpd</td><td>Yawing speed</td></tr>
<tr><td>Ydir</td><td>Lateral direction</td></tr>
<tr><td>YwBrakeSt</td><td>Mode of the yaw brake:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>On</td><td>1</td><td>Yaw brake is On</td></tr>
<tr><td>Off</td><td>2</td><td>Yaw brake is Off</td></tr>
</table></td></tr>
<tr><td>YwSt</td><td>Mode of yaw system:
<table>
<tr><th>value</th><th>numeric value</th><th>semantic</th></tr>
<tr><td>Auto</td><td>1</td><td>Yaw in Auto operation mode</td></tr>
<tr><td>Cw</td><td>2</td><td>Yaw in clock wise operation mode</td></tr>
<tr><td>Blk</td><td>3</td><td>Yaw blocked</td></tr>
<tr><td>Ccw</td><td>4</td><td>Yaw in counter clock wise operation mode</td></tr>
<tr><td>Flt</td><td>5</td><td>Yaw is faulty</td></tr>
</table></td></tr>
</table>

7 Common data classes

7.1 Basic concepts for common data classes (CDC)

7.1.1 Categories of common data classes

Shared properties of a group of data classes (of data defined in logical nodes are defined in a common data class (CDC). A data class inherits all information (data and meta-data) as specified in its accompanying common data class attributes. Based on the wind power plant information requirements, a set of specific common data classes for wind power plants have been specified.

The following groups of common data classes are defined.

a) Wind power plant specific common data classes (CDC) (see 7.3):

Setpoint Value (SPV),

Status Value (STV),

Alarm (ALM),

Command (CMD),

Event counting (CTE),

State timing (TMS),

Alarm Set Status (ASS).

b) Common data classes inherited from IEC 61850-7-3 (see 7.4.1):
   Single point status (SPS),
   Integer status (INS),
   Binary counter reading (BCR),
   Measured value (MV),
   Phase to ground related measured values of a three phase system (WYE),
   Phase to phase related measured values of a three phase system (DEL),
   Controllable single point (SPC),
   Controllable integer status (INC),
   Controllable analogue process value (APC) (future amendment to the present standard),
   Logical node name plate (LPL).
c) Common data classes inherited from IEC 61850-7-3 and specialised (see 7.4.2):
   Device name plate (DPL) -> WDPL.

7.1.2 Structure of common data classes

The abbreviated names of wind power plant specific common data classes are in capitals, short (3 characters is recommended) and shall be unique.

Inside a common data class, the information (data and meta-data) of a certain data class is modelled unambiguously by a table notation as shown in Table 24.

Table 24 – General table structure of a common data class (CDC)

xxx class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and Value / Range**	**M/O**
Data attribute					
Status information					
cdc attr. name	attr type	fc		Description and range	
Analogue information					
cdc attr. name	attr type	fc		Description and range	
Statistical information					
cdc attr. name	attr type	fc		Description and range	
Historical information					
cdc attr. name		fc		Description and range	
cdc attr. name	attr typeA	fc		Description and range	
cdc attr. name	attr typeB	fc		Description and range	
cdc attr. name	attr typeA	fc		Description and range	
cdc attr. name	attr typeC	fc		Description and range	
Control information					
cdc attr. name	attr type	fc		Description and range	
Setpoint information					
cdc attr. name	attr type	fc		Description and range	
Description and extension					
cdc attr. name	attr type	fc		Description and range	

For the sake of convenience, all common data class attributes are divided into categories.

A common data class has attributes of the types that are explained briefly in Table 25.

Table 25 – Common data class attributes

Data class attribute	Description
Attribute name	Mnemonic abbreviation of the common data class attribute record
Attribute type	Basic (for example INT, BOOLEAN) or composed data type definition
Functional constraint	Label to build groups for efficient information exchange. The list of functional constraints shall be as defined in IEC 61850-7-2, Table 18 Examples: ST Status MX Measurand CO Control SP Setpoint CF Configuration DC Description
Trigger option	Conditional notification that a state or value change has occurred dchg: data change, qchg: quality change, dupd: data update
Explanation/Range	Description and range of an attribute record
Mandate	M: Mandatory, O: Optional, Conditional

At least all mandatory defined common data class attributes shall be inherited to the concerning data class. Optional defined data attribute names are meant to be useful, but free to use. A common data attribute is also mandatory if the given condition is true.

The conditions that specify the presence of an attribute shall be as defined in Table 26.

Table 26 – Conditions for the presence of an attribute

Abbreviation	Condition
AC_ALM_ST_POS	This attribute shall be present, if the WALM logical node includes the AlmSt data
AC_DLN_M	The attribute shall be present, if data name space of this data deviates from the data name space referenced by either lnNs of the logical node in which the data is contained or ldNs of the logical device in which the data is contained (applies to dataNs in all CDCs only)
AC_DLNDA_M	The attribute shall be present, if CDC name space of this data deviates from the CDC name space referenced by either the dataNs of the data, the lnNs of the logical node in which the data is defined or ldNs of the logical device in which the data is contained (applies to cdcNs and cdcName in all CDCs only)
AC_PRE_TRG	The attribute is mandatory, if pre-triggering is supported
AC_PST_TRG	The attribute is mandatory, if post-triggering is supported
AC_TRG	The attribute is mandatory, if triggering is supported (pre- or post-triggering)
GC_1	At least one of the attributes shall be present for a given instance of DATA
GC_CON	A configuration data attribute shall only be present, if the (optional) specific data attributes to which this configuration relates, is also present
M	Attribute is mandatory
O	Attribute is optional

The attribute type of a common data class is the most basic attribute of information. Table 27 shows the range of basic types.

Table 27 – CDC: Attribute basic types

Attribute type	
Name	**Range / explanation**
BOOLEAN	True | False
INT8	-128 to +127
INT16	-32.768 to +32.767
INT24	-8.388.608 to 8.388.607
INT32	-2**31 to (2**31)-1
INT64	-2**63 to (2**63)-1
INT128	-2**127 to (2**127)-1
INT8U	0 to 255
INT16U	0 to 65 535
INT24U	0 to 16 777 215
INT32U	0 to 4 294 967 295
FLOAT32	Single precision floating point, range and precision as specified by IEEE 754 single precision floating point.
FLOAT64	Double precision floating point, range and precision as specified by IEEE 754 double precision floating point.
OCTETSTRING64	Octet string
ENUMERATED	Ordered set of values dependent of information to be modelled; custom extensions are allowed
CODED ENUM	Ordered set of values, defined once; custom extensions are not allowed. Type shall be mapped to an efficient encoding in the mappings
VISIBLE STRING	ASCII string
UNICODE STRING	Unicode character string

Derived composed types are listed separately in detail in the following Subclauses.

7.2 Common data class attributes

7.2.1 Analogue value

Floating point or integer value (scalable). Analogue value type shall be as defined in Table 28.

Table 28 – Analogue value

Analogue value type definition			
Attribute name	**Attribute type**	**Value/Value range**	**M/O**
i	INT32	integer value	GC_1 [a)]
f	FLOAT32	floating point value	GC_1 [a)]
[a)] GC_1 = At least one of the attributes shall be present for a given instance of DATA.			

The notation Analogue Value[n] shall be an array of n Analogue Values.

Analogue values may be represented as a basic data type INTEGER (attribute i) or as FLOATING POINT (attribute f). At least one of the attributes shall be used. If both i and f exist, the server has to ensure that both values remain consistent. The latest value set by the communication service shall be used to update the other value. As an example, if xxx.f is written, the application shall update xxx.i accordingly.

i: The value of i shall be an integer representation of the measured value. The formula to convert between i and f shall be:

$$f \times 10^{\text{units} \times \text{multiplier}} = (i \times scaleFactor) + offset$$

It shall be true within acceptable error when *i, scale Factor, offset* and *f* are all present.

f: The value of *f* shall be the floating point representation of the measured value. *f* shall represent the technological value.

NOTE The reason for both integer and floating point representation is so that IEDs without FLOATING POINT capabilities shall be enabled to support analogue values. In this case, the scale Factor and offset may be exchanged offline between clients and servers.

7.2.2 TimeStamp

The TimeStamp type shall represent a UTC time with the epoch of midnight (00:00:00) of 1970-01-01 specified in Table 29.

Table 29 – TimeStamp type

TimeStamp type definition			
Attribute name	**Attribute type**	**Value/value range/explanation**	**M/O**
SecondSinceEpoch	INT32	(0…MAX)	M
FractionOfSecond	INT24U	Value = SUM from i=0 to 23 of bi*2**–(i+1); Order = b0, b1, b2, b3,…	M
TimeQuality	TimeQuality		M

SecondSinceEpoch

The SecondSinceEpoch shall be the interval in seconds continuously counted from the epoch 1970-01-01 00:00:00 UTC.

NOTE 1 SecondSinceEpoch corresponds with the Unix epoch.

FractionOfSecond

The attribute FractionOfSecond shall be the fraction of the current second when the value of the TimeStamp has been determined. The fraction of second shall be calculated as (SUM from I = 0 to 23 of bi*2**–(I+1) s).

NOTE 2 The resolution is the smallest unit by which the timeStamp is updated. The 24 bits of the integer provides 1 out of 16 777 216 counts as the smallest unit; calculated by 1/2**24 which equals approximately 60 ns.

NOTE 3 The resolution of a time stamp may be 1/2**1 (= 0,5 s) if only the first bit is used; or may be 1/2**2 (= 0,25 s) if the first two bits are used; or may be approximately 60 ns if all 24 bits are used. The resolution provided by an IED is outside the scope of the IEC 61400-25 series.

TimeQuality

The TimeQuality shall provide information about the time source of the sending IED as listed in Table 30.

Table 30 – TimeQuality definition

TimeQuality definition			
Attribute name	**Attribute type**	**Value/Value range/explanation**	**M/O**
	PACKED LIST		
LeapSecondsKnown	BOOLEAN		M
ClockFailure	BOOLEAN		M
ClockNotSynchronized	BOOLEAN		O
TimeAccuracy	CODED ENUM	Number of significant bits in the FractionOfSecond: Minimum time interval shall be: 2**–n	M

LeapSecondsKnown: The value TRUE of the attribute LeapSecondsKnown shall indicate that the value for SecondSinceEpoch takes into account all leap seconds occurred. If it is FALSE, then the value does not take into account the leap seconds that occurred before the initialization of the time source of the device.

ClockFailure: The value TRUE of the attribute clockFailure shall indicate that the time source of the sending device is unreliable. The value of the TimeStamp shall be ignored.

ClockNotSynchronized: The value TRUE of the attribute clockNotSynchronized shall indicate that the time source of the sending device is not synchronized with the external UTC time.

TimeAccuracy: The attribute TimeAccuracy shall represent the time accuracy class of the time source of the sending device relative to the external UTC time. The timeAccuracy classes shall represent the number of significant bits in the FractionOfSecond.

The values of n shall be as listed in Table 31.

Table 31 – TimeAccuracy

n	Resulting TimeAccuracy (2**–n)	Corresponding time performance class defined in IEC 61850-5
31	–	– unspecified
7	approx. 7,8 ms	10 ms (performance class T0)
10	approx. 0,9 ms	1 ms (performance class T1)
14	approx. 61 µs	100 µs (performance class T2)
16	approx. 15 µs	25 µs (performance class T3)
18	approx. 3,8 µs	4 µs (performance class T4)
20	approx. 0,9 µs	1 µs (performance class T5)

7.2.3 Quality

Different identifiers that specify the quality and validity of information. Quality type shall be as defined in Table 32.

Table 32 – Quality

Quality type definition			
Attribute name	**Attribute type**	**Value/Value range**	**M/O**
	PACKED LIST		
validity	CODED ENUM	good | invalid | reserved | questionable	M
detailQual	PACKED LIST		O
overflow	BOOLEAN		O
outOfRange	BOOLEAN		O
badReference	BOOLEAN		O
oscillatory	BOOLEAN		O
failure	BOOLEAN		O
oldData	BOOLEAN		O
inconsistent	BOOLEAN		O
inaccurate	BOOLEAN		O
source	CODED ENUM	process | substituted DEFAULT process	O
test	BOOLEAN	DEFAULT FALSE	O
operatorBlocked	BOOLEAN	DEFAULT FALSE	O

The DEFAULT value shall be applied, if the functionality of the related attribute is not supported. The mapping may specify to exclude the attribute from the message if it is not supported or if the DEFAULT value applies. Further details shall be as defined in 6.2 of IEC 61850-7-3.

7.2.4 Units

Unit type shall be as defined in Table 33.

Table 33 – Unit

Unit type definition			
Attribute name	**Attribute type**	**Value/Value range**	**M/O**
SIUnit	ENUMERATED	According to Table B.1, Table B.2, Table B.3, and Table B.4	M
multiplier	ENUMERATED	According to Table B.5	O

SIUnit: shall define the SI unit according to Annex A.

multiplier: shall define the multiplier value according to Annex A. The default value is 0 (i.e. multiplier = 1).

The units shall be SI units, derived from ISO 1000, represented as an enumeration. The enumeration shall be as defined in Table B.1, Table B.2,

Table B.3, and Table B.4. The multiplier shall be represented as an enumeration where the value of the enumeration equals the exponent of the multiplier value in base 10, as defined in Table B.5.

7.2.5 CtlModels

CtlModels type is defined as follows:

ENUMERATED (status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security)

7.2.6 SboClasses

SboClasses type is defined as follows:

ENUMERATED (operate-once | operate-many)

7.2.7 Originator

Originator shall be as defined in Table 34.

Table 34 – Originator

Originator type definition			
Attribute name	**Attribute type**	**Value/Value range**	**M/O**
orCat	ENUMERATED	not-supported (0) | reserved (1) | station-control (2) | remote-control(3) | reserved2 (4) | automatic-station (5) | automatic-remote (6) | maintenance (7) | process (8)	M
orIdent	OCTET STRING64		M

Originator shall contain information related to the originator of the last change of the data attribute representing the value of a controllable data.

orCat: The originator category shall specify the category of the originator that caused a change of a value. An explanation of the values for orCat is given in Table 35.

Table 35 – Values for orCat

Value	Numeric value	Explanation
not-supported	0	OrCat is not supported
reserved1	1	
station-control	2	Control operation issued from an operator using a client located inside the wind power plant
remote-control	3	Control operation issued from an operator using a client located outside the wind power plant
reserved2	4	
automatic-station	5	Control operation issued from an automatic funccntion inside the wind power plant
automatic-remote	6	Control operation issued from an automatic function outside the wind power plant
maintenance	7	Control operation issued from a maintenance/service tool
process	8	Status change ocurred without control action

7.2.8 CtxInt

This type can represent either an INT32 or an ENUMERATED depending on the name of the data it is used. If the data defines a set of possible values, the ENUMERATED type shall be used.

7.2.9 ObjectReference

ObjectReference type is defined as follows: VISIBLE STRING255

Further explanation can be found in 19.2 of IEC 61850-7-2.

7.3 Wind power plant specific common data classes (CDC)

7.3.1 General

Two groups of common data classes are distinguished:

1) wind power plant specific common data classes (this Sublause);
2) common data classes inherited from IEC 61850-7-3 and possibly specialised (see 7.3.8).

Because the IEC 61400-25 series uses a similar modelling approach as IEC 61850, some already existing common data classes of IEC 61850-7-3 can be reused for extensions, or for incorporating grid related information into the wind power plant model.

However, all wind power related information shall mainly be built by wind power plant specific common data classes, as listed in Table 36.

Table 36 – Wind power plant specific common data classes

CDC classes	description	Table
SPV	Setpoint value	Table 37
STV	Status value	Table 38
ALM	Alarm	Table 39
CMD	Command	Table 40
CTE	Event counting	Table 41
TMS	State timing	Table 42
ASS	Alarm set status	Table 43

The data attribute names of all CDCs are alphabetically listed in 7.5.

Each data attribute shall inherit at least all mandatory properties of its attribute type.

Only the attributes specified in the data used to build the wind power plant specific common data classes should be used.

7.3.2 Setpoint value (SPV)

Common data class SPV shall comprise attributes, which represent information and control of a setpoint or a parameter DATA. Both are analogue DATA and difference is found in access authorisation only. The detailed specification shall be as represented in Table 37. A value change shall be represented by its old and current value, demanded (target) value, a timestamp and operator stamp. Otherwise, the rate of change and limits can be configured to avoid undesired system dynamics. A description and unit are recommended.

NOTE The APC CDC will be defined in an amendment to the present standard. It is also expected to be published in the second edition of IEC 61850-7-3. Table 37 lists the attributes of the APC CDC that shall be used for actVal and oldVal.

Table 37 – CDC: Setpoint value (SPV)

SPV class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
DataName	Inherited from Data Class (see Table 20 of IEC 61850-7-2)				
Data					
Control and status information					
chaManRs	SPC			Manual forced reset of characteristic information	O
ctlVal	BOOLEAN	CO		Reset (TRUE)	M
origin	Originator	CO, ST		Operator identifier of last reset	M
stVal	BOOLEAN	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
ctlModel	CtlModels	CF		direct-with-normal-security	M
Set point information					
actVal	APC			Demand value of setpoint or parameter	M
ctlVal	Analogue Value	CO	dchg		M
origin	Originator	CO, MX		Operator identifier of last change	M
operTm	TimeStamp	CO			O
mxVal	Analogue Value	MX	dchg		M
q	Quality	MX	qchg		M
t	TimeStamp	MX			M
stSeld	BOOLEAN	ST	dchg		O
ctlModel	CtlModels	CF		direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M
sboTimeout	INT32U	CF			O
sboClass	SboClasses	CF			O
oldVal	APC			Previous setpoint	O
ctlVal	Analogue Value	CO			M
origin	Originator	CO, MX		Operator identifier of previous change	O
operTm	TimeStamp	CO			O
mxVal	Analogue Value	MX	dchg		O
q	Quality	MX	qchg		M
t	TimeStamp	MX			M
ctlModel	CtlModels	CF		status-only	M
Data attribute					
Characteristics information					
minMxVal	Analogue Value	MX		Minimum measured value	O
maxMxVal	Analogue Value	MX		Maximum measured value	O
totAvVal	Analogue Value	MX		Total average value of data	O
sdvVal	Analogue Value	MX		Standard deviation of data	O
Configuration, description and extension information					
units	Unit	CF			O
minVal	Analogue Value	CF	dchg	Allowed lower limit	O
maxVal	Analogue Value	CF	dchg	Allowed upper limit	O
incRate	Analogue Value	CF	dchg	Rate of increase	O
decRate	Analogue Value	CF	dchg	Rate of decrease	O
spAcs	CODED ENUM	CF		Setpoint or parameter access level Low | medium | high	O
chaPerRs	CODED ENUM	CF		Time periodical reset hly | dly | wly | mly	O
d	VISIBLE STRING255	DC			O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_

SPV class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
					M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLESTRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					
NOTE 1 chaManRs is a transient data. NOTE 2 oldVal gives the information about the previous demanded setpoint. It shall not allow any kind of service of the control model.					

7.3.3 Status Value (STV)

Common data class STV, shall be defined as specified in Table 38. It comprises attributes that represent status information of a status DATA. Because the current and previous status are both modelled, the status change (event) is determined as well. The status value is determined by the data class to which the CDC STV has been assigned (for example 'on', 'off', 'healthy'). Relevant analogue DATA can be selected, their values at the time of occurrence can be valuable for event analysis. This DATA, if needed, should be included in a DATA SET referenced by dataSetMx. The DATA shall be specified by its current status value, identifier and timestamp. A description is recommended, however optional.

Table 38 – CDC: Status Value (STV)

STV class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and Value / Range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
Data					
Status Information					
actSt	INS			Actual status	M
stVal	CtxInt	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
oldSt	INS			Previous Status	O
stVal	CtxInt	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
Statistical Information					
stTm	TMS			Time duration of active status	O
stCt	CTE			Number of changes to active status	O
Data attribute					
Configuration, Description And Extension Information					
preTmms	INT32U	CF		Pre-trigger time	AC_PRE_TRG
pstTmms	INT32U	CF		Post-trigger time	AC_PST_TRG
smpTmms	INT16U	CF		Sample time for data attributes sampled during the Pre-trigger and Post-trigger time	AC_TRG
datSetMx	ObjectReference	CF	dchg	Analogue data related to this status value	O
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					

7.3.4 Alarm (ALM)

Common data class ALM shall comprise attributes, which represent status information of an alarm. The specified alarm wind power plant information model shall be defined as depicted in Table 39, it identifies four status values, viz. 'on', 'warning', 'acknowledged' and 'off'. An alarm event (status change) is also determined because both the previous and the status are modelled. Acknowledgement services of an active alarm status are incorporated by acknowledgement control, which will be confirmed by an operator identifier and a timestamp. In case of alarm event analysis, not only relevant analogue information at the time of alarm occurrence will be useful, but relevant status information as well.

The DATA shall be specified by its current status value, identifier, timestamp and acknowledgement services.

Table 39 – CDC: Alarm (ALM)

ALM class						
Attribute name		**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
DataName		Inherited from Data Class (see IEC 61850-7-2)				
Data						
Status information						
almAck		SPC			Acknowledgement	M
	ctlVal	BOOLEAN	CO	dchg	ack (TRUE)	M
	origin	Originator	CO,ST			M
	stVal	BOOLEAN	ST	dchg		M
	q	Quality	ST	qchg		M
	t	TimeStamp	ST			M
	ctlModel	CtlModels	CF		direct-with-normal-security	M
actSt		INS			Actual alarm status value	M
	stVal	CtxInt	ST	dchg	Off | Warning | On | Acknowledged	M
	q	Quality	ST	qchg		M
	t	TimeStamp	ST			M
oldSt		INS			Previous alarm status value	O
	stVal	CtxInt	ST	dchg	Off | Warning | On | Acknowledged	M
	q	Quality	ST	qchg		M
	t	TimeStamp	ST			M
Statistical information						
almTm		TMS			Time duration of active alarm status	O
almCt		CTE			Number of changes to active alarm status	O
Data attribute						
Status information						
almLev		ENUMERATED	ST		Alarm urgency level Low | normal | urgent	O
seqId		INT32U	ST		Sequence identifier of an alarm	O
Configuration, description and extension						
almStPos		INT32	CF		Alarm position in the alarm status set (AlSt)	AC_ALM_ST_POS
preTmms		INT32U	CF		Pre-trigger time	AC_PRE_TRG
pstTmms		INT32U	CF		Post-trigger time	AC_PST_TRG
smpTmms		INT16U	CF		Sample time for data attributes sampled during the Pre-trigger and Post-trigger time	AC_TRG
datSetMx		ObjectReference	CF	dchg	List of measurements that have an influence in this alarm	O
datSetSt		ObjectReference	CF	dchg	List of status that have an influence in this alarm	O

ALM class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					
NOTE 1 akmAck is a transient data. NOTE 2 The attribute almStPos is conditional to the presence of the AlmSt data in the WALM logical node. AlmSt data stores the current status value of a set of preconfigured alarms. The value of almStPos shall be negative if this alarm is not included in the set of alarms whose values are monitored by the AlmSt data. If its value is positive, it represents the position of this alarm in the set of values included in AlmSt data.					

7.3.5 Command (CMD)

Common data class CMD shall represent information and control of a command. The detailed specification shall be as represented in Table 40. The command value is determined by the data class to which the CMD-CDC has been assigned (for example 'on', 'off', 'automatic'). Each status change shall be represented by its previous, actual and commanded status, as well as the accompanying time and operator stamp of the last occurrence. Access authorisation will often be used to protect the system against dangerous situations.

The DATA shall be specified by its current status value, commanded value, timestamp and identifier of last operator. A description is recommended.

Table 40 – CDC: Command (CMD)

CMD class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
Data					
Control and status information					
actSt	INC			Actual controllable status	M
ctlVal	CtxInt	CO	dchg		M
origin	Originator	CO,ST			M
stVal	CtxInt	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
stSeld	BOOLEAN	ST	dchg		O
ctlModel	CtlModels	CF		direct-with-normal-security, sbo-with-normal,security, direct-with-enhanced-security, sbo-with-enhanced-security	M
sboTimeout	INT32U	CF			O
sboClass	SboClasses	CF			O
oldSt	INS			Old status	O
stVal	CtxInt	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
statistical information					
cmTm	TMS			Duration of active command status	O
cmCt	CTE			Number of command activation events	O

CMD class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and value / range**	**M/O**
Data attribute					
Configuration, description and extension					
cmAcs	INT8U	CF		Command Access Level	O
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					

7.3.6 Event counting (CTE)

Common data class CTE shall comprise attributes, which represent counting information of status change (event). The specified model shall be as depicted in Table 41 and it discriminates three counting values, viz. number of occurrences since last reset, previous number of occurrences just before the last reset and the total number of occurrences. Reset can be set to each day, week, month and year or forced manually. Timestamp and operator identifier of last reset are foreseen.

The DATA shall be specified by its actual and previous counting value and a manual reset A description is recommended.

Table 41 – CDC: Event counting (CTE)

CTE class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and Value / Range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
Data					
Status information					
manRs	SPC			Manual forced reset	M
ctlVal	BOOLEAN	CO		Reset (TRUE)	M
origin	Originator	CO, ST			M
stVal	BOOLEAN	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
ctlModel	CtlModels	CF		direct-with-normal-security	M
hisRs	INC			Reset counting information	O
ctlVal	CtxInt	CO		dly | mly | yly | tot | all	M
origin	Originator	CO, ST			M
stVal	INT32	ST	dchg		M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
ctlModel	CtlModels	CF		direct-with-normal-security	M
actCtVal	INS			Actual event counts	M
stVal	CtxInt	ST	dchg	INT32	M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
oldCtVal	INS			Previous event counts	M
stVal	CtxInt	ST	dchg	INT32	M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M

CTE class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and Value / Range**	**M/O**
Data attribute					
Statistical information					
ctTot	INT32U	ST		Total counts of an event	O
Historical information					
dly	ARRAY OF [0..31] INT32U	ST	dchg	Daily counting data	O
mly	ARRAY OF [0..12] INT32U	ST	dchg	Monthly counting data	O
yly	ARRAY OF [0..20] INT32U	ST	dchg	Yearly counting data	O
tot	INT32U	ST	dchg	Total counting data	O
Configuration, description and extension					
rsPer	CODED ENUM	CF		Time periodical reset dly | wly | mly | yly | manual	O
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					
NOTE manRs and hisRs are transient data.					

7.3.7 State timing (TMS)

Common data class TMS shall comprise attributes, which represent time duration information of a state. The specified model shall be as shown in Table 42. It discriminates three time durations, viz. time duration of state since last reset, previous time duration of state just before the last reset and the total time duration of state. Reset can be set to each day, week, month and year or forced manually. Timestamp and operator identifier of last reset are foreseen.

The DATA shall be specified by its actual and previous timing value and a manual reset. A description is recommended.

Table 42 – CDC: State timing (TMS)

TMS class						
Attribute name		**Attribute type**	**FC**	**TrgOp**	**Explanation and value / Range**	**M/O**
DataName		Inherited from Data Class (see IEC 61850-7-2)				
Data						
Status information						
manRs		SPC			Manual forced reset	M
	ctlVal	BOOLEAN	CO		Reset (TRUE)	M
	origin	Originator	CO, ST			M
	stVal	BOOLEAN	ST			M
	q	Quality	ST			M
	t	TimeStamp	ST			M
	ctlModel	CtlModels	CF		direct-with-normal-security	M
hisRs		INC			reset historical information	O
	ctlVal	CtxInt	CO		dly | mly | yly | tot | all	M
	origin	Originator	CO, ST			M
	stVal	INT32	ST			M
	q	Quality	ST			M
	t	TimeStamp	ST			M
	ctlModel	CtlModels	CF		direct-with-normal-security	M
actTmVal		INS			Actual time duration of state	M
	stVal	CtxInt	ST	dchg	INT32	M
	q	Quality	ST	qchg		M
	t	TimeStamp	ST			M
oldTmVal		INS			Previous time duration of state	M
	stVal	CtxInt	ST	dchg	INT32	M
	q	Quality	ST	qchg		M
	t	TimeStamp	ST			M
Data attribute						
Statistical information						
tmTot		INT32U	ST		Total time duration of a state	O
Historical information						
dly		ARRAY OF [0..31] INT32U	ST	dchg	Daily counting data	O
mly		ARRAY OF [0..12] INT32U	ST	dchg	Monthly counting data	O
yly		ARRAY OF [0..20] INT32U	ST	dchg	Yearly counting data	O
tot		INT32U	ST	dchg	Total counting data	O
Configuration, description and extension						
rsPer		CODED ENUM	CF		Time periodical reset dly | wly | mly | yly | manual	O
d		VISIBLE STRING255	DC		Text	O
dU		UNICODE STRING255	DC			O
cdcNs		VISIBLE STRING255	EX			AC_DLNDA_M
cdcName		VISIBLE STRING255	EX			AC_DLNDA_M
dataNs		VISIBLE STRING255	EX			AC_DLN_M
Services						
As defined in Table B.1 of IEC 61400-25-3.						
NOTE manRs and hisRs are transient data.						

7.3.8 Alarm Set Status (ASS)

Common data class ASS shall comprise attributes which represent in a single data the status value of a defined set of alarms. The time stamp provides information about when the last change in one of the controlled alarms ocurred.

The specified model shall be as shown in Table 43.

Table 43 – CDC: Alarm Set Status (ASS)

ASS class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Explanation and Value / Range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
Data attribute					
Status					
stVal	ARRAY [0..numAlm] OF CODED_ENUM	ST	dchg	Off | Acknowledged | Warning | Active	M
q	Quality	ST	qchg		M
t	TimeStamp	ST			M
Configuration, description and extension					
numAlm	INT16U	CF		Number of elements in the array of alarms	M
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table B.1 of IEC 61400-25-3.					

7.4 Common data classes inherited from IEC 61850-7-3

7.4.1 CDCs from IEC 61850-7-3 (unchanged)

The following CDCs shall be inherited (see Clause 7 of IEC 61850-7-3):

- Single point status (SPS),
- Integer status (INS),
- Binary counter reading (BCR),
- Measured value (MV),
- Phase to ground related measured values of a three phase system (WYE),
- Phase to phase related measured values of a three phase system (DEL),
- Controllable single point (SPC),
- Controllable integer status (INC),
- Controllable analogue process value (APC) (future amendment to the present standard),
- Logical node name plate (LPL).

7.4.2 CDCs from IEC 61850-7-3 (specialised)

7.4.2.1 General

The following CDCs shall be inherited from IEC 61850-7-3 and specialised in this part of the IEC 61400-25 series:

Device name plate (DPL) -> WDPL

Specialised CDS shall be as listed in Table 44.

Table 44 – Specialized common data classes

CDC classes	Description	Table
WDPL		Table 45

7.4.2.2 Device name plate common data class specification WDPL

Table 45 defines the common data class “device name plate”. Data of this common data class are used to identify entities like primary equipment or physical devices. The core definition of the LPHD has been inherited from IEC 61850-7-4. The CDC WDPL shall be used instead of the CDC DPL as specified in IEC 61850-7-3.

Table 45 – Device name plate common data class specification WDPL

WDPL class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Value/Value range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
Data attribute					
Configuration, description and extension					
vendor	VISIBLE STRING255	DC			M
hwRev	VISIBLE STRING255	DC			O
swRev	VISIBLE STRING255	DC			O
serNum	VISIBLE STRING255	DC			O
model	VISIBLE STRING255	DC			O
location	VISIBLE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Specialization					
Local time information					
tmOffset	INT16	DC		Offset from UTC in minutes (excluding daylight saving time correction)	M
tmUseDT	BOOLEAN	DC		Flag indicating if this location uses daylight saving (summer) time	M
tmDT	BOOLEAN	DC		Flag indicating if daylight saving (summer) time is in effect now	M
tmAutoDT	BOOLEAN	DC		Flag indicating if daylight saving (summer) time flag and time zone offset are set automatically using rules specified by tmTZ attribute	O
tmTZ	VISIBLE STRING128	DC		String containing name of time zone using identifiers in industry standard time zone database referenced in IETF RFC 2445. Actual RFC 2445 time zone data is stored internally in vendor dependent manner	O
tmLang	VISIBLE STRING3	DC		ISO 639 series 2 or 3 letter language code. Used as intelligent default for	O

WDPL class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Value/Value range**	**M/O**
				application layer displays	
tmCountry	VISIBLE STRING2	DC		ISO 3166 series 2 letter country identifier where device is geographically located	O
Time status information					
stDT	BOOLEAN	ST		Status indicating whether daylight saving (summer) time is in effect now (can be forced by setting tmDT if tmAutoDT is not true)	O
Description and extension information					
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
Services					
As defined in Table B.1 of IEC 61400-25-3.					

7.5 Common data class attribute semantics

The data attribute names, as used in the common data classes of this Clause, are alphabetically listed in Table 46. Any user made extension for specific use shall be consistent with these names and in accordance with the guidelines as described in Annex A of IEC 61850-7-4 and in Clause 14 of IEC 61850-7-1.

Table 46 – Common data class attribute semantic

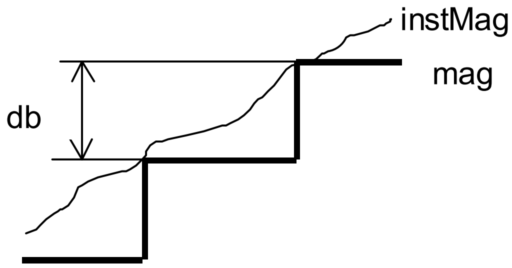
<table>
<tr><th>Data name</th><th>Common data class attribute semantics</th></tr>
<tr><td>actCtVal</td><td>Actual event counts</td></tr>
<tr><td>actSt</td><td>Actual status</td></tr>
<tr><td>actTmVal</td><td>Actual time duration of a state</td></tr>
<tr><td>actVal</td><td>Actual value</td></tr>
<tr><td>almAck</td><td>Acknoledgement of an alarm</td></tr>
<tr><td>almCt</td><td>Number of changes to active alarm status</td></tr>
<tr><td>almLev</td><td>Alarm urgency level
<table>
<tr><th>value</th><th>number</th></tr>
<tr><td>low</td><td>1</td></tr>
<tr><td>normal</td><td>2</td></tr>
<tr><td>urgent</td><td>3</td></tr>
</table></td></tr>
<tr><td>almStPos</td><td>Position of this alarm in the array of alarm status values included in the data AlmSt of a WALM logical node.</td></tr>
<tr><td>almTm</td><td>Time duration of active alarm status</td></tr>
<tr><td>cdcNs</td><td>Common data class name space. The name space mechanism shall be as defined in Clause 14 of IEC 61850-7-1.</td></tr>
<tr><td>cdcName</td><td>Common data class name</td></tr>
<tr><td>chaManRs</td><td>Manual forced reset of characteristic information</td></tr>
<tr><td>chaPerRs</td><td>Time periodical reset</td></tr>
<tr><td>cmAcs</td><td>Command access level</td></tr>
<tr><td>cmCt</td><td>Number of command activation events</td></tr>
<tr><td>cmTm</td><td>Duration of active command status</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Common data class attribute semantics</th></tr>
<tr><td>ctlModel</td><td>Specifies the control model of IEC 61850-7-2 that corresponds the behaviour of the data.
<table>
<tr><th>Value</th><th>Numeric value</th><th>Explanation</th></tr>
<tr><td>status-only</td><td>0</td><td>The object is not controllable, only the services that apply to a status object are supported.</td></tr>
<tr><td>direct-with-normal-security</td><td>1</td><td>Direct control with normal security</td></tr>
<tr><td>sbo-with-normal-security</td><td>2</td><td>SBO control with normal security</td></tr>
<tr><td>direct-with-enhanced-security</td><td>3</td><td>Direct control with enhanced security</td></tr>
<tr><td>sbo-with-enhanced-security</td><td>4</td><td>SBO control with enhanced security</td></tr>
</table>

NOTE 1 If a datainstance of a control class has no status information associated, then the attribute stVal (mxVal) does not exist. In that case, the value range for ctlModel is restricted to direct-with-normal-security and sbo-with-normal-security.

NOTE 2 In some attributes of the IEC 61400-25 specific CDCs, the values of ctlModel have been restricted.</td></tr>
<tr><td>ctlVal</td><td>Determines the control activity. It holds the value requested in the control order.</td></tr>
<tr><td>ctTot</td><td>Total counts of an event</td></tr>
<tr><td>d</td><td>Textual description</td></tr>
<tr><td>dataNs</td><td>Data namespace. The name space mechanism shall be as defined in IEC 61850-7-1.</td></tr>
<tr><td>datSetMx</td><td>ObjectReference of a data-set with measured information related to this data.</td></tr>
<tr><td>datSetSt</td><td>ObjectReference of a data-set with status information related to this data.</td></tr>
<tr><td>db</td><td>Deadband. Shall represent a configuration parameter used to calculate all deadbanded attributes (for example mag attribute in the CDC MV). The value shall represent the percentage of difference between max. and min. in units of 0,001 %.

If an integral calculation is used to determine the deadbanded value, the value shall be represented as 0,001 % s.</td></tr>
<tr><td>decRate</td><td>Rate of decrease</td></tr>
<tr><td>dly</td><td>Daily counting data</td></tr>
<tr><td>dU</td><td>Textual description in Unicode</td></tr>
<tr><td>hisRs</td><td>Reset history information</td></tr>
<tr><td>hwRev</td><td>HW-revision</td></tr>
<tr><td>incRate</td><td>Rate of increase</td></tr>
<tr><td>instMag</td><td>Magnitude of instantaneous value</td></tr>
<tr><td>instVal</td><td>Instantaneous value</td></tr>
<tr><td>location</td><td>Location, where the device is placed</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Common data class attribute semantics</th></tr>
<tr><td>mag</td><td>Deadbanded value. Shall be based on a dead band calculation from instMag as illustrated below. The value of mag shall be updated to the current value of instMag when the value has changed according the configuration parameter db.


NOTE 3 The figure above is an example. There may be other algorithms providing a comparable result; for example as an alternate solution, the dead band calculation may use the integral of the change of instMag. The algorithm used is a local issue.
NOTE 4 This value mag is typically used to create reports for analogue values. Such a report sent "by exception" is not comparable to the transfer of sampled measured values as supported by the CDC SAV.</td></tr>
<tr><td>manRs</td><td>Manual forced reset</td></tr>
<tr><td>maxVal</td><td>Maximum value of data. It is used as the upper limit of the range of a setting.</td></tr>
<tr><td>maxMxVal</td><td>Maximum measured value of a data in a period of time</td></tr>
<tr><td>minVal</td><td>Minimum value of data. It is used as the lower limit of the range of a setting.</td></tr>
<tr><td>minMxVal</td><td>Minimum measured value of a data in a period of time</td></tr>
<tr><td>mly</td><td>Monthly counting data</td></tr>
<tr><td>model</td><td>Vendor specific product name</td></tr>
<tr><td>mxVal</td><td>Measured value of a data</td></tr>
<tr><td>numAlm</td><td>Number of elements in the array of alarms</td></tr>
<tr><td>oldCtVal</td><td>Previous event counts</td></tr>
<tr><td>oldSt</td><td>Previous status</td></tr>
<tr><td>oldTmVal</td><td>Previous time duration of a state</td></tr>
<tr><td>oldVal</td><td>Previous value</td></tr>
<tr><td>origin</td><td>Contains information related to the originator of the last change of the controllable value of data.</td></tr>
<tr><td>operTm</td><td>If the service TimeActivatedOperate is performed, then this attribute shall specify the absolute time when the command shall be executed.</td></tr>
<tr><td>perRs</td><td>Time periodical reset</td></tr>
<tr><td>preTmms</td><td>Pre-trigger time – when a trigger occurs, the following values are logged (reported):
values sampled during Pre-trigger time.</td></tr>
<tr><td>pstTmms</td><td>Post-trigger time – when a trigger occurs, the following values are logged (reported):
• values at time of event occurrence
• values sampled during Post-trigger time</td></tr>
<tr><td>q</td><td>Quality
<table>
<tr><th>CDC</th><th>data attribute q applies to</th></tr>
<tr><td>SPS</td><td>stVal</td></tr>
<tr><td>DPS</td><td>stVal</td></tr>
<tr><td>INS</td><td>stVal</td></tr>
<tr><td>BCR</td><td>actVal</td></tr>
<tr><td>MV</td><td>mag, instMag, range</td></tr>
<tr><td>CMV</td><td>cVal, instCVal, range</td></tr>
<tr><td>SPC</td><td>stVal</td></tr>
<tr><td>INC</td><td>stVal</td></tr>
<tr><td>APC</td><td>mxVal</td></tr>
<tr><td>ASS</td><td>stVal</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Data name</th><th>Common data class attribute semantics</th></tr>
<tr><td>range</td><td>Range in which the current value of instMag or instCVal.mag is. It may be used to issue an event if the current value changes and transitions to another range. Range shall be used in the context with configuration attributes like hhLim, hLim, lLim, llLim, min and max as shown below.
<table>
<tr><th></th><th>range</th><th>validity</th><th>detail-qual</th></tr>
<tr><td></td><td>high-high</td><td>questionable</td><td>outOfRange</td></tr>
<tr><td>max</td><td></td><td></td><td></td></tr>
<tr><td></td><td>high-high</td><td>good</td><td></td></tr>
<tr><td>hhLim</td><td></td><td></td><td></td></tr>
<tr><td></td><td>high</td><td>good</td><td></td></tr>
<tr><td>hLim</td><td></td><td></td><td></td></tr>
<tr><td></td><td>normal</td><td>good</td><td></td></tr>
<tr><td>lLim</td><td></td><td></td><td></td></tr>
<tr><td></td><td>low</td><td>good</td><td></td></tr>
<tr><td>llLim</td><td></td><td></td><td></td></tr>
<tr><td></td><td>low-low</td><td>good</td><td></td></tr>
<tr><td>min</td><td></td><td></td><td></td></tr>
<tr><td></td><td>low-low</td><td>questionable</td><td>outOfRange</td></tr>
</table>
NOTE 5 The use of algorithms to filter events based on transition from one range to another is a local issue.
NOTE 6 This value with the trigger option “data-change” as described in 14.2.2.11 of IEC 61850-7-2 may be used to report an event to the client.</td></tr>
<tr><td>rangeC</td><td>Configuration parameters as used in the context with the range attribute.</td></tr>
<tr><td>rsPer</td><td>Time periodical reset</td></tr>
<tr><td>sboClass</td><td>Specifies the SBO-class according to the control model that corresponds to the behaviour of data. The following values are defined:
<table>
<tr><th>value</th><th>numeric value</th><th></th></tr>
<tr><td>operate-once</td><td>0</td><td>Following an operate request, the control object shall return to the unselected state.</td></tr>
<tr><td>operate-many</td><td>1</td><td>Following an operata request, the control object shall remain in the ready state, as long as the sboTimeOut did not expire.</td></tr>
</table></td></tr>
<tr><td>sboTimeout</td><td>Specifies the timeout according to the control model that corresponds to the behaviour of data. The value shall be in ms.</td></tr>
<tr><td>sdvVal</td><td>Standard deviation value</td></tr>
<tr><td>seqId</td><td>Sequence identifier of an occurrence</td></tr>
<tr><td>smpRate</td><td>Sampling rate that has been used to determine the analogue values. The value shall represent the number of samples per nominal period. In the case of a d.c. system, the value shall represent the number of samples per s.</td></tr>
<tr><td>smpTmms</td><td>Sample time for data attributes sampled during the Pre-trigger and Post-trigger time</td></tr>
<tr><td>spAcs</td><td>Setpoint access level</td></tr>
<tr><td>stCt</td><td>Number of changes to active status</td></tr>
<tr><td>stDT</td><td>Status indicating whether daylight saving (summer) time is in effect now (can be forced by setting tmDT if tmAutoDT is not true).</td></tr>
<tr><td>stSeld</td><td>The controllable data is in the status “selected” when stSeld is TRUE.</td></tr>
<tr><td>stTm</td><td>Time duration of active status</td></tr>
<tr><td>stVal</td><td>Status value of the Data</td></tr>
<tr><td>swRev</td><td>SW-Revision</td></tr>
</table>

<table>
<tr><th>Data name</th><th>Common data class attribute semantics</th></tr>
<tr><td>t</td><td>Timestamp of the last change in one of the attribute(s) representing the value of the data or in the q attribute. For the different CDCs t applies to the following data attributes:
<table>
<tr><th>CDC</th><th>data attribute t applies to</th></tr>
<tr><td>SPS</td><td>stVal</td></tr>
<tr><td>DPS</td><td>stVal</td></tr>
<tr><td>INS</td><td>stVal</td></tr>
<tr><td>BCR</td><td>actVal</td></tr>
<tr><td>MV</td><td>mag, range</td></tr>
<tr><td>CMV</td><td>cVal, range</td></tr>
<tr><td>SPC</td><td>stVal</td></tr>
<tr><td>INC</td><td>stVal</td></tr>
<tr><td>APC</td><td>mxVal</td></tr>
<tr><td>ASS</td><td>stVal</td></tr>
</table></td></tr>
<tr><td>tmAutoDT</td><td>Flag indicating if daylight saving (summer) time flag and time zone offset are set automatically using rules specified by tmTZ attribute</td></tr>
<tr><td>tmCountry</td><td>ISO 3166 series 2 letter country identifier where device is geographically located</td></tr>
<tr><td>tmDT</td><td>Flag indicating if daylight saving (summer) time is in effect now</td></tr>
<tr><td>tmLang</td><td>ISO 639 series 2 or 3 letter language code. Used as intelligent default for application layer displays</td></tr>
<tr><td>tmOffset</td><td>Offset from UTC in minutes (excluding daylight saving time correction)</td></tr>
<tr><td>tmTot</td><td>Total time duration of a state</td></tr>
<tr><td>tmTZ</td><td>String containing name of time zone using identifiers in industry standard time zone database referenced in IETF RFC 2445. Actual RFC 2445 time zone data is stored internally in vendor dependent manner.</td></tr>
<tr><td>tmUseDT</td><td>Flag indicating if this location uses daylight saving (summer) time</td></tr>
<tr><td>tot</td><td>Total counting data</td></tr>
<tr><td>totAvVal</td><td>Total average value of data since last reset</td></tr>
<tr><td>units</td><td>SI-unit of an analogue DATA-ATTRIBUTE; values shall be as defined in Annex A of IEC 61850-7-3.</td></tr>
<tr><td>vendor</td><td>Name of the vendor</td></tr>
<tr><td>yly</td><td>Yearly counting data</td></tr>
</table>

Annex A
(normative)

Information model for statistical data and historical statistical data

A.1 General

The analogue values defined in IEC 61850-7-3:2003 specify the following two basic data attributes as defined, for example, in the common data class MV (measured value):

instMag	AnalogueValue	instantaneous value, for example, a voltage measurement
mag	AnalogueValue	dead band filtered value

In many application domains such as wind power plants, it is required to provide additional information of a basic analogue value:

– statistical information (for example, minimum value calculated for a specified time period, for example, minimum value of last 1 hour)
– historical statistical information (for example, log of minimum values of the sequence of values calculated above, for example, last 24 hourly values)

This additional information may be derived from the basic analogue values. It may be the only information provided – depending on the application requirements.

The following examples show some possible data and how they are derived or related respectively:

– instMag (present value) (as defined in IEC 61850-7-3:2003),
– instMag (present value) → instMag (max value of last day – called statistical data),
– instMag (max value of last month).

NOTE The "→" means: right value has been derived from left value.

The specific semantic of the value instMag is defined by a special data object of a logical node instance. One logical node instance represents either the present values or maximum values, etc.

A.2 Model for statistical and historical statistical data

The models for the statistical and historical statistical data are explained conceptually in Figure A.1. On the left hand side are the basic data representing the current values (PRES), i.e. some instantaneous analogue (or integer) values that are contained in the logical node instance XXYZ.

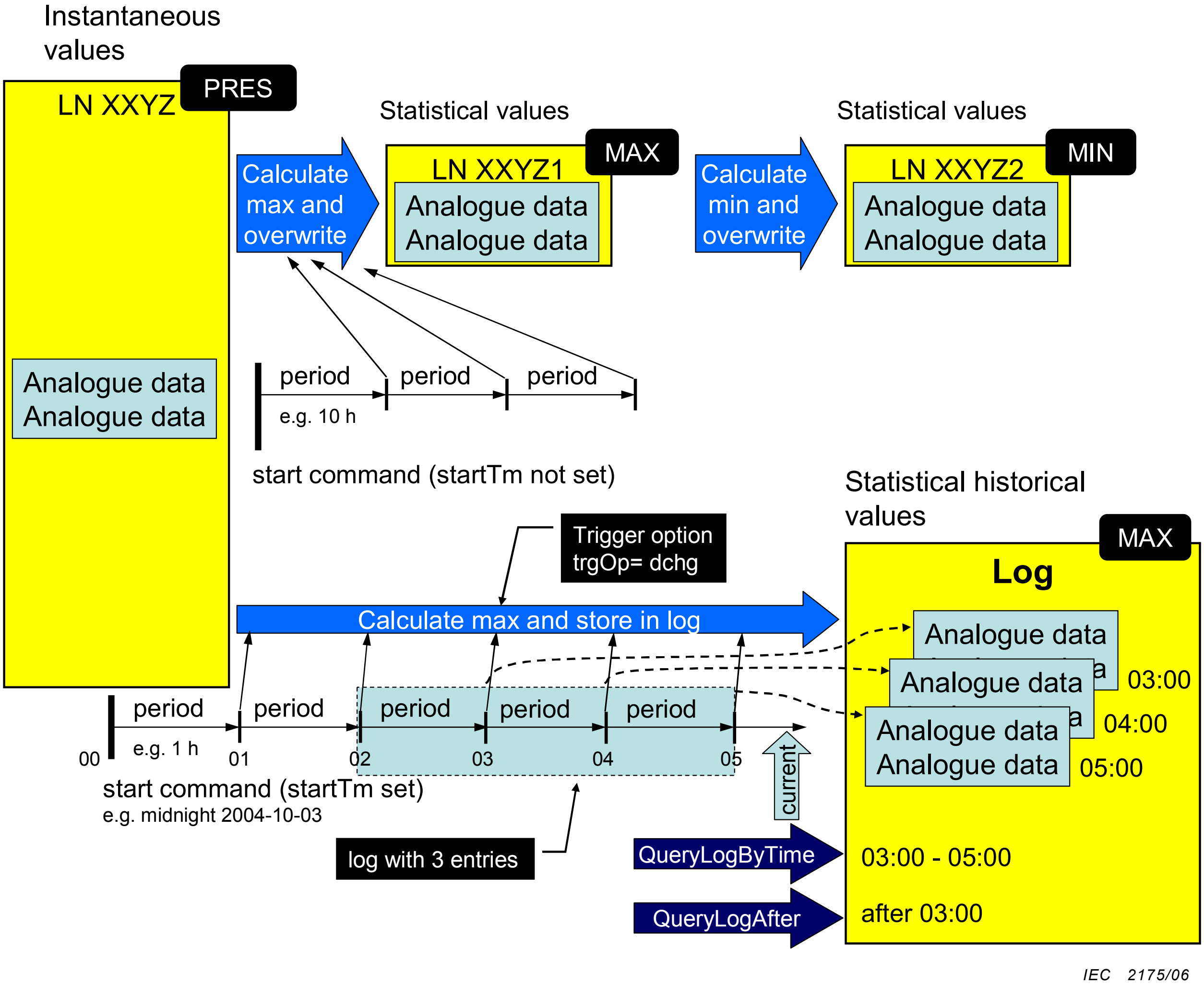


Figure A.1 – Conceptual model of statistical and historical statistical data (1)

The upper half depicts the method defined for statistical values. The first example is the instance XXYZ1 of the logical node class XXYZ. The analogue values represent the calculated maximum values derived from the instance XXYZ. The logical node XXYZ1 has a special setting data that indicates that the values are maximum values: CalcMthd equals MAX. The calculation is based on the setting data CalcPer. The period starts after a start command or by local means. At the end of the period the calculated maximum values of the instance XXYZ1 are overwritten by the new values.

The maximum values can be used to calculate the minimum maximum values in – of course – a much longer period than for the maximum calculation in XXYZ1. The instance XXYZ2 may represent the minimum value of the max value of the last 10 days.

The lower part of the figure shows the conceptual model of the historical statistical data. In this model the calculated values (in this case the maximum values) are stored in sequence in a log. The calculation in the example starts at midnight of 2004-10-03. The interval is 1 h. After that first hour the first log entry is written. After the second hour the second entry contains the value of the second hour. After five (5) hours the log contains the values of the last three hours (intervals 02-03, 03-04, 04-05).

The statistical data model is based on the calculation of analogue values contained in other logical nodes. The top logical node LN XXYZ in Figure A.2 comprises three technological logical nodes of the same Type (for example MMXU). The top logical node (LN XXYZ) represents the instantaneous measured values. The second and third logical nodes are the statistical logical nodes, i.e., the logical nodes that represent the calculated values (LN XXYZ1 represents the MIN values, the LN XXYZ2 the MAX values).

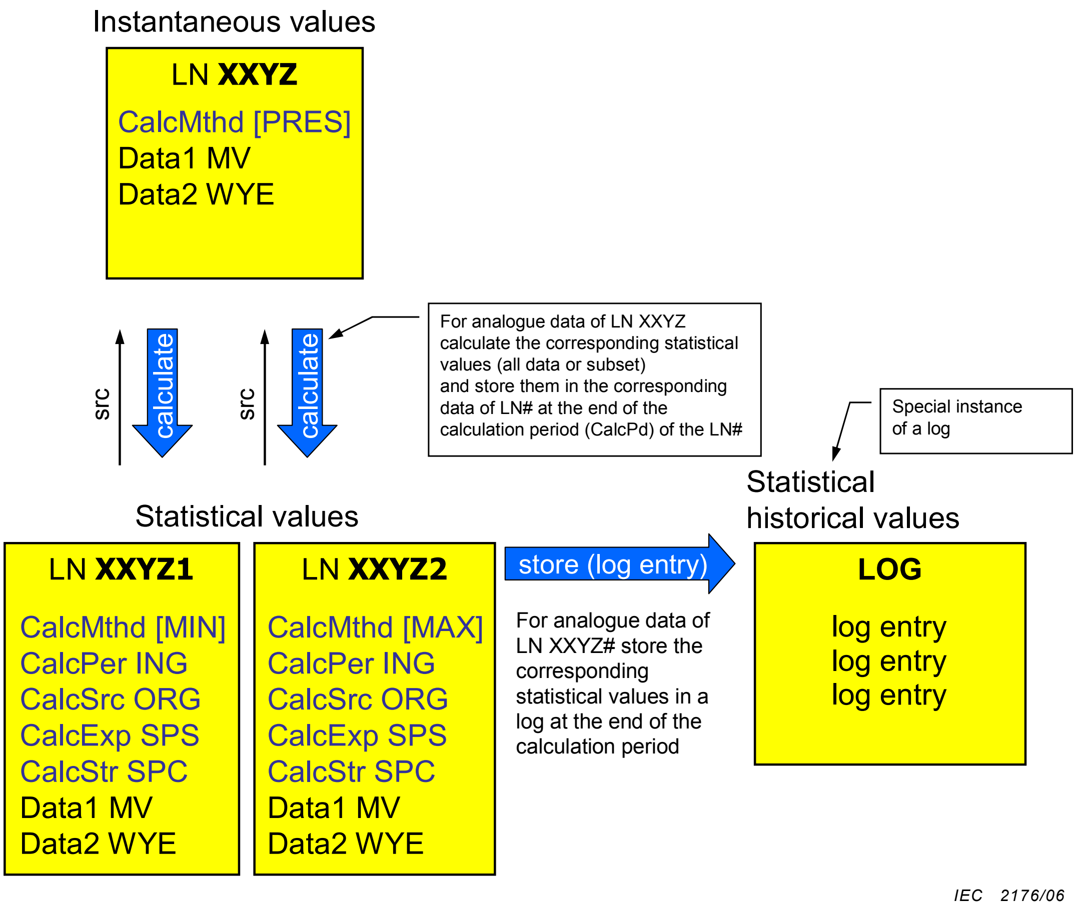


Figure A.2 – Conceptual model of statistical and historical statistical data (2)

The two logical nodes on the left of the bottom in Figure A.2 (XXYZ1 and XXYZ2) represent minimum (MIN) and maximum (MAX) values of the analogue data represented in the top logical node (XXYZ). The setting data CalcSrc (calculation source) of the two logical nodes have each the value XXYZ (this is a reference to the source logical nodes). Each logical node with analogue data can be used as a source. Additionally, they have the data CalcStr (calculation start) and CalcExp (calculation expired) and the setting data CalcPer (calculation period) and CalcSrc (calculation source).

With the settings CalcMthd, CalcPer and CalcSrc, the behaviour of the logical node can be controlled. The data CalcMthd specifies what kind of analogue data values are represented by this logical node. In this case, the logical node XXYZ1 represents the minimum (MIN) values. The data CalcPer represents the calculation interval for a statistical value. The data CalcSrc is based on the new common data class ORG (Object Reference Setting Group) specified in the first amendment to IEC 61850-7-4:2003.

A logical node representing statistical data (for example MAX values calculated every 5 min) can be used to calculate the MIN value of the MAX values in a longer period (for example, a day). The new data object CalcStr shall be used to Start (and Stop – usually the calculation is completed when the attribute CalcExp is set to TRUE) the calculation of the statistical data. The “event” CalcExp set to TRUE can be used as an event to report the new value (the statistical value) by the report control block or it may be logged as historical statistical data for later retrieval.

NOTE 1 The data names of the “Data” in all logical nodes shown in Figure A.2 are the same, i.e., in all three logical nodes. The data are contained in different logical node instances (XXYZ, XXYZ1, and XXYZ2). These result in the following references: XXYZ.Data1, XXYZ1.Data1, and XXYZ2.Data1.

NOTE 2 The models introduced and explained in this Clause are informative. The final model will be contained in future amendments to IEC 61850-7-4:2003 and IEC 61850-7-3:2003.

A.3 Logical node extension for statistical DATA

A.3.1 Data for calculation method for analogue and statistical analogue values

The wind power plant common logical node (as defined in 6.1.1) shall include the data needed for the calculation method for analogue and statistical analogue values.

A.3.2 Data name semantics

The following extension of the data name semantic (as defined in IEC 61850-7-4) shall be added to the Table 9 of IEC 61850-7-4:2003.

Table A.1 – Description of Data

<table>
<tr><th>Data name</th><th>Semantics</th></tr>
<tr><td>CalcExp</td><td>Indicates that the calculation period of a statistical logical node has expired.

This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, for example, CDC MV, CMV, WYE, etc.</td></tr>
<tr><td>CalcStr</td><td>Starts the calculation of statistical data. Either at once, or if available and set at operTm of the control model.

This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, for example, CDC MV, CMV, WYE, etc.</td></tr>
<tr><td>CalcMthd</td><td>The calculation method specifies how the Data attributes that represent analogue values have been calculated. The calculation method shall be the same for all data of a given logical node instance.

The possible values shall be as follows:
<table>
<tr><th>Value</th><th>Numeric value</th><th>Description</th></tr>
<tr><td>PRES</td><td>1</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are present values.</td></tr>
<tr><td>MIN</td><td>2</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are minimum values calculated during the corresponding calculation period calPd.</td></tr>
<tr><td>MAX</td><td>3</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are maximum values calculated during the corresponding calculation period calPd.</td></tr>
<tr><td>TOTMIN</td><td>4</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are total minimum values calculated since the start of the system.</td></tr>
<tr><td>TOTMAX</td><td>5</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are total maximum values calculated since the start of the system.</td></tr>
<tr><td>AVG</td><td>6</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are average values calculated during the corresponding calculation period calPd.</td></tr>
<tr><td>SDV</td><td>7</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are standard deviation values calculated during the corresponding calculation period calPd.</td></tr>
</table>
This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, for example, CDC MV, CMV, WYE, etc.

No data object "CalcMethd" in a logical node shall be equivalent to the value PRES.

NOTE 1 If different calculation periods are required for the data of a logical node, then different logical nodes could be instantiated – with different calculation periods.
NOTE 2 The calculation algorithm and number of samples used for the calculation is an implementation issue.</td></tr>
</table>

Data name	Semantics
CalcPer	The calculation period of a statistical logical node. The period shall always be in seconds [s]. This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, for example, CDC MV, CMV, WYE, etc. NOTE 3 The calculation algorithm and number of samples used for the calculation is an implementation issue.
CalcSrc	The reference to the logical node whose analogue data attributes are used to calculate the value contained in this logical node instance. This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, for example, CDC MV, CMV, WYE, etc.

A.4 Common data class for statistical data

A.4.1 Object reference setting group common data class (ORG)

A.4.1.1 Class model

A.4.1.1.1 General

Table A.2 defines the common data class "Object reference setting group". This common data class is used to specify the object reference to the logical node of which the statistical data have been calculated. This CDC shall be used, i.e., for the DATA **CalcSrc** to be included in the "Optional Logical Node Information" of the Common Logical Node defined in IEC 61850-7-4: 2003.

Table A.2 – Object reference setting group common data class specification

ORG class					
Attribute name	**Attribute type**	**FC**	**TrgOp**	**Value/Value range**	**M/O**
DataName	Inherited from Data Class (see IEC 61850-7-2)				
DataAttribute					
				Setting	
setVal	VISIBLE STRING129	SP		Object Reference	AC_NSG_M
				configuration, description and extension	
d	VISIBLE STRING255	DC		Text	O
dU	UNICODE STRING255	DC			O
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M
dataNs	VISIBLE STRING255	EX			AC_DLN_M
Services					
As defined in Table 39.					

A.4.1.1.2 Setting Value (setVal)

The data attribute **setVal** (Setting Value) represents the object reference to another DATA (LN, DO or DA). In this context the data shall be used to reference the logical node whose analogue data attributes are used to calculate the value contained in this logical node instance.

EXAMPLE The logical node "AB" [for PRES] may contain the present values (PRES). The logical node "CD" [for MAX] may contain the MAX values of the data contained in logical node "AB". In this case logical node "CD" references logical node "AB". A third logical node may reference the logical node CD and represent the MIN of the MAX value.

A.4.1.1.3 Configuration, description and extension

The data attributes d, dU, cdcNs, cdcName, and dataNs are the same as defined in Clause 8 of IEC 61850-7-3:2003.

Annex B
(normative)

Value range for units and multiplier

The units shall be SI units, derived from ISO 1000, represented as an enumeration. The enumeration shall be as defined in Table B.1, Table B.2, Table B.3 and Table B.4. The multiplier shall be represented as an enumeration where the value of the enumeration equals the exponent of the multiplier value in base 10, as defined in Table B.5.

Table B.1 – SI units: base units

Value	Quantity	Unit name	Symbol
1	None	dimensionless	none
2	Length	meter	m
3	Mass	kilogram	kg
4	Time	second	s
5	Current	ampere	A
6	Temperature	kelvin	K
7	Amount of substance	mole	mol
8	Luminous intensity	candela	cd

Table B.2 – SI units: derived units

Value	Quantity	Unit name	Symbol
9	Plane angle	degrees	deg
10	Plane angle	radian	rad
11	Solid angle	steradian	sr
21	Absorbed dose	Gray (J/Kg)	Gy
22	Activity	becquerel (l/s)	q
23	Relative temperature	degrees Celsius	°C
24	Dose equivalent	sievert (J/kg)	Sv
25	Electric capacitance	farad (C/V)	F
26	Electric charge	coulomb (AS)	C
27	Electric conductance	siemens (A/V)	S
28	Electric inductance	henry (Wb/A)	H
29	Electric potential	volt (W/A)	V
30	Electric resistance	ohm (VA)	Ω
31	Energy	joule (N m)	J
32	Force	newton (kg m/s^2)	N
33	Frequency	hertz (1/s)	Hz
34	Illuminence	lux (lm/m^2)	lx
35	Luminous flux	lumen (cd sr)	Lm
36	Magnetic flux	weber (V s)	Wb
37	Magnetic flux density	tesla (Wb/m^2)	T

Value	Quantity	Unit name	Symbol
38	Power	watt (J/s)	W
39	Pressure	pascal (N/m^2)	Pa

Table B.3 – SI units: extended units

Value	Quantity	Unit name	Symbol
41	Area	square meter (m^2)	m^2
42	Volume	cubic meter (m^3)	m^3
43	Velocity	meters per second (m/s)	ms^{-1}
44	Acceleration	meters per second^2 (m/s^2)	ms^{-2}
45	Volumetric flow rate	cubic meters per second (m^3/s)	m^3s^{-1}
46	Fuel efficiency	meters/cubic meter (m/m^3)	m/m^3
47	Moment of mass	kilogram meter (kg m)	M
48	Density	kilogram/cubic meter (kg/m^3)	kg/m^3
49	Viscosity	meter square/second (m^2/s)	m^2/s
50	Thermal conductivity	watt/meter Kelvin (W/m K)	W/m K
51	Heat capacity	joule/Kelvin (J/K)	J/K
52	Concentration	parts per million	ppm
53	Rotational speed	rotations per second (1/s)	s^{-1}
54	Angular velocity	radian per second (rad/s)	$rads^{-1}$

Table B.4 – SI units: industry specific units

Value	Quantity	Unit name	Symbol
61	Apparent power	volt ampere (VA)	VA
62	Real power	watts (I^2R)	W
63	Reactive power	volt ampere reactive (VISinθ)	VAr
64	Phase angle	degrees	θ
65	Power factor	(dimensionless)	cosθ
66	Volt seconds	volt seconds (Ws/A)	Vs
67	Volts squared	volt square (W^2/A^2)	V^2
68	Amp seconds	amp second (As)	As
69	Amps squared	amp square (A^2)	A^2
70	Amps squared time	amp square second (A^2s)	A^2s
71	Apparent energy	volt ampere hours	VAh
72	Real energy	watt hours	Wh
73	Reactive energy	volt ampere reactive hours	VArh
74	Magnetic flux	volts per hertz	V/Hz

Table B.5 – Multiplier

Value	Multiplier value	Name	Symbol
–24	10^{-24}	Yocto	y
–21	10^{-21}	Zepto	z
–18	10^{-18}	Atto	a
–15	10^{-15}	Femto	f
–12	10^{-12}	Pico	p
–9	10^{-9}	Nano	n
–6	10^{-6}	Micro	µ
–3	10^{-3}	Milli	m
–2	10^{-2}	Centi	c
–1	10^{-1}	Deci	d
0	1		
1	10^{1}	Deca	da
2	10^{2}	Hecto	h
3	10^{3}	Kilo	k
6	10^{6}	Mega	M
9	10^{9}	Giga	G
12	10^{12}	Tera	T
15	10^{15}	Peta	P
18	10^{18}	Exa	E
21	10^{21}	Zetta	Z
24	10^{24}	Yotta	Y

Annex C
(informative)

Wind power plant controller

C.1 General

The wind power plant control logical nodes – Wind power plant Active Power Control (WAPC) and Wind power plant Reactive Power Control (WRPC) model functionality to facilitate a wind power plant to act as a single production unit.

Based on for example the actual process information for U (Voltage), A (Current), W (Active Power), Var (Reactive Power), and Hz (Frequency), the wind power plant may be managed as a single production unit based on the various control functionalitys illustrated in this annex. Based on the measured process values the control algorithm generates a new set of reference values or set-points.

The set points are converted to a data set of reference values for the individual wind turbines and other system components involved, with respect to their capabilities and operational status.

An essential parameter in the control logic is knowledge of the generation capability for the individual turbines and the constraints in the wind power plant.

The priority between the functionality applied is an implementation specific issue and is outside the scope of the IEC 61400-25 series.

A conceptual principle of the control logic is illustrated in Figure C.1. The detailed logic is implementation specific and will not be further elaborated in this part of the IEC 61400-25 series.

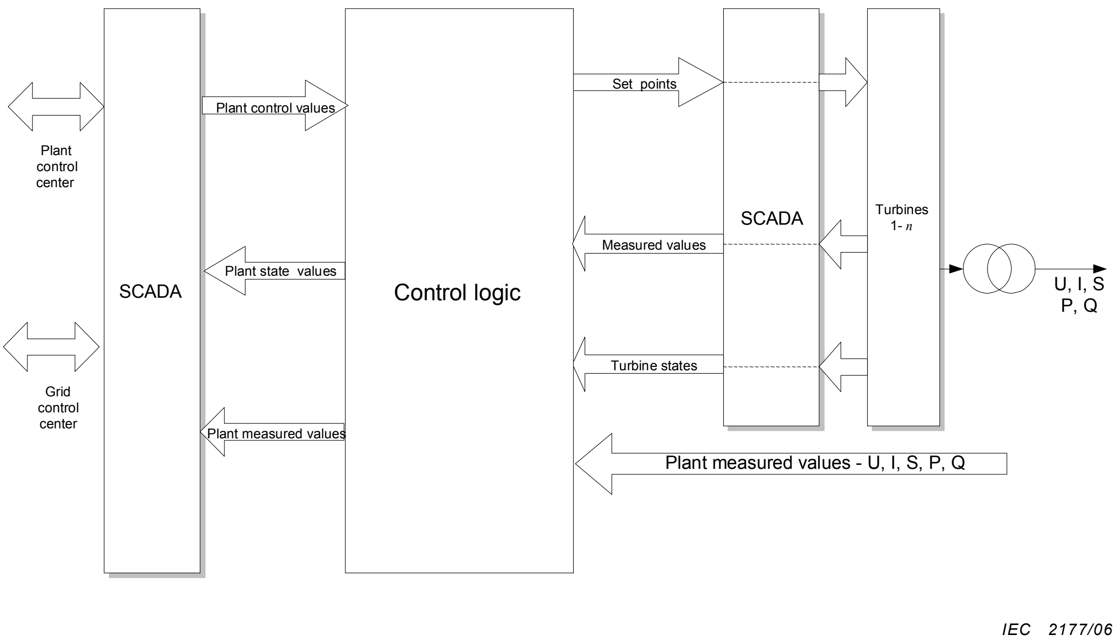


Figure C.1 – Conceptual structure of the wind power plant control functions

C.2 Active power control functions

Controlling the active power generation from a wind power plant has an added weight on priority from the utility point of view, as the generation capabilities of the wind power plant increase.

The WAPC logical node provides control functions as follows:

a) Active power limitation control – curtailment caused by various incidents (see Figure C.2).

b) Gradient power control – focus on grid stability has increased priority on gradient control (see Figure C.3)

c) Delta power control – spinning reserve of active power can be useful in frequency control (see Figure C.4)

d) Combined power control – combination of gradient, delta and active power limitation control (see Figure C.5)

e) Apparent power control function – in order to maximize life time on some wind power plant components for example transformers, control of apparent power can be applicable (see Figure C.6)

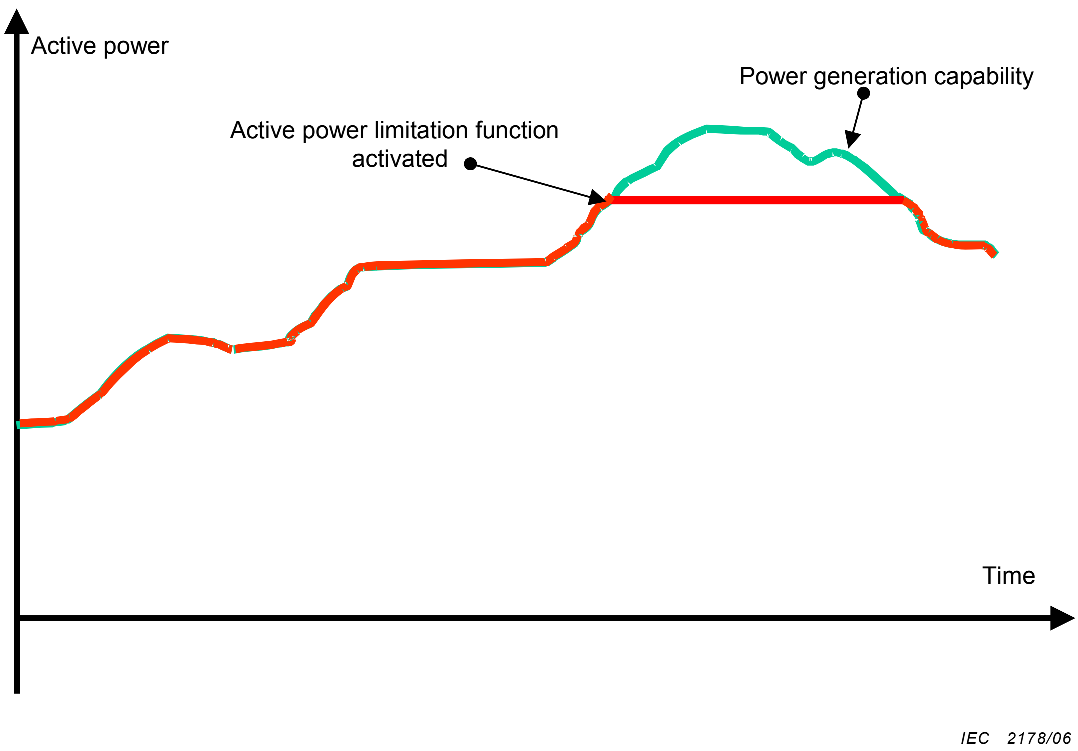


Figure C.2 – Schematic illustration of the active power limitation control function

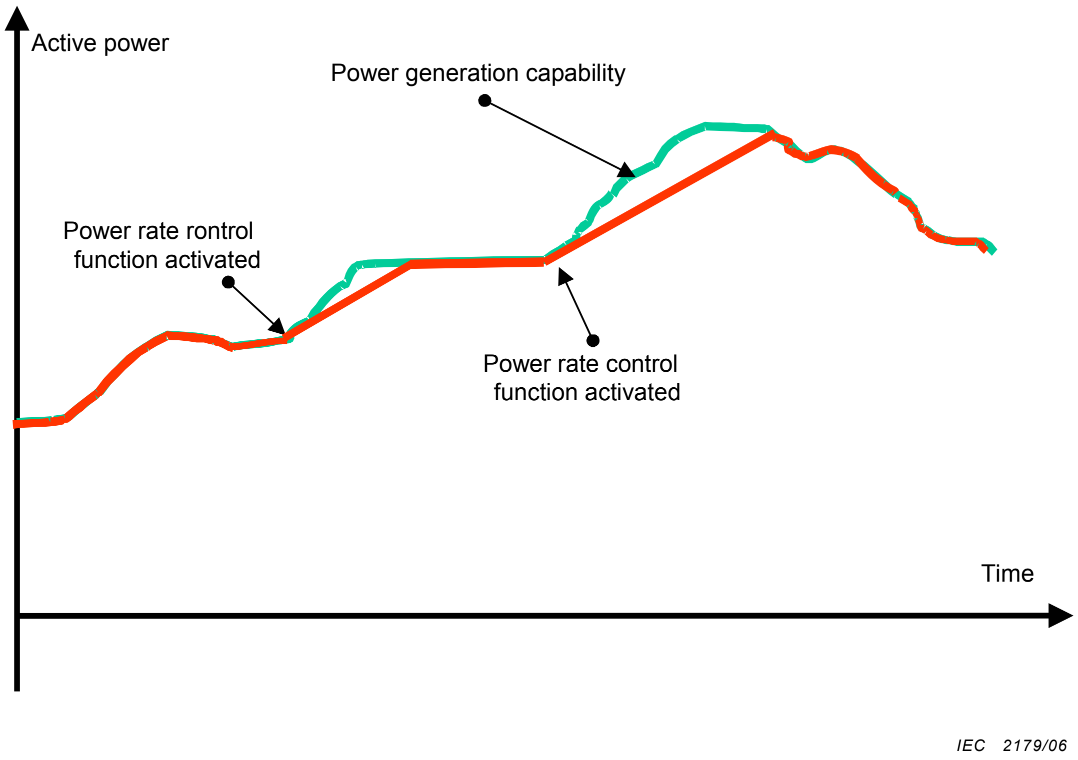


Figure C.3 – Schematic illustration of the gradient power control function

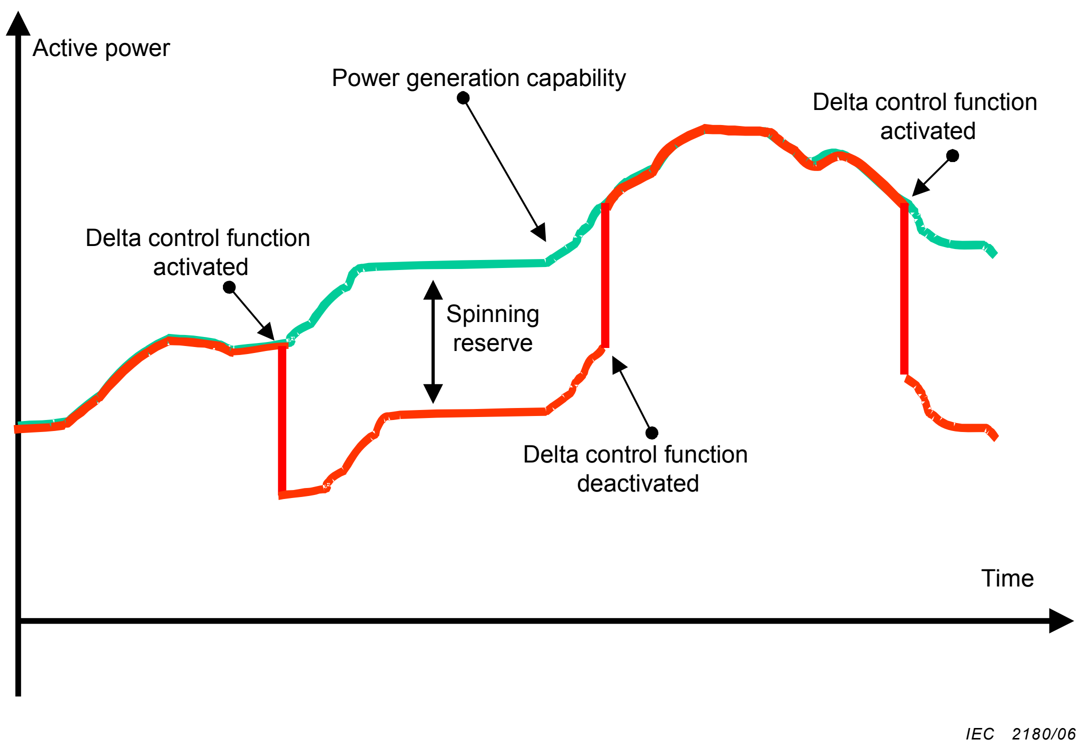


Figure C.4 – Schematic illustration of the delta power control function

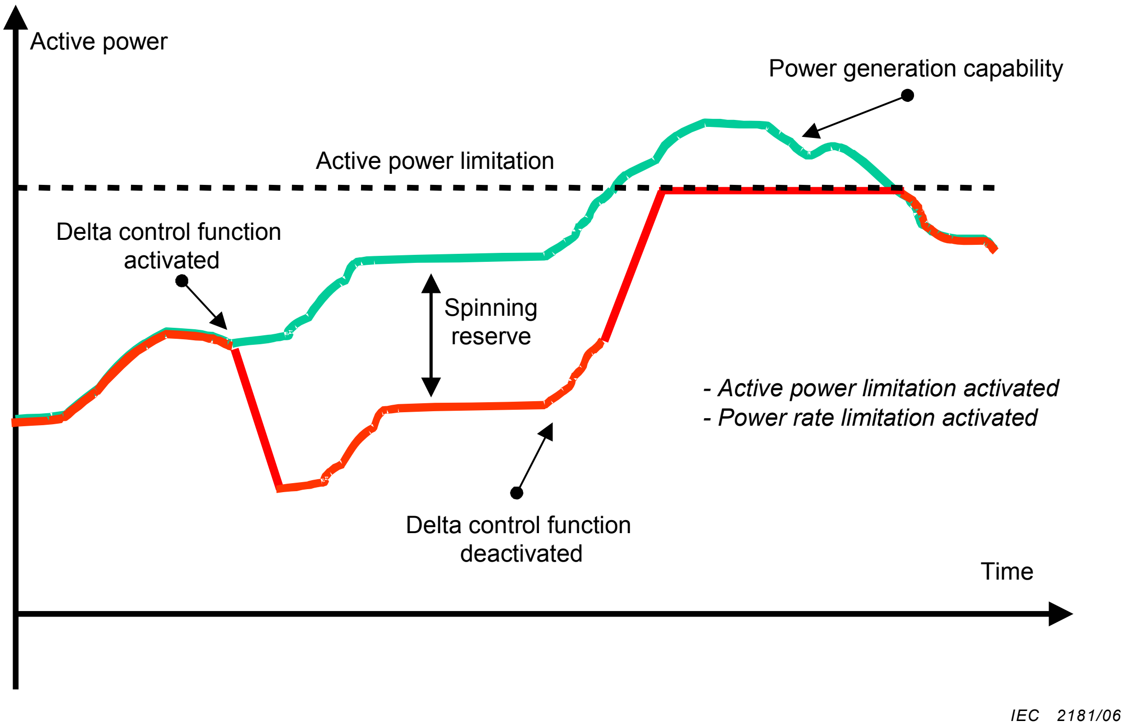


Figure C.5 – Schematic illustration of a combined control – including gradient, delta and active power limitation control

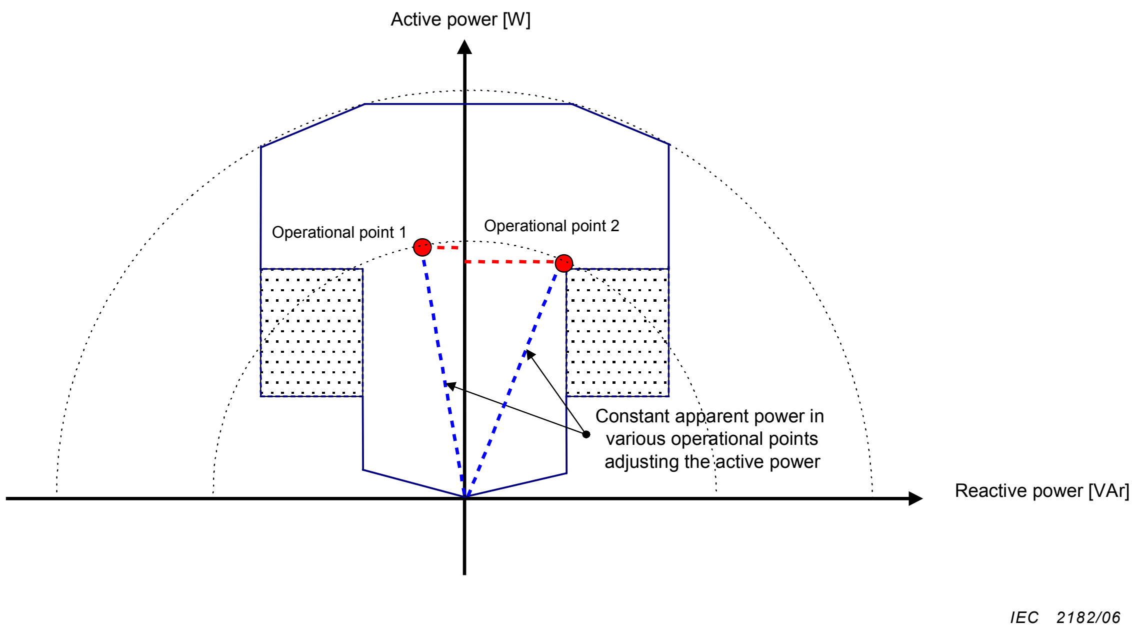


Figure C.6 – Schematic illustration of the apparent power control function

C.3 Reactive power control functions

Reactive power control functions can be implemented in the single wind turbine as well as in a common reactive correction of the wind power plant.

The WRPC logical node provides control functions as follows:

a) Reactive Power control – can be applicable to control the operational point within limits given by grid connection codes (see Figure C.7).

b) Power Factor control – can be applicable in contributing to the grid quality of supply (see Figure C.8).

c) Voltage control – can be applicable in contributing to the grid quality of supply (see Figure C.9).

In order to fulfil requirements for a common grid connection point, control of reactive power can be applicable. Usually grid connection requirements specify the operational limits for reactive power and the constraints for the operation of the wind power plant.

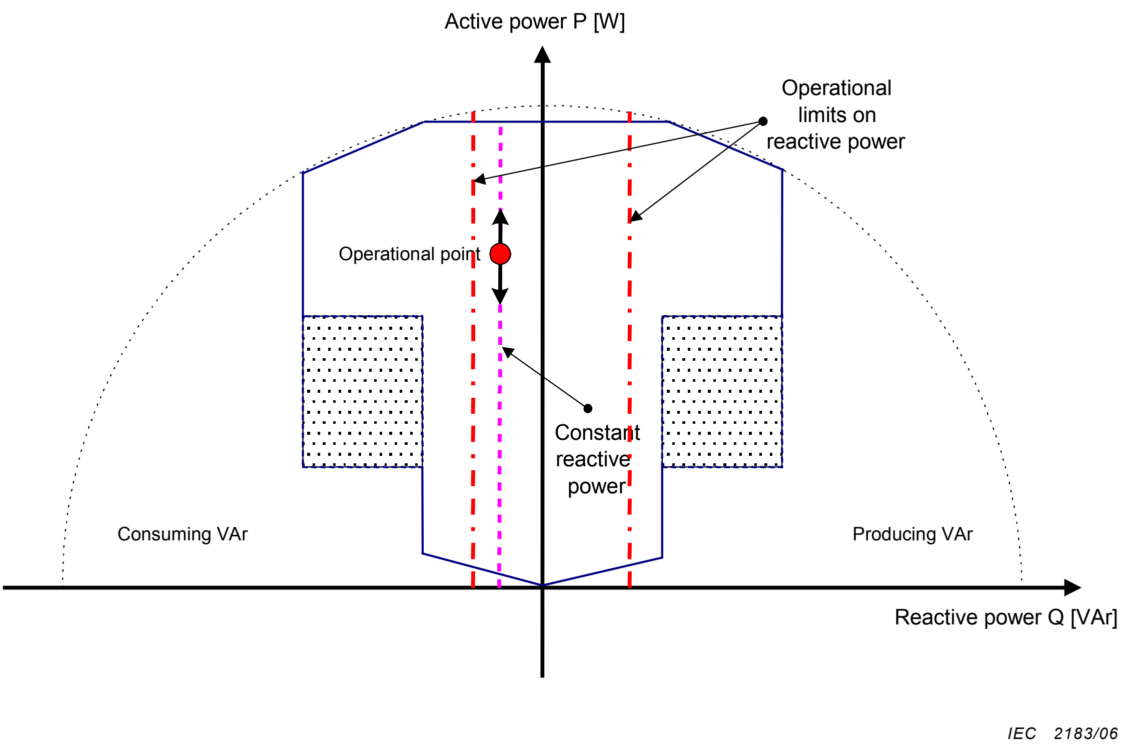


Figure C.7 – Schematic illustration of the reactive power control function

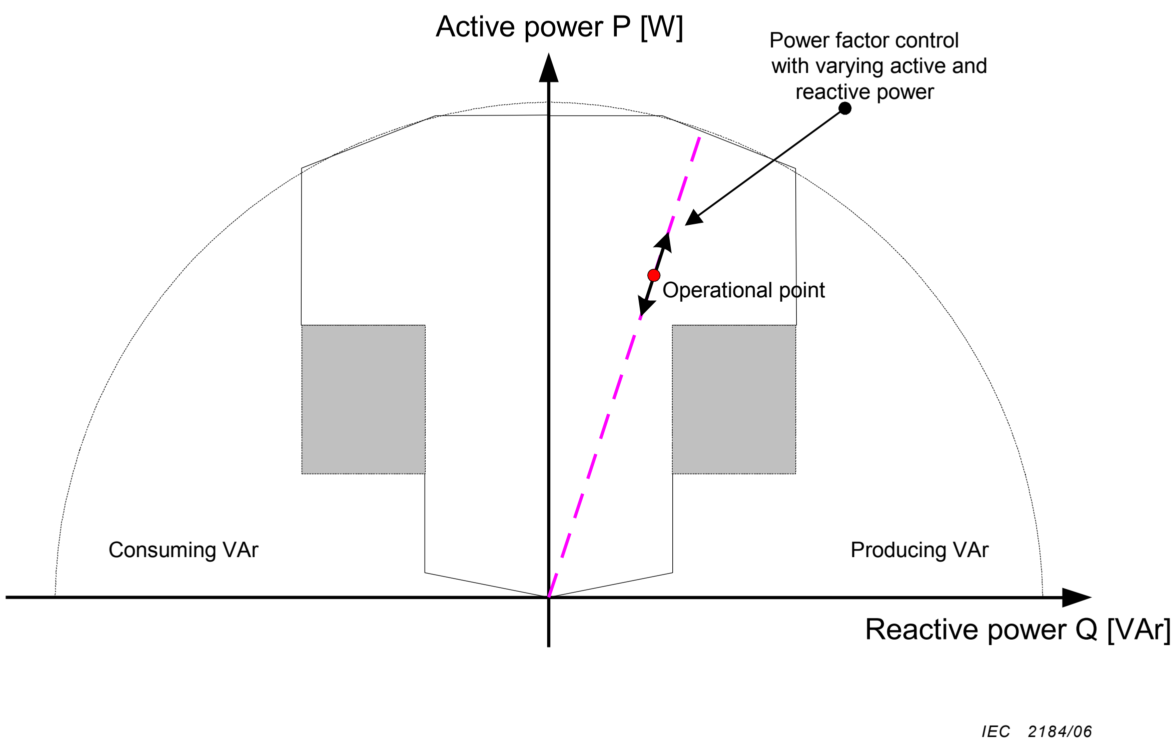


Figure C.8 – Schematic illustration of the power factor control function

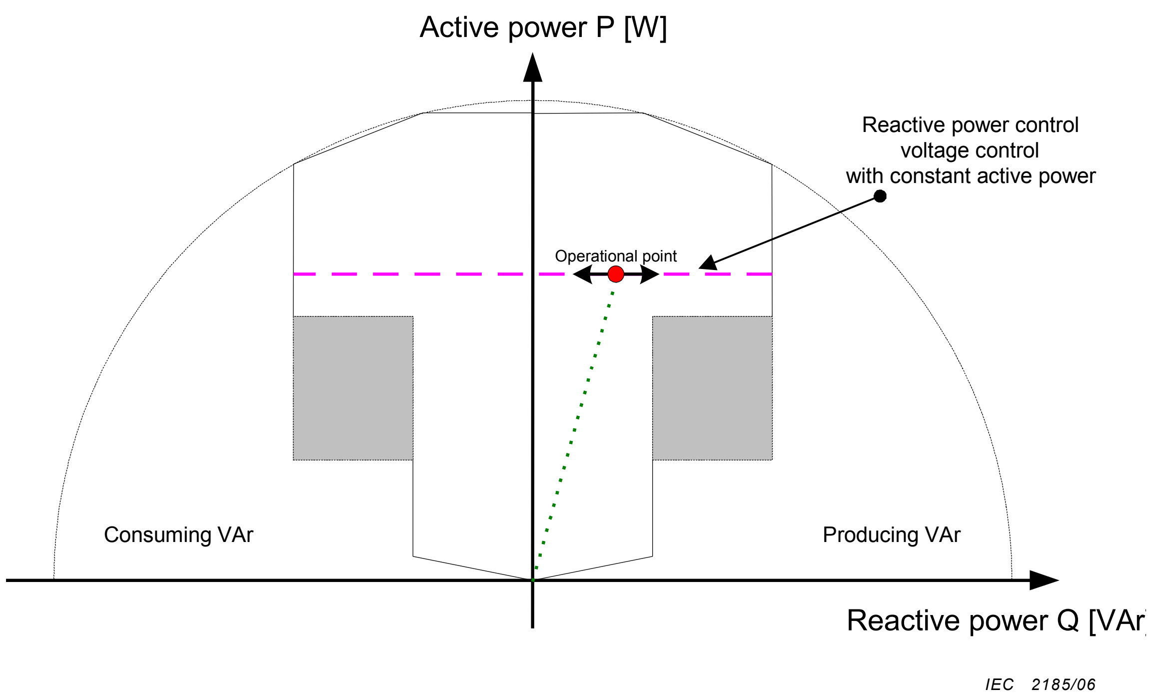


Figure C.9 – Schematic illustration of the voltage control function using reactive power control

Annex D
(informative)

List of mandatory logical nodes and data

D.1 General

The objective of this annex is to provide a list of all mandatory logical nodes, data and associated data attributes – see Tables D.1 to D.6.

Table D.1 – Mandatory system specific logical nodes

LN classes	Description
LLN0	Logical Node Zero
LPHD	Physical Device Information

Table D.2 – Mandatory wind power plant specific logical nodes

LN classes	Description
WTUR	Wind turbine general information

Table D.3 – Mandatory wind turbine specific logical nodes

LN classes	Description
WALM	Wind power plant alarm information
WGEN	Wind turbine generator information
WNAC	Wind turbine nacelle information
WROT	Wind turbine rotor information
WTUR	Wind turbine general information
WYAW	Wind turbine yawing information

Table D.4 – Mandatory wind power plant specific common data classes (CDC)

CDC	Description
ALM	Alarm
CMD	Command
CTE	Event counting
SPV	Setpoint value
STV	Status value

Table D.5 – Mandatory common data classes inherited from IEC 61850-7-3

CDC	Description
INS	Measured value
LPL	Logical node name plate
MV	Measured value
SPS	Integer status
WYE	Phase to ground related measured value of a three pahse system

Table D.6 – Mandatory common data classes inherited from IEC 61850-7-3 and specialised

CDC	Description
WDPL	Device nameplate, inhereted form DPL

Standards Survey

The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!

Customer Service Centre (CSC)

International Electrotechnical Commission
3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC**/CSC at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

Nicht frankieren
Ne pas affranchir

Non affrancare
No stamp required

A Prioritaire

RÉPONSE PAYÉE

SUISSE

Customer Service Centre (CSC)
International Electrotechnical Commission
3, rue de Varembé
1211 GENEVA 20
Switzerland

Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

....

Q2 Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

- purchasing agent ❑
- librarian ❑
- researcher ❑
- design engineer ❑
- safety engineer ❑
- testing engineer ❑
- marketing specialist ❑
- other...

Q3 I work for/in/as a: *(tick all that apply)*

- manufacturing ❑
- consultant ❑
- government ❑
- test/certification facility ❑
- public utility ❑
- education ❑
- military ❑
- other...

Q4 This standard will be used for: *(tick all that apply)*

- general reference ❑
- product research ❑
- product design/development ❑
- specifications ❑
- tenders ❑
- quality assessment ❑
- certification ❑
- technical documentation ❑
- thesis ❑
- manufacturing ❑
- other...

Q5 This standard meets my needs: *(tick one)*

- not at all ❑
- nearly ❑
- fairly well ❑
- exactly ❑

Q6 If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

- standard is out of date ❑
- standard is incomplete ❑
- standard is too academic ❑
- standard is too superficial ❑
- title is misleading ❑
- I made the wrong choice ❑
- other ....

Q7 Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

- timeliness ....
- quality of writing....................................
- technical contents.................................
- logic of arrangement of contents ....
- tables, charts, graphs, figures...............
- other ....

Q8 I read/use the: *(tick one)*

- French text only ❑
- English text only ❑
- both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

....
....
....
....
....
....
....
....
....
....
....
....

ISBN 2-8318-8913-8

9 782831 889139

ICS 27.180

Typeset and printed by the IEC Central Office
GENEVA, SWITZERLAND