

INTERNATIONAL STANDARD

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Wind turbines –

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

Eoliennes –

**Partie 25-2: Communications pour la surveillance et la commande des centrales
éoliennes – Modèles d'information**



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INTERNATIONAL STANDARD

NORME INTERNATIONALE



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Information models**

Eoliennes –

**Partie 25-2: Communications pour la surveillance et la commande des centrales
éoliennes – Modèles d'information**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND TURBINES –

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

FOREWORD

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International Standard IEC 61400-25-2 has been prepared by IEC technical committee 88: Wind turbines.

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

FDIS	Report on voting
88/539FDIS	88/551/RVD

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

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

The scope of revision includes:

- harmonization with Common Data Classes in Edition 2 of IEC 61850-7-3,
- harmonization with Logical node classes in Edition 2 of IEC 61850-7-4,
- harmonization with Information models in IEC 61850-7-410 and IEC 61850-7-420,
- reduction of overlap between standards and simplification by increased referencing,
- extension of Data objects for operation of smart grids (in US and other areas),
- extended and enhanced semantics for existing data objects,

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

- a) The model on alarm handling has been revised and the logical node WALM and associated cdc's have been modified.
- b) A new logical node class WPPD that represents general data for non-turbine devices has been added.
- c) A new logical node class WAVL that represents availability data has been added.
- d) WMET has been revised and harmonized with MMET. If MMET is extended with data object for altitude and ice then WMET may be deleted in future editions.
- e) External Met sensors (WndDir, WndSpd, Humidity, Pressure, Temperature) have been removed from WNAC and moved to WMET.
- f) Some data types, such as CtxInt, are not supported by IEC 61850 so other data types need to be used.
- g) Abbreviations have been changed to resolve inconsistencies with IEC 61850. This affects several data names.
- h) Enumeration values and definitions in the standard have been harmonized.
- i) Additional data objects regarding smart grid have been added.
- j) Wind power specific CDCs that in Edition 1 contained subsets of attributes of CDCs from IEC 61850-7-3 now implicitly include all attributes of these CDCs.
- k) Technical issues related to IEC 61400-25-2:2006 have been resolved and results incorporated in the standard.
- l) The presence conditions for statistical information has been modified compared to IEC 61850-7-4:2010.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

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 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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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 IEC 61400-25-4.

To reach interoperability, all data in the information model need a strong definition with regard to syntax and semantics. The semantics of the data are 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 many 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 intelligent electronic 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, data object name and data attribute name definitions found in this part and the associated semantics are fixed.

NOTE 1 Performance of the IEC 61400-25 series implementations is 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).

NOTE 2 Authorisation processes using PKI, role based access control as e.g. defined in the IEC 62351 series of standards or other security and access safety methods are beyond the scope of this standard.

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:

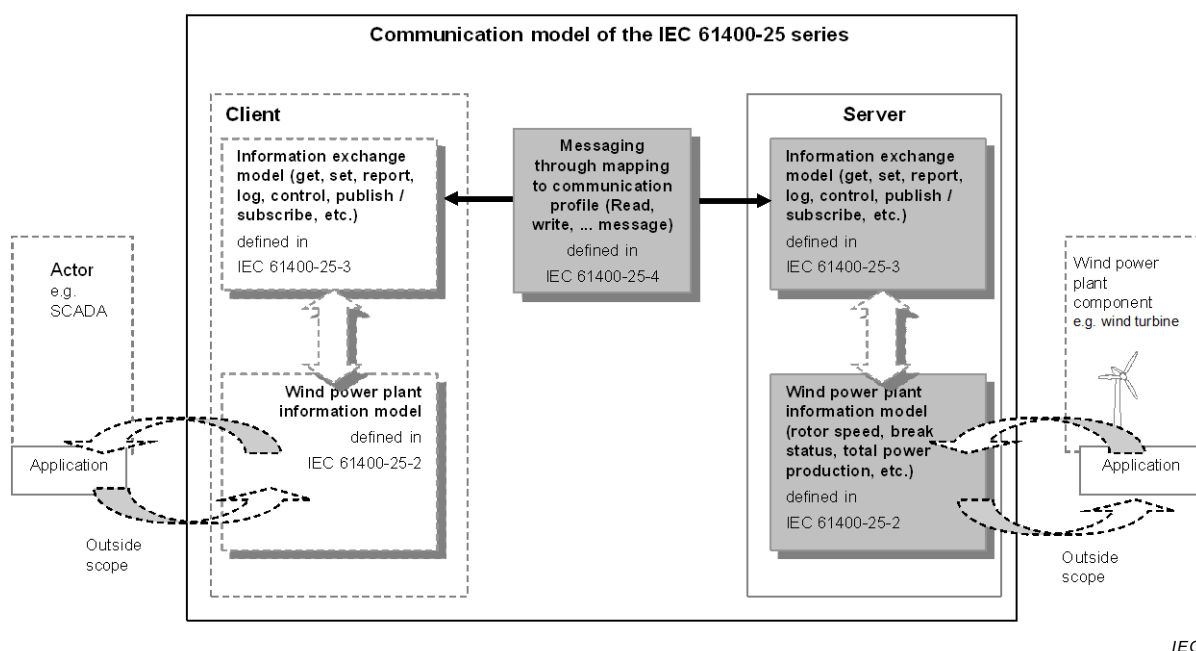
- information provided by a wind power plant component, for example “wind turbine rotor speed” or “total power production of a certain time interval”, is modelled and made available for access;
- services to exchange values of the modelled information defined in IEC 61400-25-3;
- mapping to a communication 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.



IEC

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

Devices implementing the information model of this part 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 61400-25-1, *Wind turbines – Part 25-1: Communications for monitoring and control of wind power plants – Overall description of principles and models*

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

IEC 61400-25-4:___¹, *Wind turbines – Part 25-4: Communications for monitoring and control of wind power plants – Mapping to communication profile*

IEC TS 61400-26-1:2011, *Wind turbines – Part 26-1: Time-based availability for wind turbine generating systems*

IEC 61850-5, *Communication networks and systems for power utility automation – Part 5: Communication requirements for functions and device models*

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

IEC 61850-7-2:2010, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

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

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

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

ISO 80000-1, *Quantities and units – Part 1: General*

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

IEEE 754, *Standard for Binary Floating-Point Arithmetic*

¹ To be published.

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 objects 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, alternating current
Acs	Access
Act	Action, activity, active, activate
Alm	Alarm
Alt	Altitude
An	Analogue
Ane	Anemometer
Ang	Angle
Avl	Availability
Bec	Beacon
Beh	Behaviour
Bl	Blade
Blb	Bulb
Blk	Block, blocked
Brg	Bearing
Brk	Brake
Cab	Cable
Cap	Capability, capacity
Ccw	Counter clockwise
Chk	Check
Chr	Characteristic
Cl	Cooling, cooling system
Clc	Calculate, calculated, calculation
Cloud	Cloud
Cmd	Command
Cnt	Counter, counting
Cnv	Converter
Ctl	Control
Cut	Cut, cut-out, cut-in
Cvr	Cover, cover level
Cw	Clockwise
DC	DC, direct current
Dcl	DC-link
Dct	Direct
Dehum	De-humidifier
Del	Delta
Den	Density
Dev	Device
Dew	Dew
Dff	Diffuse
Dir	Direction
DI	Daylight
Dmd	Demand
Dn	Down, downstream
Drp	Droop
Dsp	Displacement
Dur	Duration
EE	External equipment
Emg	Emergency

Term	Description
Ena	Enabled, enable, allow operation
Env	Environment
Eq	Equalization, equal
Exp	Expired
Expt	Export
Ext	Excitation
Fil	Filter, filtration, filtration system
Fll	Fall
Flsh	Flash, flashing
Gbx	Gearbox
Gn	Generator
Gr	Group
Gra	Gradient
Gri	Grid
Gs	Grease
Gust	Gust
Health	Health
Hi	High, highest
Hor	Horizontal
Ht	Heating, heating system
Htex	Heat-exchanger
Hub	Hub
Hum	Humidity
Hy	Hydraulic, hydraulic system
Hz	Frequency
Ia	Information available
Iafm	Information available force majeure
Iano	Information available nonoperative
Ianofo	Information available nonoperative forced outage
Ianopca	Information available nonoperative planned corrective actions
Ianos	Information available nonoperative suspended
Ianosm	Information available nonoperative scheduled maintenance
Iao	Information available operative
Iaog	Information available operative generating
Iaogfp	Information available operative generating with full performance
Iaogpp	Information available operative generating with partial performance
Iaong	Information available operative nongenerating
Iaongel	Information available operative nongenerating out of electrical specification
Iaongen	Information available operative nongenerating out of environmental specification
Iaongrs	Information available operative nongenerating requested shutdown
Iaongts	Information available operative nongenerating technical standby

Term	Description
Ice	Ice
Impt	Import
In	Input
Inl	Inline
Inlet	Inlet
Insol	Insolation
Intn	Internal
Intv	Interval
Iu	Information unavailable
Key	Key, physical control device
Lev	Level
Lft	Lifting, lift
Lim	Limit
Lo	Low
Loc	Local
Log	Log
Lu	Lubrication
Lum	Luminosity
Min	Minimum
Mod	Mode
Mth	Method
Nam	Name
Num	Number
Of	Off line
Oil	Oil
Op	Operate, Operating
Out	Output
Ov	Over, override, overflow
Per	Periodic, period
PF	Power factor
Phs	Phase
Phy	Physical
Pl	Plant
Plt	Plate, long-term flicker severity
PNV	Phase to neutral voltage
Pos	Position
PPV	Phase to phase voltage
Pres	Pressure
Prod	Production
Proxy	Proxy
Pt	Point
Pth	Pitch
Pwr	Power
Ref	Reference
Rf	Refreshment
Rn	Rain
Rot	Rotational, rotor
Rp	Report
Rs	Reset, resettable
Shft	Shaft
Sign	Sign

Term	Description
Snw	Snow
Spd	Speed
Spt	Setpoint
Src	Source
St	Status, state
Sta	Station, function at plant level
Stat	Statistics
Stop	Stop
Str	Start
Stt	Stator
Sub	Sub
Sup	Supply
Sw	Switch, switched
Syn	Synchronisation, synchronous, synchronism
Sys	System
Tgt	Target
Tm	Time
Tmh	Time in hours
Tmms	Time in milli seconds
Tmp	Temperature
Tms	Time in seconds
Tnk	Tank
Torq	Torque
Tot	Total
Trf	Transformer
Trg	Trigger
Tur	Turbine
Typ	Type
Up	Up, upstream
Urg	Urgent
V	Voltage
VA	Apparent power (volt amperes)
Val	Value
VAr	Reactive power (volt amperes reactive)
VArh	Reactive energy
Vbr	Vibration
Ver	Vertical
Vis	Visibility
W	Active power
Wac	Watchdog
Wd	Wind
Wet	Wet
Wh	Watt hours
Wrm	Warm
Wtr	Water
Wup	Windup
Xdir	X-direction
Ydir	Y-direction
Yw	Yaw

5 General

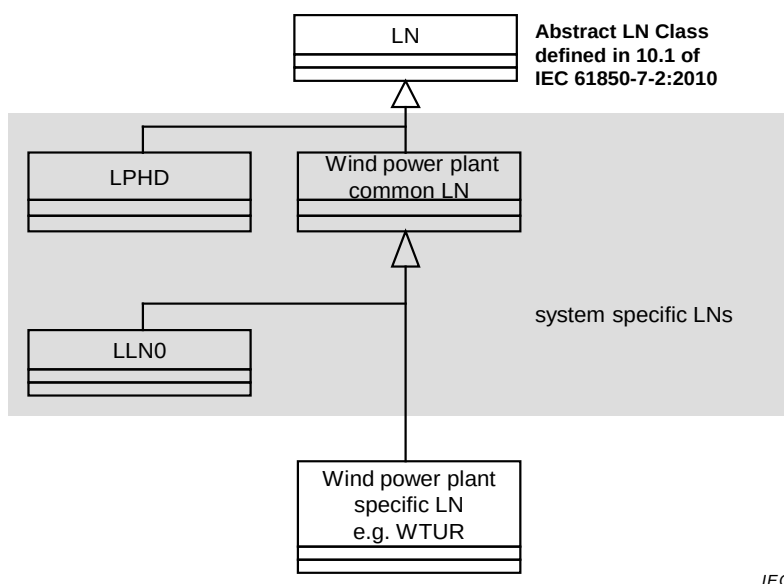
5.1 Overview of logical node classes

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 (GenLogicalNode, see Figure 2) defined in 10.1 of IEC 61850-7-2:2010. 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 wind power plant common logical node.



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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 61850-7-1:2011).

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. A wind power plant consists of several components, including one or more wind turbines, which may be modelled as individual devices. Table 2 shows the wind power plant general information break down into logical nodes which are common to a complete wind power plant. The logical nodes associated with the individual turbines are listed in Table 3.

Table 2 – Wind power plant general logical nodes

LN classes	Description	M/O
WTUR	Wind turbine general information	O
WPPD	Wind power plant general information	O
WALM	Alarm information	O
WMET	Meteorological information	O
WAPC	Active power control information	O
WRPC	Reactive power control information	O
WSLG	State log information	O
WALG	Analogue log information	O
WREP	Report information	O
WAVL	Availability information	O
LTIM	Time management (inherited from IEC 61850-7-4)	O

Table 3 shows the breakdown of a wind turbine into the logical nodes to be used. Each model of a wind turbine shall include the mandatory logical nodes listed in Table 3. Despite the fact that some logical nodes are optional for use, it is recommended in the IEC 61400-25 series to deviate as little as possible from the logical nodes as proposed in Table 3.

Table 3 – Logical nodes for modelling a wind turbine

LN classes	Description	M/O
WTUR	General information	M
WROT	Rotor information	M
WTRM	Transmission information	O
WGEN	Generator information	M
WCNV	Converter information	O
WTRF	Transformer information	O
WNAC	Nacelle information	M
WYAW	Yawing information	M
WTOW	Tower information	O
WALM	Alarm information	M
WMET	Meteorological information	O
WSLG	State log information	O
WALG	Analogue log information	O
WREP	Report information	O
WAVL	Availability information	O
LTIM	Time management (inherited from IEC 61850-7-4)	O

Table 4 shows the wind power plant device specific information for non wind turbine devices break down into logical nodes.

Table 4 – Logical nodes for modelling a non-turbine device

LN classes	Description	M/O
WPPD	Wind power plant device general information	O
WALM	Alarm information	O
WMET	Meteorological information	O
WAPC	Active power control information	O
WRPC	Reactive power control information	O
WSLG	State log information	O
WALG	Analogue log information	O
WREP	Report information	O
WAVL	Availability information	O
LTIM	Time management (inherited from IEC 61850-7-4)	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 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 5.16.2 and 5.10.12 of IEC 61850-7-4:2010, have to be instantiated in real systems. Figure 3 depicts an example of a real wind turbine that uses several instances of logical nodes.

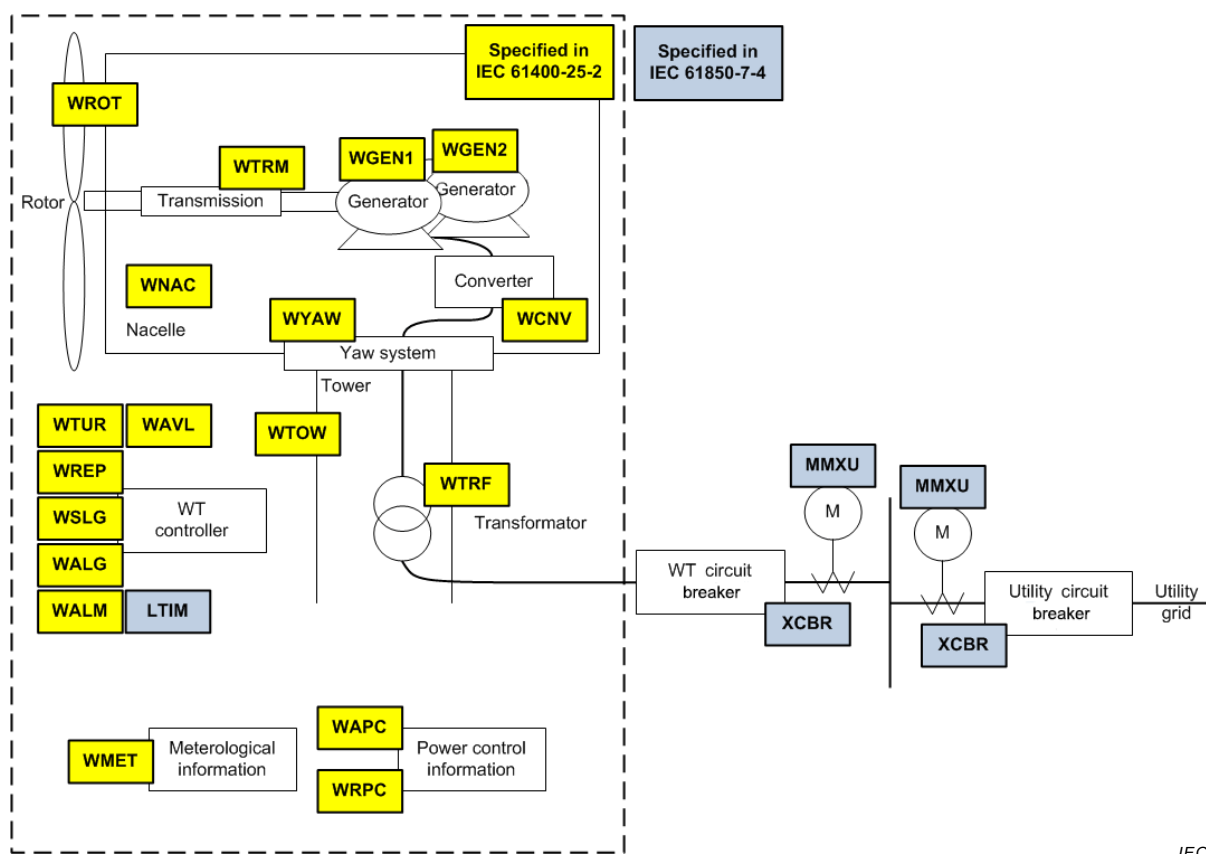


Figure 3 – Use of instances of logical nodes

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 61850-7-4:2010. The name space concept defined in Clause 14 of IEC 61850-7-1:2011 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 5.

Table 5 – Wind power plant common logical node class

Wind power plant common logical node class			
Data Object Name	Common Data Class	Explanation	M/O
LNName		Logical node name. Shall be inherited from GenLogicalNode Class (see 10.1 of IEC 61850-7-2:2010)	M
LNRef		Logical node reference. Shall be inherited from GenLogicalNode Class (see 10.1 of IEC 61850-7-2:2010)	M
Data Objects			
<i>Mandatory and conditional logical node information (Shall be inherited by ALL LN but LPHD)</i>			
<i>Descriptions</i>			
NamPlt	LPL	Name plate (inherited from IEC 61850-7-4)	C1
<i>Status information</i>			
Beh	ENS	Behaviour (inherited from IEC 61850-7-4)	M
Health	ENS	Health (inherited from IEC 61850-7-4)	C1
<i>Controls</i>			
Mod	ENC	Mode (inherited from IEC 61850-7-4)	C1
CmdBlk	SPC	Blocking of control sequences and action triggers of controllable data objects (inherited from IEC 61850-7-4)	C2
<i>Optional logical node information</i>			
EEHealth	INS	External equipment health (inherited from IEC 61850-7-4)	O
EENam	WDPL	External equipment name plate	O
OpCntRs	INC	Operation counter resettable (inherited from IEC 61850-7-4)	O
OpCnt	INS	Operation counter (inherited from IEC 61850-7-4)	O
OpTmh	INS	Operation time in hours (inherited from IEC 61850-7-4)	O
<i>Logical node information (statistical calculation specific – refer to Annex A and IEC 61850-7-4:2010 Annex F)</i>			
<i>Status information</i>			
ClcExp	SPS	Calculation period expired	O
<i>Controls</i>			
ClcStr	SPC	Enables the calculation start at time operTm from the control model (if set) or immediately	O
<i>Settings</i>			
ClcMth	ENG	Calculation method of statistical data. Allowed values: UNSPECIFIED TRUE_RMS PEAK_FUNDAMENTAL RMS_FUNDAMENTAL MIN MAX AVG SDV PREDICTION RATE	C3
ClcMod	ENG	Calculation mode. Allowed values: TOTAL PERIOD SLIDING	C4
ClcIntvTyp	ENG	Calculation interval type	C4
ClcIntvPer	ING	In case ClcIntvTyp equals to MS, PER-CYCLE, CYCLE, DAY, WEEK, MONTH, YEAR, number of units to consider to calculate the calculation interval duration	C4
NumSubIntv	ING	The number of sub-intervals a calculation period interval duration contains	O
ClcRfTyp	ENG	Refreshment interval type	O
ClcRfPer	ING	In case ClcIntvTyp equals to MS, PER-CYCLE, CYCLE, DAY, WEEK, MONTH, YEAR, number of units to consider to calculate the refreshment interval duration	O
ClcSrc	ORG	Object reference to source logical node	C5

Wind power plant common logical node class			
ClcNxTmms	ING	Remaining time up to the end of the current calculation interval in ms	O
InSyn	ORG	Object reference to the source of the external synchronization signal for the calculation interval	O
Condition C1:	Mod, Health and NamPlt shall be inherited by LLN0 of the root LD of a hierarchy as mandatory and by all other LN as optional.		
Condition C2:	CmdBlk shall be inherited as optional data object by all LNs which contain controllable data objects additionally to Mod, if there is no BlkOpn/BlkCls available (like in XCBR).		
Condition C3:	This data object is optional but mandatory when considering statistical calculation, especially the MMXU, MMXN LN.		
Condition C4:	These data objects are mandatory, except when ClcMth equals UNSPECIFIED.		
Condition C5:	This data object is mandatory, if the considered LN is performing statistical calculation derived from another LN.		
NOTE The presence of ClcSrc in a logical node instance indicates that the LN is a derived LN (ie contains statistical data derived from another LN of the same class.) The conditional data C1 and C2 are mandatory if ClcSrc is absent, otherwise forbidden, with exception for “analogue value”.			

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 LN: Logical node zero Name: LLN0

The LLN0 class shall be used to address common issues for Logical Devices as defined in Table 6.

Table 6 – Logical node zero class

LLNO class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1).	M
Data Objects			
<i>Status information</i>			
LocKey	SPS	Local operation for complete logical device (inherited from IEC 61850-7-4)	O
Loc	SPS	Local control behaviour (inherited from IEC 61850-7-4)	O
<i>Controls</i>			
LocSta	SPC	Switching authority at station level (inherited from IEC 61850-7-4)	O
<i>Settings</i>			
GrRef	ORG	Reference to a higher level Logical Device	O

LLN0 represents the root name space (logical device namespace, IdNs) for a logical device. The value for the IEC 61400-25 series is “IEC 61400-25:2014”. 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 LN: Physical device information Name: LPHD

The LPHD class shall model common issues for physical devices as defined in Table 7.

Table 7 – Physical device information class

LPHD class			
Data Object Name	Common Data Class	Explanation	M/O
LNName		Logical node name. Shall be inherited from Logical Node Class (see IEC 61850-7-2)	
Data Objects			
<i>Descriptions</i>			
PhyNam	WDPL	Physical device name plate (see 7.4.2.2)	M
<i>Status information</i>			
PhyHealth	ENS	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
<i>Controls</i>			
RsStat	SPC	Reset device statistics (inherited from IEC 61850-7-4)	O

6.2 Wind power plant specific logical nodes

6.2.1 LN: Wind power plant general information Name: WPPD

The logical node comprises the data classes that represent a wind power plant device with its general information.

Table 8 – LN: Wind power plant general information (WPPD)

WPPD class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
StrCnt	CTE	Number of device starts (vendor-specific)	O
StopCnt	CTE	Number of device stops (vendor-specific)	O
<i>Status</i>			
DevSt	STV	Device status	M
<i>Measured and metered values</i>			
<i>Controls</i>			
DevOp	CMD	Device operation command	O

6.2.2 LN: Wind turbine general information Name: WTUR

The logical node comprises the data classes that represent the wind turbine general information as listed in Table 9. 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 9 – LN: Wind turbine general information (WTUR)

WTUR class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
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
<i>Status information</i>			
TurSt	STV	Turbine status	M
<i>Measured and metered values</i>			
W	MV	Active power generation	M
VAR	MV	Reactive power generation	O
<i>Controls</i>			
TurOp	CMD	Wind turbine operation command	M
VARovW	SPC	Activate wind turbine reactive power priority over active power	O
DmdVSpt	SPV	Turbine voltage output setpoint	O
DmdWSpt	SPV	Turbine active power generation setpoint	O
DmdVARspt	SPV	Turbine reactive power generation setpoint	O
DmdPFSpt	SPV	Turbine power factor setpoint	O

6.2.3 LN: Wind turbine rotor information Name: 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 10 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 10 – LN: Wind turbine rotor information (WROT)

WROT class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
RotSt	STV	Status of rotor	O
BIS	STV	Status of blade as feedback from the pitch system	O
PthCtlSt	STV	Status of pitch control	O
<i>Measured and metered values</i>			
RotSpd	MV	Rotational speed	O
RotPos	MV	Angular rotor position	O
HubTmp	MV	Temperature in the rotor hub	O
BIPthHyPres	MV	Pressure of hydraulic pitch system	O
BIPthAngTgt	MV	Pitch angle target value	O
BIPthAngVal	MV	Pitch angle for blade as feedback from the pitch system	O
<i>Controls</i>			
RotBlk	CMD	Block rotor position command	O
PthEmgChk	CMD	Check emergency pitch system	O

6.2.4 LN: Wind turbine transmission information Name: WTRM

This logical node shall comprise the data classes that represent wind turbine (mechanical) transmission information. The logical node is optional. It contains 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 11.

Table 11 – LN: Wind turbine transmission information (WTRM)

WTRM class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data			
<i>Common information</i>			
<i>Status information</i>			
BrkOpSt	STV	Status of shaft brake	O
LuSt	STV	Status of gearbox lubrication system	O
FilSt	STV	Status of filtration system	O
CISt	STV	Status of transmission cooling system	O
HtSt	STV	Status of heating system	O
OilLevSt	STV	Status of oil level in gearbox sump	O
OfFilSt	STV	Status of offline filter contamination	O
InlFilSt	STV	Status of inline filter contamination	O
<i>Measured and metered values</i>			
ShftBrgTmp	MV	Measured temperature of shaft bearing	O
GbxOilTmp	MV	Measured temperature of gearbox oil	O
ShftBrkTmp	MV	Measured temperature of shaft brake (surface)	O
GbxVbr	MV	Measured gearbox vibration of gearbox	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
OfFil	MV	Offline filter contamination	O
InlFil	MV	Inline filter contamination	O

6.2.5 LN: Wind turbine generator information Name: 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 12 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 12 – LN: Wind turbine generator information (WGEN)

WGEN class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
OpTmsRs	TMS	Generator operation time in seconds (vendor specific)	O
<i>Status information</i>			
GnOpSt	STV	Status of generator	O
CISSt	STV	Status of generator cooling system	O
<i>Measured and metered values</i>			
RotSpd	MV	Rotational speed	M
W	WYE	Generator active power	O
VAr	WYE	Generator reactive power	O
SttTmp	MV	Temperature measurements for generator stator	O
RotTmp	MV	Temperature measurements for generator rotor	O
InletTmp	MV	Temperature measurement for inlet air/water temperature at generator	O
SttPPV	DEL	Generator stator 3 phase phase-to-phase voltage	O
SttPNV	WYE	Generator stator 3 phase phase-to-neutral voltage	O
SttA	WYE	Generator stator 3 phase current	O
RotPPV	DEL	Generator rotor 3 phase phase-to-phase voltage	O
RotPNV	WYE	Generator rotor 3 phase-to-neutral voltage	O
RotA	WYE	Generator rotor 3 phase current	O
RotExtDC	MV	Generator rotor direct current excitation	O
RotExtAC	MV	Generator rotor alternating current excitation	O

6.2.6 LN: Wind turbine converter information Name: 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 13 shall be available for compliance with the IEC 61400-25 series.

The data names 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 13 – LN: Wind turbine converter information (WCNV)

WCNV class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
OpTmsRs	TMS	Converter operation time in seconds (vendor specific)	O
<i>Status information</i>			
CnvOpSt	STV	Status of converter	M
CISSt	STV	Status of converter cooling system	O
<i>Measured and metered values</i>			
GnHz	MV	Generator side frequency	O
GriHz	MV	Grid side frequency	O
Torq	MV	Torque value	O
GnPPV	DEL	Generator side 3 phase phase-to-phase voltage	O
GnPNV	WYE	Generator side 3 phase-to-neutral 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
GriPNV	WYE	Grid side 3 phase-to-neutral voltage	O
GriA	WYE	Grid side 3 phase current	O
GriPF	WYE	Grid side 3 phase power factor	O
GnTmp	MV	Generator side temperature	O
DclTmp	MV	Temperature inside the converter	O
GriTmp	MV	Grid side temperature	O
DclV	MV	DC-link voltage inside converter	O
DclA	MV	DC-link current inside converter	O

6.2.7 LN: Wind turbine transformer information Name: 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 14 shall be available for compliance with the IEC 61400-25 series.

Table 14 – LN: Wind turbine transformer information (WTRF)

WTRF class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
OpTmsRs	TMS	Transformer operation time in seconds (vendor specific)	O
<i>Status information</i>			
ClSt	STV	Status of transformer cooling system	O
OilLevSt	STV	Oil level status information for oil filled transformers	O
TnkPresSt	STV	Gas pressure status of main tank for oil filled transformers	O
<i>Measured and metered values</i>			
TurPPV	DEL	Turbine side 3 phase phase-to-phase voltage	O
TurPNV	WYE	Turbine side 3 phase-to-neutral voltage	O
TurA	WYE	Turbine side 3 phase current	O
GriPPV	DEL	Grid side 3 phase phase-to-phase voltage	O
GriPNV	WYE	Grid side 3 phase-to-neutral voltage	O
GriA	WYE	Grid side 3 phase current	O
TurTmp	MV	Temperature on turbine side	O
GriTmp	MV	Temperature on grid side	O
<i>Controls</i>			
GriSwOp	CMD	Main grid switch command	O

6.2.8 LN: Wind turbine nacelle information Name: WNAC

This logical node shall comprise the data classes that represent information concerning the wind turbine nacelle. It includes 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 15 shall be available for compliance with the IEC 61400-25 series.

Table 15 – LN: Wind turbine nacelle information (WNAC)

WNAC class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
OpTmsRs	TMS	Operation time of beacon in seconds (vendor specific)	O
<i>Status information</i>			
BecBlbSt	STV	Status of beacon	O
WdHtSt	STV	Status of heater for wind sensor	O
AneSt	STV	Status of primary anemometer /secondary anemometer	O
<i>Measured and metered values</i>			
Dir	MV	Nacelle orientation	O
IntnTmp	MV	Temperature inside component	O
IntnHum	MV	Humidity inside component	O
BecLumLev	MV	Value of luminosity level of beacon	O
Vis	MV	Visibility outside nacelle	O
XdirDsp	MV	Tower displacement (longitudinal direction)	O
YdirDsp	MV	Tower displacement (lateral direction)	O
<i>Controls</i>			
BecMod	CMD	Set modus of beacon	O
BecLevSpt	SPV	Setpoint bulb light level of beacon	O
FlshSpt	SPV	Setpoint value of flash duty cycle of beacon	O

6.2.9 LN: Wind turbine yawing information Name: 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 shall be available for compliance with the IEC 61400-25 series.

The listed data classes of Table 16 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 16 – LN: Wind turbine yawing information (WYAW)

WYAW class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
CwOpTms	TMS	Clockwise yawing operation time in seconds	O
CcwOpTms	TMS	Counter clockwise yawing operation time in seconds	O
<i>Status information</i>			
YwSt	STV	Status of yaw system	O
BrkSt	STV	Status of the yaw brake	O
<i>Measured and metered values</i>			
RotSpd	MV	Rotational speed	O
Tmp	MV	Yawing motor/gear temperature	O
YwAng	MV	Yaw bearing rotational angle relative to nominal true North	M
CabWup	MV	Cable windup. Number of windings from calibration point	M
SysGsLev	MV	Grease level for lubrication of yaw system	O
BrkPres	MV	Yaw brake pressure	O
<i>Controls</i>			
YwOp	CMD	Yaw system command	O

6.2.10 LN: Wind turbine tower information Name: WTOW

This logical node shall comprise the data classes that represent information concerning the wind turbine tower structure. Table 17 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 17 – LN: Wind turbine tower information (WTOW)

WTOW class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
LftSt	STV	Status of lift system	O
DehumSt	STV	Status of de-humidifier	O
HtexSt	STV	Status of heat-exchanger	O
<i>Measured and metered values</i>			
LftPos	MV	Lift position	O
IntnHum	MV	Humidity inside tower	O

6.2.11 LN: Wind power plant meteorological information Name: WMET

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

The data classes as shown in Table 18 focus on met station meteorological information.

If meteorological equipment has been installed at more than one altitude at a Met Station, it is recommended to use more logical nodes: WMET1, WMET2, 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.

Table 18 – LN: Wind power plant meteorological information (WMET)

WMET class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
IceSt	STV	Status of ice detection	O
<i>Measured and metered values</i>			
Alt	MV	Sensor altitude	O
EnvTmp	MV	Ambient temperature	O
WetBltTmp	MV	Wet bulb temperature	O
CloudCvr	MV	Cloud cover level	O
EnvHum	MV	Humidity	O
DewPt	MV	Dew point	O
DffInsol	MV	Diffuse insolation	O
DctInsol	MV	Direct normal insolation	O
DIIDur	MV	Daylight duration (time elapsed between sunrise and sunset)	O
HorInsol	MV	Total horizontal insolation	O
HorWdDir	MV	Horizontal wind direction	O
HorWdSpd	MV	Horizontal wind speed	O
VerWdDir	MV	Vertical wind direction	O
VerWdSpd	MV	Vertical wind speed	O
WdGustSpd	MV	Wind gust speed	O
EnvPres	MV	Barometric pressure	O
RnFll	MV	Rainfall	O
SnwDen	MV	Density of snowfall	O
SnwTmp	MV	Temperature of snowfall	O
SnwCvr	MV	Snow cover	O
SnwFll	MV	Snowfall	O
SnwEq	MV	Water equivalent of snowfall	O
Ice	MV	Thickness of ice	O
AirDen	MV	Density of air	O
WtrTmp	MV	Temperature of water	O

6.2.12 LN: Wind power plant alarm information Name: 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 19 shall be available for compliance with the IEC 61400-25 series.

If distinction 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 AST can be used for a dedicated application of LN WALM.

Table 19 – LN: Wind power plant alarm information (WALM)

WALM class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
AlmSt	AST	Alarm set status	O
<alarm name>	ALM	Alarm instance. Several instances are possible	O
NOTE WALM is a container for instances of CDC ALM. The number and names of instances are implementation-dependent.			

6.2.13 LN: Wind turbine availability information Name: WAVL

This logical node shall comprise the data classes that represent wind turbine availability information. The logical node is optional. This logical node is orientated to IEC 61400-26, but not limited to it.

Most of the data names are defined in IEC TS 61400-26-1 (time based availability), but if required it could also be used for production-based availability. In case of using time and production-based availability, it is recommended to instantiate the logical nodes: WAVL1: time-based availability; WAVL2: production-based availability; etc.

Examples of the calculation algorithms can be found in the Annex B of IEC TS 61400-26-1:2011. In case of divergent topology, the user is free to assign the optional information of the IEC 61400-26 to additional data names.

Table 20 – LN: Wind turbine availability (WAVL)

WAVL class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
laogfp	INC	Information available operative generating with full performance	O
laogpp	INC	Information available operative generating with partial performance	O
laongts	INC	Information available operative nongenerating technical standby	O
laongen	INC	Information available operative nongenerating out of environmental specification	O
laongrs	INC	Information available operative nongenerating requested shutdown	O
laongel	INC	Information available operative nongenerating out of electrical specification	O
lanosm	INC	Information available nonoperative scheduled maintenance	O
lanopca	INC	Information available nonoperative planned corrective actions	O
lanofa	INC	Information available nonoperative forced outage	O
lanos	INC	Information available nonoperative suspended	O
lafm	INC	Information available force majeure	O
lu	INC	Information unavailable	O
la	INC	Information available	O
lao	INC	Information available operative	O
lano	INC	Information available nonoperative	O
laog	INC	Information available operative generating	O
laong	INC	Information available operative nongenerating	O
AvlTmsRs	TMS	Turbine availability time in seconds (implementation specific)	O
OpTmsRs	TMS	Operation time in seconds (implementation specific)	O
<i>Measured and metered values</i>			
SysAvl	MV	System availability (implementation specific)	O
TurAvl	MV	Turbine availability (implementation specific)	O
For data objects of type INC, the integer value 0 shall be transmitted to reset the value.			
It is recommended that all data objects that belong to IEC 61400-26 are reset at the same time.			
NOTE The process information data is a measured value with unit dimensionless for the calculation methods defined in IEC 61400-26 Annex B.			

6.2.14 LN: Wind power plant active power control Name: 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			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
OpTurNum	INS	Actual number of wind turbines in operation	O
CutHiTurNum	INS	Number of turbines not running due to high wind speed	O
CutLoTurNum	INS	Number of turbines not running due to low wind speed	O
WLimEna	STV	Active power limitation mode enabled	O
VAEna	STV	Active power control mode enabled controlling apparent power	O
GraEna	STV	Gradient function enabled	O
DelEna	STV	Delta function enabled	O
<i>Measured and metered values</i>			
WCap	MV	Wind power plant active power output capability	O
W	MV	Wind power plant active generation	M
VA	MV	Wind power plant apparent power	O
Gra	MV	Wind power plant gradient	O
WDel	MV	Wind power plant active power reserve utilizing the delta function – the difference between active power generation capability and active power generated	O
WMinCap	MV	Wind power plant minimum capability active power	O
<i>Controls</i>			
WAct	CMD	Activate active power control function	O
VAAct	CMD	Activate apparent power control function	O
GraAct	CMD	Activate gradient control function	O
DelAct	CMD	Activate delta control function	O
WSpt	SPV	Set reference value for the wind power plant active power output	M
VASpt	SPV	Set reference value for the wind power plant apparent power output	O
WUpGraSpt	SPV	Set reference value for gradient ramping up the wind power plant active power output	O
WDnGraSpt	SPV	Set reference value for gradient ramping down the wind power plant active power output	O
DelSpt	SPV	Set reference value for the delta function, wind power plant active power reserve	O

6.2.15 LN: Wind power plant reactive power control Name: 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. When operating in Power Factor mode the IEEE Power factor convention is used.

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

WRPC class			
Data Object Name	Common Data Class	Explanation	M/O
		LN shall inherit all Mandatory Data from Wind Power Plant Common Logical Node Class (see 6.1.1)	M
Data Objects			
<i>Common information</i>			
<i>Status information</i>			
OpTurNum	INS	Actual number of wind turbines in operation	O
VARMod	STV	Reactive power control mode	O
PFSign	INS	Power factor sign convention: IEEE = 2	O
<i>Measured and metered values</i>			
VAr	MV	Wind power plant reactive power generation	O
VArCapImpt	MV	Wind power plant reactive power import (demand) capability	O
VArCapExpt	MV	Wind power plant reactive power export (supply) capability	O
VArMinCap	MV	Wind power plant minimum reactive power capability of plant	O
PF	MV	Wind power plant actual power factor	O
V	MV	Wind power plant output voltage at the external grid connection point	O
<i>Controls</i>			
VArAct	CMD	Activate reactive power control function	O
VArSpt	SPV	Set reference value of wind power plant reactive power output	O
VArUpGraSpt	SPV	Set reference value for gradient for ramping up the wind power plant reactive power output	O
VArDnGraSpt	SPV	Set reference value for gradient for ramping down the wind power plant reactive power output	O
VSpt	SPV	Set reference value for wind power plant voltage output	O
VUpGraSpt	SPV	Set reference value for wind power plant voltage ramping up	O
VDnGraSpt	SPV	Set reference value for wind power plant voltage ramping down	O
DrpSpt	SPV	Set reference value for slope of voltage control droop	O
PFSpt	SPV	Set reference value for wind power plant power factor – negative: lagging (producing reactive power); positive: leading (consuming reactive power) as defined by IEEE	O

6.3 Data name semantic

The wind power plant specific data objects given in 6.2 are listed in Table 23. Data object names are built as mnemonics and based consistently on abbreviations of Clause 4.

The length of a DataName is not constrained by the IEC 61400-25 series as it is in Clause 22 of IEC 61850-7-2:2010. The limit will be the length of the ObjectReference with all its different levels in the hierarchy. The length of the DataName may be restricted by the specific communication service mapping.

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

Table 23 – Data name semantic

Data name	Wind power plant specific data name semantics		
AirDen	Density of Air		
<alarm name>	Alarm instance. Several instances are possible.		
	value	numeric value	semantic
	On	1	Alarm is on
	Off	2	Alarm is off
AlmSt	Alarm set status. It contains information about the actual status value of a set of the alarms included in a WALM logical node		
	value	numeric value	semantic
	On	1	Alarm is on
	Off	2	Alarm is off
Alt	Sensor altitude		
AneSt	Status of primary anemometer /secondary anemometer		
	value	numeric value	semantic
	Auto	1	Anemometers in Auto mode
	Ane1	2	Primary anemometer in operation
	Ane2	3	Secondary anemometer in operation
	Off	4	Anemometers in Off
	Flt	5	Anemometers faulty
AvlTmsRs	Availability time in seconds. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.		
BecBibSt	Status of beacon		
	value	numeric value	semantic
	Auto	1	Beacon in Auto mode
	Bulb1	2	Beacon at bulb1
	Bulb2	3	Beacon at bulb2
	Off	4	Beacon in Off
	Flt	5	Beacon is faulty
BecLevSpt	Setpoint bulb light level of beacon		
BecLumLev	Value of luminosity level of beacon		
BecMod	Set modus of beacon value	numeric value	semantic
	Auto	1	Set to AUTOMATIC MODE
	Bulb1	2	Set bulb 1 to ON
	Bulb2	3	Set bulb 2 to ON
Beh	Behaviour (defined in Clause 6 of IEC 61850-7-4:2010)		
BIPthAngTgt	Pitch angle target value for blade. There shall be one instance for each blade modelled. If only one blade is modelled, then BIPthAngTgt shall be instantiated as BIPthAngTgt1. BIPthAngTgt1 shall be the pitch angle target value of the reference blade.		
BIPthAngVal	Pitch angle for blade as feedback from the pitch system. There shall be one instance for each blade modelled. If only one blade is modelled, then BIPthAngVal shall be instantiated as BIPthAngVal1. BIPthAngVal1 shall be the pitch angle of the reference blade.		

Data name	Wind power plant specific data name semantics		
BIPthHyPres	Pressure of hydraulic pitch system for blade. There shall be one instance for each blade modelled. If only one blade is modelled, then BIPthHyPres shall be instantiated as BIPthHyPres1. BIPthHyPres1 shall be the pressure of hydraulic pitch system of the reference blade.		
BISt	Status of blade as feedback from the pitch system. There shall be one instance for each blade modelled. If only one blade is modelled, then BIStshall be instantiated as BISt1. BISt1 shall be the status of the reference blade.		
	value	numeric value	semantic
	Blk	1	Blade is blocked
	Stop	2	Blade is stopped
	Pt	3	Blade is pitching
BrkHyPres	Hydraulic pressure for shaft brake		
BrkOpSt	Status of shaft brake		
	value	numeric value	semantic
	Brk	1	Shaft has stopped by brake
	Rdy	2	Brake is ready
	OvHt	3	Brake disk is overheated
Flt	4	Brake system is faulty	
BrkPres	Yaw brake pressure		
BrkSt	Status of the yaw brake; ON meaning yaw brake is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
Flt	3	System is in faulty condition	
CabWup	Cable windup. Number of windings from calibration point. The number of windings is defined positive in clockwise direction, seen from the top of the nacelle towards the ground.		
CcwOpTms	Counter clockwise yawing operation time in seconds. The rotational angle is negative in counter clockwise direction, seen from the top of the nacelle towards the ground.		
ClcExp	See Table A.1. Defined in IEC 61850-7-4.		
ClcIntvPer	See Table A.1. Defined in IEC 61850-7-4.		
ClcIntvTyp	See Table A.1. Defined in IEC 61850-7-4.		
ClcMod	See Table A.1. Defined in IEC 61850-7-4.		
ClcMth	See Table A.1. Defined in IEC 61850-7-4.		
ClcNxTmms	See Table A.1. Defined in IEC 61850-7-4.		
ClcRfPer	See Table A.1. Defined in IEC 61850-7-4.		
ClcRfTyp	See Table A.1. Defined in IEC 61850-7-4.		
ClcSrc	See Table A.1. Defined in IEC 61850-7-4.		
ClcStr	See Table A.1. Defined in IEC 61850-7-4.		
CloudCvr	Cloud cover level		
CISt	Status of cooling system		
	value	numeric value	semantic
	Cl	1	System is cooling
	Stdby	2	System is in standby mode
	Off	3	System is off
Flt	4	System is faulty	

Data name	Wind power plant specific data name semantics		
CmdBlk	Blocking of control sequences and action triggers of controllable data objects (as defined in Clause 6 of IEC 61850-7-4:2010)		
CnvOpSt	Status of converter		
	value	numeric value	semantic
	Chrg	1	Converter is currently charging
	Rdy	2	Converter is ready
	Run	3	Converter is running
	Flt	4	Converter is faulted
CutHiTurNum	Number of turbines not running due to high speed cutout The count of wind turbine generating systems not operating because the wind velocity is above cut out wind speed.		
CutLoTurNum	The count of wind turbine generating systems not operating because the wind velocity is below cut in wind speed The wind speed is below the lowest wind speed at which the turbines will produce power and this is the count of turbines so affected.		
CwOpTms	Clockwise yawing operation time in seconds. The rotational angle is positive in clockwise direction, seen from the top of the nacelle towards the ground.		
DclA	DC-link current inside converter		
DclTmp	Temperature inside the converter		
DclV	DC-link voltage inside converter		
DctInsol	Direct normal insolation		
DehumSt	Status of de-humidifier; ON meaning the de-humidifier is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
DelAct	Activate delta control function: ON OFF		
DelEna	Delta function enabled		
	value	numeric value	semantic
	Enabled	1	Delta function enabled
	Disabled	2	Delta function disabled
DelSpt	Set reference value for the delta function, the wind power plant active power reserve		
DevOp	Device operation command; START meaning start the device		
	value	numeric value	semantic
	Str	1	Start
	Stop	2	Stop
DevSt	Device status		
	value	numeric value	semantic
	Stop	1	Device stopped
	Stdbby	2	Device is in standby
	Str	3	Device is starting
	Run	4	Device is running
DewPt	Dew point		
DffInsol	Diffuse insolation		
Dir	Nacelle orientation		

Data name	Wind power plant specific data name semantics		
DIDur	Daylight duration (time elapsed between sunrise and sunset)		
DmdPFSpt	Turbine power factor setpoint		
DmdVArh	Reactive energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)		
DmdVArSpt	Turbine reactive power generation setpoint		
DmdVSpt	Turbine voltage output setpoint		
DmdWh	Active (real) energy demand (default demand direction: energy flow from a substation busbar away and towards the wind turbine)		
DmdWSpt	Turbine active power generation setpoint		
DrpSpt	Set reference value for slope of voltage control droop		
EEHealth	External equipment health (inherited from IEC 61850-7-4)		
EEName	External equipment name plate		
EnvHum	Humidity of environment (usually in %)		
EnvPres	Barometric pressure of environment		
EnvTmp	Ambient temperature		
FilSt	Status of filtration system: ON meaning filtration system is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
FlshSpt	Setpoint value of flash duty cycle of beacon		
GbxOilLev	Oil level in gearbox sump		
GbxOilPres	Gear oil pressure		
GbxOilTmp	Measured temperature of gearbox oil		
GbxVbr	Measured vibration of gearbox. The data object could be instantiated according to 14.6 of IEC 61850-7-1:2011 to represent one or more gearboxes.		
GnA	Generator side 3 phase current		
GnHz	Generator side frequency		
GnOpSt	Status of generator		
	value	numeric value	semantic
	Op	1	Generator in operation
	Run	2	Generator running
	Rdy	3	Generator ready
	Flt	4	Generator in faulty condition
GnPF	Generator side 3 phase power factor		
GnPNV	Generator side 3 phase-to-neutral voltage		
GnPPV	Generator side 3 phase phase-to-phase voltage		
GnTmp	Generator side temperature		
Gra	Wind power plant gradient		
GraAct	Activate gradient control function: ON OFF		
GraEna	Gradient function enabled		
	value	numeric value	semantic
	Enabled	1	Gradient function enabled
	Disabled	2	Gradient function disabled
GriA	Grid side 3 phase current		

Data name	Wind power plant specific data name semantics		
GriHz	Grid side frequency		
GriPF	Grid side 3 phase power factor		
GriPNV	Grid side 3 phase-to-neutral voltage		
GriPPV	Grid side 3 phase phase-to-phase voltage		
GriSwOp	Main grid switch command; ON meaning close connection to main grid switch		
	value	numeric value	semantic
	On	1	Set to ON
	Off	2	Set to OFF
	Auto	3	Set to AUTOMATIC MODE
GriTmp	Grid side temperature		
GrRef	Reference to a higher level Logical Device		
GsLev	Grease level for lubrication of main shaft bearing		
Health	Health (defined in Clause 6 of IEC 61850-7-4:2010). Reflects the state of the logical node related hardware and software		
HiAcsSpt	High access protected setpoints		
HiUrgAlm	High urgent alarms		
HorInsol	Total horizontal insolation		
HorWdDir	Horizontal wind direction		
HorWdSpd	Horizontal wind speed		
HtexSt	Status of heat-exchanger; ON meaning the heat-exchanger is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
HtSt	Status of heating system; ON meaning heating system is operating		
	value	numeric value1	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
HubTmp	Temperature in the rotor hub		
Ia	Information available (defined in IEC TS 61400-26-1)		
Iafm	Information available force majeure (defined in IEC TS 61400-26-1)		
Iano	Information available nonoperative (defined in IEC TS 61400-26-1)		
Ianofo	Information available nonoperative forced outage (defined in IEC TS 61400-26-1)		
Ianopca	Information available nonoperative planned corrective actions (defined in IEC TS 61400-26-1)		
Ianos	Information available nonoperative suspended (defined in IEC TS 61400-26-1)		
Ianosm	Information available nonoperative scheduled maintenance (defined in IEC TS 61400-26-1)		
Iao	Information available operative (defined in IEC TS 61400-26-1)		
Iaog	Information available operative generating (defined in IEC TS 61400-26-1)		
Iaogfp	Information available operative generating with full performance (defined in IEC TS 61400-26-1)		
Iaogpp	Information available operative generating with partial performance (defined in IEC TS 61400-26-1)		

Data name	Wind power plant specific data name semantics																							
laong	Information available operative nongenerating (defined in IEC 61400-26-1)																							
laongel	Information available operative nongenerating out of electrical specification (defined in IEC TS 61400-26-1)																							
laongen	Information available operative nongenerating out of environmental specification (defined in IEC TS 61400-26-1)																							
laongrs	Information available operative nongenerating requested shutdown (defined in IEC TS 61400-26-1)																							
laongts	Information available operative nongenerating technical standby (defined in IEC TS 61400-26-1)																							
Ice	Thickness of ice																							
IceSt	Status of ice detection; ON meaning that there is ice <table><tr><th>value</th><th>numeric value</th><th>semantic</th></tr><tr><td>On</td><td>1</td><td>Condition is true</td></tr><tr><td>Off</td><td>2</td><td>Condition is false</td></tr><tr><td>Flt</td><td>3</td><td>Condition is unknown (faulty)</td></tr></table>			value	numeric value	semantic	On	1	Condition is true	Off	2	Condition is false	Flt	3	Condition is unknown (faulty)									
value	numeric value	semantic																						
On	1	Condition is true																						
Off	2	Condition is false																						
Flt	3	Condition is unknown (faulty)																						
InletTmp	Temperature measurement for inlet air/water temperature at generator																							
InlFil	Inline filter contamination																							
InlFilSt	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>Value above high-high level</td></tr><tr><td>Hi</td><td>2</td><td>Value above high level</td></tr><tr><td>Nor</td><td>3</td><td>Value in normal range</td></tr><tr><td>Lo</td><td>4</td><td>Value below low level</td></tr><tr><td>LoLo</td><td>5</td><td>Value below low-low level</td></tr><tr><td>OutRng</td><td>6</td><td>Value out of range</td></tr></table>			value	numeric value	semantic	HiHi	1	Value above high-high level	Hi	2	Value above high level	Nor	3	Value in normal range	Lo	4	Value below low level	LoLo	5	Value below low-low level	OutRng	6	Value out of range
value	numeric value	semantic																						
HiHi	1	Value above high-high level																						
Hi	2	Value above high level																						
Nor	3	Value in normal range																						
Lo	4	Value below low level																						
LoLo	5	Value below low-low level																						
OutRng	6	Value out of range																						
InOv	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.																							
InSyn	Object reference to the source of the external synchronization signal for the calculation interval																							
IntnHum	Humidity inside component																							
IntnTmp	Temperature inside component																							
Iu	Information unavailable (defined in IEC TS 61400-26-1)																							
LftPos	Lift position																							
LftSt	Status of lift system <table><tr><th>value</th><th>numeric value</th><th>semantic</th></tr><tr><td>Op</td><td>1</td><td>Lift in operation</td></tr><tr><td>Run</td><td>2</td><td>Lift running</td></tr><tr><td>Rdy</td><td>3</td><td>Lift ready</td></tr><tr><td>Flt</td><td>4</td><td>Lift in faulty condition</td></tr></table>			value	numeric value	semantic	Op	1	Lift in operation	Run	2	Lift running	Rdy	3	Lift ready	Flt	4	Lift in faulty condition						
value	numeric value	semantic																						
Op	1	Lift in operation																						
Run	2	Lift running																						
Rdy	3	Lift ready																						
Flt	4	Lift in faulty condition																						
LNName	Logical node name. Shall be inherited from GenLogicalNode Class (see 10.1 of IEC 61850-7-2:2010)																							
LNRef	Logical node reference. Shall be inherited from GenLogicalNode Class (see 10.1 of IEC 61850-7-2:2010)																							
LoAcsSpt	Low access protected setpoints																							
Loc	Local control behaviour (defined in IEC 61850-7-4)																							
LocKey	Local operation for complete logical device (defined in IEC 61850-7-4)																							

Data name	Wind power plant specific data name semantics		
LocSta	Switching authority at station level (defined in IEC 61850-7-4)		
LoUrgAlm	Low urgent alarms		
LuSt	Status of gearbox lubrication system; ON meaning gearbox lubrication system is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
Mod	Mode (defined in Clause 6 of IEC 61850-7-4:2010)		
NamPlt	Name plate of the logical node. In case of the LLNO, the name plate represents the name plat information of the logical device.		
NumPwrUp	Number of Power ups. The number of power up operations of the physical device since the last reset.		
NumSubIntv	The number of sub-intervals a calculation period interval duration contains		
OfFil	Offline filter contamination		
OfFilSt	Status of offline filter contamination:		
	value	numeric value	semantic
	HiHi	1	Value above high-high level
	Hi	2	Value above high level
	Nor	3	Value in normal range
	Lo	4	Value below low level
	LoLo	5	Value below low-low level
	OutRng	6	Value out of range
OilLevSt	Status of oil level:		
	value	numeric value	semantic
	HiHi	1	Value above high-high level
	Hi	2	Value above high level
	Nor	3	Value in normal range
	Lo	4	Value below low level
	LoLo	5	Value below low-low level
	OutRng	6	Value out of range
OpCnt	Operation counter (as defined in IEC 61850-7-4)		
OpCntRs	Operation counter resetable (as defined in IEC 61850-7-4)		
OpTmh	Operation time in hours (as defined in IEC 61850-7-4)		
OpTmsRs	Operation time in seconds. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.		
OpTurNum	Actual number of wind turbines in operation		
OutOv	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.		
PF	Wind power plant actual power factor		

Data name	Wind power plant specific data name semantics												
PFSign	PFSign will always use the IEEE sign convention. Requisite: Power factor Control setpoint will in the windpower domain only be used in 1st and 4th quadrant. Power Factor Setpoint (SptPIPF in IEC 61400-25-2:2015) is a composite of two kinds of information: – PowerFactor ($\cos\Phi$ always positive in 1st and 4th quadrant) – Lagging(-) or Leading(+) by use of the sign. IEEE sign convention Reference: IEC 61850-7-4 :2010, Clause 6. "Data object name semantics" for PFSign												
PFSpt	Set reference value for wind power plant power factor – negative: lagging (producing reactive power); positive: leading (consuming reactive power) as defined by IEEE												
PhyHealth	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><thead><tr><th>value</th><th>numeric value</th><th>semantic</th></tr></thead><tbody><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></tbody></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.	value	numeric value	semantic	Ok	1	Ok ("green") – no problems, normal operation	Warning	2	Warning ("yellow") – minor problems, but in safe operation mode	Alarm	3	Alarm ("red") – severe problem, no operation possible
value	numeric value	semantic											
Ok	1	Ok ("green") – no problems, normal operation											
Warning	2	Warning ("yellow") – minor problems, but in safe operation mode											
Alarm	3	Alarm ("red") – severe problem, no operation possible											
PhyNam	Physical device name plate represents the name plate information of the physical device in which the logical device resides.												
Proxy	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.												

Data name	Wind power plant specific data name semantics		
PthCtlSt	Status of pitch control; ON meaning pitch control is operating		
	value	numeric value	semantic
	On	1	System is operating
	Off	2	System is not operating
	Flt	3	System is in faulty condition
PthEmgChk	Command to check emergency pitch system; START meanng start to check:		
	value	numeric value	semantic
	Str	1	Start
	Stop	2	Stop
	The result of the check – if it needs to be exposed – should be described.		
PwrDn	Power down detected. TRUE shall indicate that a device power down has been detected.		
PwrSupAlm	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.		
PwrUp	Power up detected. TRUE shall indicate that a device power up has been detected.		
RnFll	Rainfall (usually in mm)		
RotA	Generator rotor 3 phase current		
RotBlk	Block rotor position command; ON meaning block rotor position		
	value	numeric value	semantic
	On	1	Set to ON
	Off	2	Set to OFF
	Auto	3	Set to AUTOMATIC MODE
RotExtAC	Generator rotor alternating current excitation		
RotExtDC	Generator rotor direct current excitation		
RotPNV	Generator rotor 3 phase phase-to-neutral voltage		
RotPos	Angular rotor position		
RotPPV	Generator rotor 3 phase phase-to-phase voltage		
RotSpd	Rotational speed		
RotSt	Status of rotor		
	value	numeric value	semantic
	Blk	1	Rotor is blocked
	Stop	2	Rotor is stopped
	Idl	3	Rotor is in idle
	Run	4	Rotor is rotating
RotTmp	Temperature measurements for generator rotor		
RsStat	Setting this value to TRUE shall reset all device statistics data of this LN, for example, the data NumPwrUp, WrmStr, WacTrg.		
ShftBrgTmp	Measured temperature of shaft bearing. The data object could be instantiated according to 14.6 of IEC 61850-7-1:2011 to represent one or more bearings.		
ShftBrkTmp	Measured temperature of shaft brake (surface)		
SnwCvr	Snow cover (usually in mm)		
SnwDen	Density of snowfall (usually in g/cm³)		
SnwEq	Water equivalent of snowfall (usually in mm)		
SnwFll	Snowfall (usually in mm)		
SnwTmp	Temperature of snowfall (usually in °C)		

Data name	Wind power plant specific data name semantics		
StopCnt	Number of stops. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.		
SttA	Generator stator 3 phase current		
SttPNV	Generator stator 3 phase phase-to-neutral voltage		
SttPPV	Generator stator 3 phase phase-to-phase voltage		
SttTmp	Temperature measurements for generator stator		
StrCnt	Number of starts. The precise semantic shall be defined and documented by the manufacturer of the turbine controller.		
SupVARh	Reactive energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)		
SupWh	Active (real) energy supply (default supply direction: energy flow from the wind turbine and towards a substation busbar)		
SysAvl	System availability (implementation specific)		
SysGsLev	Grease level for lubrication of yaw system		
Tmp	Temperature		
TnkPresSt	Status of gas pressure of main tank for oil filled transformers		
	value	numeric value	semantic
	HiHi	1	Value above high-high level
	Hi	2	Value above high level
	Nor	3	Value in normal range
	Lo	4	Value below low level
	LoLo	5	Value below low-low level
	OutRng	6	Value out of range
Torq	Torque value		
TotVARh	Total (net) reactive energy production		
TotWh	Total (net) active energy production		
TrgEmgStop	Transient log triggered at emergency shut down		
TrgProdGri	Transient log triggered at grid connection		
TurA	Turbine side 3 phase current		
TurAvl	Turbine availability (implementation-specific)		
TurAnLog	All logged (historical) turbine analogue time series		
TurCmdLog	All logged (historical) turbine commands		
TurCntLog	All logged (historical) turbine counters		
TurChrRp	Turbine analogue characteristics report		
TurCntRp	Turbine event counts report		
TurOp	Wind turbine operation command; START meaning start the turbine		
	value	numeric value	semantic
	Str	1	Start
	Stop	2	Stop
TurPhsLog	All logged (historical) turbine three phase time series		
TurPNV	Turbine side 3 phase-to-neutral voltage		
TurPPV	Turbine side 3 phase phase-to-phase voltage		

Data name	Wind power plant specific data name semantics		
TurSt	Turbine status		
	value	numeric value	semantic
	Stop	1	Turbine stopped
	Stdbby	2	Turbine is in standby
	Str	3	Turbine is starting
	Run	4	Turbine is running in normal operation
	Free	5	Turbine is in freerun with the generator disconnected
	Brk	6	Turbine is braking
TurStLog	All logged (historical) turbine statuses		
TurTmLog	All logged (historical) turbine timers		
TurTmp	Temperature on turbine side		
TurTmRp	Turbine time durations report		
V	Wind power plant output voltage at the external grid connection point		
VA	Wind power plant apparent power		
VAAct	Activate apparent power control function: ON OFF		
VAEna	Active power control mode enabled controlling apparent power		
	value	numeric value	semantic
	Enabled	1	Power Control Mode Enabled
	Disabled	2	Power Control Mode Disabled
VAR	Reactive power generation		
VARAct	Activate reactive power control function		
	value	numeric value	semantic
	Off	1	No reactive power control
	VAR	2	Reactive power control
	Voc	3	Voltage control
	PF	4	Power factor control
VARCapExpt	Wind power plant reactive power export (supply) capability		
VARCapImpt	Wind power plant reactive power import (demand) capability		
VARDnGraSpt	Set reference value for gradient for ramping down the wind power plant reactive power output		
VARMinCap	The minimum value of the plant's reactive power capability under prevailing conditions. The sum of the on-line individual turbine's minimum attainable reactive power.		
VARMod	Reactive power control mode		
	value	numeric value	semantic
	Off	1	No reactive power control
	VAR	2	Reactive power control
	Voc	3	Voltage control
	PF	4	Power factor control
VAROvW	Activate wind turbine reactive power priority over active power		
VARspt	Set reference value of wind power plant reactive power output		
VARUpGraSpt	Set reference value for gradient for ramping up the wind power plant reactive power output		
VASpt	Set reference value for wind power plant apparent power output		
VDnGraSpt	Set reference value for wind power plant voltage ramping down		
VSpt	Set reference value for wind power plant voltage output		

Data name	Wind power plant specific data name semantics		
VUpGraSpt	Set reference value for wind power plant voltage ramping up		
VerWdDir	Vertical wind direction		
VerWdSpd	Vertical wind speed		
Vis	Visibility		
W	Active power generation		
WAct	Activate active power control function: ON OFF		
WacTrg	The number of times the watchdog circuit has reset the device since the counter reset		
WCap	Wind power plant active power output capability		
WDel	Wind power plant active power reserve utilizing the delta function – the difference between active power generation capability and active power generated		
WdGustSpd	Wind gust speed		
WdHtSt	Status of heater for wind sensor		
	value	numeric value	semantic
	On	1	Heater is operating
	Off	2	Heater is not operating
	Dis	3	Heater is disabled
WDnGraSpt	Set reference value for gradient ramping down the wind power plant active power output		
WetBlbTmp	Wet bulb temperature		
WLimEna	Active power limitation mode enabled		
	value	numeric value	semantic
	Enabled	1	Power limitation mode enabled
	Disabled	2	Power limitation mode disabled
WMinCap	Wind power plant minimum capability active power. Portion of the net electric power output to which the system operator may command. This is the minimum achievable real power output for the entire plant under present wind and turbine conditions which may be commanded by the operator.		
WrmStr	The number of warm starts made by the physical device since the last reset		
WSpt	Set reference value for the wind power plant active power output		
WtrTmp	Temperature of water		
WUpGraSpt	Set reference value for gradient ramping up the wind power plant active power output		
XdirDsp	Tower displacement (longitudinal direction)		
YdirDsp	Tower displacement (lateral direction)		
YwAng	Yaw bearing rotational angle relative to nominal true North. The rotational angle is positive in clockwise direction, seen from the top of the nacelle towards the ground.		
YwOp	Yaw system command		
	value	numeric value	semantic
	Cw	1	Set to CLOCKWISE
	Off	2	Set to OFF
	Ccw	3	Set to COUNTER CLOCKWISE
	Auto	4	Set to AUTOMATIC MODE

Data name	Wind power plant specific data name semantics		
YwSt	Status of yaw system		
	value	numeric value	semantic
	Auto	1	Yaw in Auto operation mode
	Cw	2	Yaw in clock wise operation mode
	Blk	3	Yaw blocked
	Ccw	4	Yaw in counter clock wise operation mode
	Flt	5	Yaw is faulty

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 (AST).
- b) Common data classes inherited from IEC 61850-7-3 (see 7.4.1):
 - Single point status (SPS),
 - Integer status (INS),
 - Integer status setting (ING),
 - Object reference setting (ORG),
 - Enumerated status (ENS),
 - Binary counter reading (BCR),
 - Measured value (MV),
 - Phase to ground (neutral) 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 enumerated status (ENC),
 - Controllable analogue process value (APC) (future amendment to the present standard),
 - Enumerated status setting (ENG),
 - 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					
Data attribute name	Type	FC	TrgOp	Explanation and Value / Range	M/O
SubDataObject					
cdc attr. name	common data class				
DataAttribute					
Status					
cdc attr. name	attr type	fc		Description and range	
Measured attributes					
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	
Status/measured attributes and control mirror					
cdc attr. name	attr type	fc		Description and range	
Configuration, 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.