

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Communication networks and systems for power utility automation –
Part 7-410: Basic communication structure – Hydroelectric power plants –
Communication for monitoring and control**

**Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques –
Partie 7-410: Structure de communication de base – Centrales
hydroélectriques – Communication pour le contrôle-commande**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

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

About the IEC

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

About IEC publications

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

IEC Catalogue - webstore.iec.ch/catalogue

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

IEC publications search - www.iec.ch/searchpub

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

IEC Just Published - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

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

A propos de l'IEC

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

A propos des publications IEC

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

Catalogue IEC - webstore.iec.ch/catalogue

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

Recherche de publications IEC - www.iec.ch/searchpub

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

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 60 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

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

CONSOLIDATED VERSION

VERSION CONSOLIDÉE



**Communication networks and systems for power utility automation –
Part 7-410: Basic communication structure – Hydroelectric power plants –
Communication for monitoring and control**

**Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques –
Partie 7-410: Structure de communication de base – Centrales
hydroélectriques – Communication pour le contrôle-commande**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.200

ISBN 978-2-8322-3000-8

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

REDLINE VERSION

VERSION REDLINE



**Communication networks and systems for power utility automation –
Part 7-410: Basic communication structure – Hydroelectric power plants –
Communication for monitoring and control**

**Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques –
Partie 7-410: Structure de communication de base – Centrales
hydroélectriques – Communication pour le contrôle-commande**

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Abbreviated terms	7
5 Logical node classes	9
5.1 Logical node groups	9
5.2 Interpretation of logical node tables.....	9
5.3 Summary of logical nodes groups to be used in ~~hydro~~ power plants	11
5.3.1 General	11
5.3.2 Group A – Automatic functions	11
5.3.3 Group F – Functional blocks	12
5.3.4 Group H – Hydropower specific logical nodes	12
5.3.5 Group I – Interface and archiving.....	13
5.3.6 Group K – Mechanical and non-electrical primary equipment.....	13
5.3.7 Group P – Protection functions	13
5.3.8 Group R – Protection related functions	14
5.3.9 Group S – Supervision and monitoring.....	14
5.3.10 Group X – Switchgear.....	14
5.3.11 Group E – Thermal power plant specific logical nodes (“Enthalpy”).....	11
5.3.12 Group G – Logical nodes for general purposes	12
5.3.13 Group T – Transducers and instrument transformers	14
5.4 Automatic control logical nodes LN group A	14
5.4.1 Modelling remarks	14
5.4.2 LN: Control mode selection Name: ACTM.....	15
5.4.3 LN: Joint control Name: AJCL.....	15
5.4.4 LN: PSS 4B filter function Name: APSF	16
5.4.5 LN: PSS control, common information Name: APSS	17
5.4.6 LN: PSS 2A/B filter function Name: APST.....	18
5.13 Logical nodes for thermal power LN group E	19
5.13.1 LN: Block coordination function Name: EBCF	19
5.13.2 LN: Fuel Control Valve Name: EFCV	19
5.13.3 LN Gas turbine unit Name: EGTU.....	20
5.13.4 LN: Steam Control Valve Name: ESCV.....	20
5.13.5 LN: Speed monitoring Name: ESPD.....	21
5.13.6 LN Steam turbine unit Name: ESTU.....	22
5.5 ~~Functional~~ Logical nodes for functional blocks LN Group F.....	22
5.5.1 Modelling remarks	22
5.5.2 LN: Functional heartbeat Name: FHBT	24
5.5.3 LN: Scheduler Name: FSCH	24
5.5.4 LN: Functional priority status Name: FXPS	25
5.5.5 LN: Deadband filter Name: FDBF	23
5.5.6 LN: Trip Matrix Name: FMTX	23
5.6 Hydropower specific logical nodes LN group H.....	25
5.6.1 Modelling remarks	25
5.6.2 LN: Turbine – generator shaft bearing Name: HBRG	25

5.6.3	LN: Combinator	Name: HCOM	26
5.6.4	LN: Hydropower dam	Name: HDAM	26
5.6.5	LN: Deflector control	Name: HDFL	27
5.6.6	LN: Dam leakage supervision	Name: HDLS	27
5.6.7	LN: Electrical brake	Name: HEBR	27
5.6.8	LN: Governor control mode	Name: HGOV	28
5.6.9	LN: Gate position indicator	Name: HGPI	28
5.6.10	LN: Dam gate	Name: HGTE	28
5.6.11	LN: Intake gate	Name: HITG	29
5.6.12	LN: Joint control	Name: HJCL	30
5.6.13	LN: Leakage supervision	Name: HLKG	30
5.6.14	LN: Water level indicator	Name: HLVL	31
5.6.15	LN: Mechanical brake	Name: HMBR	31
5.6.16	LN: Needle control	Name: HNDL	31
5.6.17	LN: Water net head data	Name: HNHD	32
5.6.18	LN: Dam over-topping protection	Name: HOTP	32
5.6.19	LN: Hydropower / water reservoir	Name: HRES	33
5.6.20	LN: Hydropower unit sequencer	Name: HSEQ	33
5.6.21	LN: Speed monitoring	Name: HSPD	33
5.6.22	LN: Surge shaft	Name: HSST	34
5.6.23	LN: Guide vanes (wicket gate)	Name: HTGV	35
5.6.24	LN: Runner blades	Name: HTRB	36
5.6.25	LN: Trash rack	Name: HTRK	36
5.6.26	LN: Turbine	Name: HTUR	36
5.6.27	~~LN: Hydropower unit~~	~~Name: HUNT~~	
	Logical nodes for general purposes	LN group G	37
5.6.28	LN: Valve (butterfly valve, ball valve)	Name: HVLV	39
5.6.29	LN: Water control	Name: HWCL	40
5.7	Logical nodes for interface and archiving	LN group I	41
5.7.1	Modelling remarks		41
5.7.2	LN: Fire detection and alarm	Name: IFIR	41
5.7.3	LN: Hand interface	Name: IHND	41
5.8	Logical nodes for mechanical and non-electric primary equipment		
	LN group K		42
5.8.1	Modelling remarks		42
5.8.2	LN: Heater, cubicle heater	Name: KHTR	42
5.9	Logical nodes for protection functions	LN group P	42
5.9.1	Modelling remarks		42
5.9.2	~~LN: Rotor protection~~ Detection of under impedance		
	Name: ~~PRTR~~ PTUI		43
5.10	Logical nodes for protection related functions	LN group R	43
5.10.1	Modelling remarks		43
5.10.2	LN: Field breaker configuration	Name: RFBC	43
5.11	Logical nodes for supervision and monitoring	LN group S	43
5.11.1	Modelling remarks		43
5.11.2	LN: Supervision of media flow	Name: SFLW	44
5.11.3	LN: Supervision of media level	Name: SLVL	45
5.11.4	LN: Supervision of the position of a device	Name: SPOS	46
5.11.5	LN: Supervision media pressure	Name: SPRS	47
5.11.6	LN: Supervision of electrical conductivity in water	Name: SECW	44

5.12	Logical nodes for switchgear LN group X.....	48
5.12.1	Modelling remarks	48
5.12.2	LN: Switching control for field flashing Name: XFFL	48
5.15	Logical nodes for instrument transformers and sensors LN group T.....	49
5.15.1	LN: Measurement of electrical conductivity in water Name: TECW.....	49
6	Data ~~name~~ attribute semantics	49
7	Common data classes	63
7.1	General.....	63
7.2	Maintenance and operational tag (TAG)	63
7.3	Operational restriction (RST).....	64
8	Data attribute semantics.....	64
	Bibliography.....	68
	Table 1 – Abbreviated terms	8
	Table 2 – List of logical node groups.....	9
	Table 3 – Interpretation of logical node tables.....	10
	Table 4 – Logical nodes for automatic functions.....	11
	Table 5 – Logical nodes representing functional blocks.....	12
	Table 6 – Hydropower specific logical nodes.....	12
	Table 7 – Logical nodes for interface and archiving	13
	Table 8 – Logical nodes for mechanical and non-electric primary equipment.....	13
	Table 9 – Logical nodes for protections.....	13
	Table 10 – Logical nodes for protection related functions.....	14
	Table 11 – Logical nodes for supervision and monitoring	14
	Table 12 – Logical nodes for switchgear	14
	Table 13 – PSS filter comparison.....	17
	Table 14 – Description of data	49
	Table 15 – Semantics of data attributes	65
	Table 16 – Logical nodes representing thermal power.....	11
	Table 17 – Logical nodes representing generic functions references.....	12
	Table 18 – Logical nodes for transducers.....	14

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –**

**Part 7-410: Basic communication structure –
Hydroelectric power plants –
Communication for monitoring and control**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

DISCLAIMER

This Consolidated version is not an official IEC Standard and has been prepared for user convenience. Only the current versions of the standard and its amendment(s) are to be considered the official documents.

This Consolidated version of IEC 61850-7-410 bears the edition number 2.1. It consists of the second edition (2012-10) [documents 57/1274/FDIS and 57/1289/RVD] and its amendment 1 (2015-11) [documents 57/1607/FDIS and 57/1633/RVD]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61850-7-410 has been prepared by technical committee 57: Power systems management and associated information exchange.

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

- a) The logical nodes in IEC 61850-7-410:2007 that were not specific to hydropower plants have been transferred to IEC 61850-7-4:2010 and have been removed from this edition of IEC 61850-7-410.
- b) The definitions of logical nodes in this edition of IEC 61850-7-410 have been updated using the format introduced in IEC 61850-7-4:2010.
- c) Most of the modelling examples and background information that was included in IEC 61850-7-410:2007 has been transferred to IEC/TR 61850-7-510.
- d) However, this edition of IEC 61850-7-410 includes additional general-purpose logical nodes that were not included in IEC 61850-7-4:2010, but are required in order to represent the complete control and monitoring system of a hydropower plant.

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

A list of all the parts in the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation* can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

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

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 7-410: Basic communication structure – Hydroelectric power plants – Communication for monitoring and control

1 Scope

This part of IEC 61850 specifies the additional common data classes, logical nodes and data objects required for the use of IEC 61850 in a hydropower plant.

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/TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-7-1, *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 for substations and feeder equipment – 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*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 61850-2 apply.

4 Abbreviated terms

The terms listed in Table 1 are used to build concatenated Data Object Names in this document. IEC 61850-7-410 inherits all the abbreviated terms described in Clause 4 of IEC 61850-7-4:2010.

NOTE Data Object Names in the logical nodes representing PSS filter functions follow names in IEEE 421.5 as closely as possible. These names are not included in Table 1.

Table 1 – Abbreviated terms

Term	Description	Term	Description
Act	Action, activity, active, activate ^a	Lkg	Leakage
Atr	Actuator	Lo	Low, lower (position) ^a
BG	Before Gain	LoPress	Low pressure
Brg	Bearing	Lub	Lubrication
Boil	Boiler	Man	Manual (- operation selected)
Brk	Brake	Mft	Main fuel trip
Bt	Heartbeat	Mnt	Maintenance
BtB	Back-to-Back	Msk	Mask
Cam	Cam, e.g. rotating non-circular disk	Mtx	Matrix
Cap	Capacity, capability ^a	Ndl	Needle (used in Pelton turbines)
Cbr	Calibration	Nhd	Net head
Cff	Coefficient	Nrm	Normal
Cm	Centimetres	Nxt	Next
Cmpl	Completed, completion, complete	Off	Device disengaged (= off)
Cmpr	Compressor	On	Device applied (= on)
Cnd	Condenser, synchronous compensator	Operate	Operate order to any device
Cndtc	Electrical conductivity [S]	Opn	Open, opened, openinga
Crl	Correlation	Pe	Electric power
Crp	Creeping, slow movement	Pmp	Pump
Ctl	Control	Polytr	Polytropic
Cwb	Crowbar	Prec	Precondition, initial status
De	Remove	Prt	Priority
Deg	Degrees, for angle indication in °	Psk	Penstock
Dfl	Deflector (used in Pelton turbines)	Pss	PSS, power system stabiliser function
Dia	Diaphragm	Qu	Queue
Dith	Dither	Rb	Runner blade
Dn	Down, below, downstream, lowest	Reg	Regulation
Drtb	Draft tube	Req	Requested
Droop	Droop	Rh	Re-heat
Dtc	Detection	Rlf	Relief
Dvc	Device	Rng	Range
Dw	Delta Omega	Rpt	Repeat, repetition
Ena	Enable, allow operation ^a	Rtg	Rating, rated
Fa	"Fire all" sequence (to thyristors)	Rwy	Runaway, e.g. in runaway speed
Fbc	Field breaker configuration	Saf	Safety
Fir	Fire	Sft	Soft (as in soft start)
Flm	Flame	Shft	Shaft
Flsh	Flashing (e.g. field flashing)	Sld	Solidity
Flt	Fault	SM	Servo, servo-motor
Flw	Flow, flowing	SNL	Speed-no-load, connected but not generating
Fst	Fast	Spir	Spiral
Gdv	Guide vanes	Src	Source
Grd	Gradient	Srv	Service
Gte	Gate, dam gate	Stl	Still, not moving
Hd	Head	Stm	Steam
HiPres	High pressure	Stnd	Stand, standing
Hwt	Headwater, water level at intake	Syn	Synchronous, synchronism
Hys	Hysteresis	Tp	Test Point
I	Intermediate	Trg	Trigger
Icp	Intercept	~~T+b~~ Tur	Turbine
Ign	Ignition	Twt	Tailwater, water level at outlet
Iner	Inertia	Unt	Unit, production unit
Inlet	Inlet (to turbine)	Up	Up, above, upstream, upper
Ip	Intermediate pressure	Va	Variable
Jnt	Joint	Vsi	Voltage stabilizer input
Lft	Lifting, lift	Vst	Voltage stabilizer terminal (output)
Lkd	Locked		

^a Extended description of IEC 61850-7-4

5 Logical node classes

5.1 Logical node groups

Logical nodes are grouped together with nodes of similar or related functions having the same first letter. Table 2 shows presently assigned letters, letters marked “reserved” may be used in future extensions to the standard series. Names of logical nodes shall start with the letter of the group to which the LN belongs. E.g. most of the logical nodes, defined in this document, are specific for hydropower use and thus have names that start with the letter H.

Table 2 – List of logical node groups

A	Automatic control functions
B	Reserved
C	Control functions
D	Functions specific to distributed energy resources (DER)
E	Reserved
F	Logical nodes representing functional blocks
G	Generic references
H	Functions specific to hydropower plants
I	Interface and archiving functions
J	Reserved
K	Kinetic energy, mechanical devices and equipment
L	Physical devices and common logical nodes
M	Metering and measurement
N	Reserved
O	Reserved
P	Electrical protections
Q	Power quality
R	Protection related functions
S	Supervision and monitoring
T	Sensors and transmitters (including instrument transformers)
U	Reserved
V	Reserved
W	Functions specific to wind power plants
X	Switchgear
Y	Power transformers
Z	Power system equipment

5.2 Interpretation of logical node tables

The interpretation of the headings for the logical node tables is presented in Table 3.

Table 3 – Interpretation of logical node tables

Data Object Name	Function of the Data Object
Common Data Class	Common Data Class that defines the structure of the Data Object. See IEC 61850-7-3.
Explanation	Short explanation of the data and how it is used.
T	Transient Data – the status of data with this designation is momentary and shall be logged or reported to provide evidence of their momentary state. Some T may be only valid on a modelling level. The TRANSIENT property of DATA only applies to BOOLEAN process data attributes (FC=ST) of that DATA. Transient DATA is identical to normal DATA, except that for the process state change from TRUE to FALSE no event may be generated for reporting and for logging.
M/O	This column defines whether data, data sets, control blocks or services are mandatory (M) or optional (O) for the instantiation of a specific logical node. In some cases a data object can be instantiated; this is marked by “multi”, i.e. Omulti or Mmulti. Instantiation shall be made by numbers 01 to 99, added directly after the data object name. The part of the data object that is instantiated is marked by {inst} in the data object explanation The attributes for data that are instantiated may also be mandatory or optional based on the CDC (Attribute Type) definition in IEC 61850-7-3. Where the letter C is used for “conditional”, at least one of the items of data labelled with C shall be used from each category where C occurs.

All data object names are listed alphabetically in Clause 8. Despite some overlapping, the data in the logical node classes are grouped for the convenience of the reader into some of the following categories.

Common logical node information

Common logical node information is information independent of the dedicated function represented by the LN class. Mandatory data (M) are common to all LN classes; optional data (O) are valid for a reasonable subset of LN classes.

Status information

Status information is data which shows either the status of the process or of the function allocated to the LN class. This information is produced locally and cannot be changed remotely unless substitution is applicable. Data such as “start” or “trip” are listed in this category. Most of these data are mandatory. The data can only be read and not set from an external source.

Settings

Settings are data which are needed for the function to operate. Since many settings are dependent on the implementation of the function, only a commonly agreed minimum is standardised. They may be changed remotely, but normally not very often. The setting can not always be read back; whether it is possible or not depends on the data class used for the setting.

Measured values

Measured values are analogue data measured from the process or calculated in the functions such as currents, voltages, power, etc. This information is produced locally and cannot be changed remotely unless substitution is applicable.

Controls

Controls are data which are changed by commands such as switchgear state (ON/OFF), tap changer position or reset-able counters. They are typically changed remotely, and are changed during operation much more than settings. Data objects under controls cannot be read back.

5.3 Summary of logical nodes groups to be used in hydropower plants

5.3.1 General

This document specifies the compatible logical node classes to be used in hydropower plants listed in Tables 4 to 12. For other logical node classes that might be of use also in hydropower plants, see IEC 61850-7-4.

5.3.2 Group A – Automatic functions

Table 4 – Logical nodes for automatic functions

LN Class	Description
ACTM	Control mode selection. Overall LN for controllers with different possible modes.
AJCL	Joint control function, to balance total power from different sources.
APSS	PSS Control. Common information of a PSS function.
APST	PSS 2A/B filter. Represents a filter according to IEEE 421.5-2005.
APSF	PSS 4B filter. Represents a filter according to IEEE 421.5-2005.
ASEQ	Generic control action sequencer

5.3.11 Group E – Thermal power plant specific logical nodes (“Enthalpy”)

Table 16 – Logical nodes representing thermal power

LN Class	Description
EBCF	Block control function. This LN will represent one physical device that coordinates the control of the thermal pressure of the steam generator and the electrical power regulation of turbine / generator system.
EFCV	Fuel control valve. This LN will represent the physical device of fuel control valve related to the gas turbine in a thermal power plant.
EGTU	Gas turbine production unit. This LN represents the physical device of the GT and the generator combination in a thermal power plant. It is intended as an extended rating plate that allows settings of data. It also acts as a placeholder for the current operating conditions of the unit.
ESCV	Steam control valve. This LN will represent the physical device of inlet control valve of the steam turbine in a thermal power plant.
ESPD	Speed monitoring. This LN is derived from HSPD.
ESTU	Steam turbine production unit. This LN represents the physical device of the ST and the generator combination in a thermal power plant. It is intended as an extended rating plate that allows settings of data. It also acts as a placeholder for the current operating conditions of the unit.
EUNT	Thermal unit operating mode. The present status of the production unit.

5.3.3 Group F – Functional blocks

Table 5 – Logical nodes representing functional blocks

LN Class	Description
FDBF	Dead-band filter. This LN represents a settable filter for dead-band.
FHBT	Heart-beat. This LN represents the heart-beat function of a controlling device. I.e. the function used to ensure that a specific device or program in a device is running.
FMTX	Trip matrix. This LN represents a matrix for linking various trip functions to equipment that shall be tripped or controlled during a fault.
FSCH	Scheduler. This LN represents a task scheduler that will perform predefined tasks at given times.
FXPS	Functional priority status. This LN is used to specify in which order devices should be started or activated.

5.3.12 Group G – Logical nodes for general purposes

Table 17 – Logical nodes representing generic functions references

LN Class	Description
GUNT	Production unit operating mode. The present status of the production unit.

5.3.4 Group H – Hydropower specific logical nodes

Table 6 – Hydropower specific logical nodes

LN Class	Description
~~HSEQ~~ ASEQ	Start / stop sequencer. A simple LN that only presents what the sequencer is doing (inactive – starting – stopping) and in case it is active, what step it is presently working on.
~~HUNT~~ GUNT	Hydropower production unit. This LN represents the physical device of the turbine and generator combination in a hydropower plant. It is intended as an extended rating plate that allows temporary settings of data. It also acts as a placeholder for the current operating conditions of the unit.
HBRG	Turbine – generator shaft bearing. This LN holds data pertaining to bearings, such as temperatures and lubrication oil flows.
HCOM	Combinator (3D-CAM or 2D-CAM), optimises the relation between net head, guide vanes and runner blades. It is used in power plants with Kaplan turbines with moveable runner blades. The combinatory function will also use the FCSD LN to hold the relation curves for different net heads.
HDAM	Hydropower dam. A logical node that is used to represent the physical aspects of the dam.
HDFL	Deflector control. This logical node represents the deflector control of a Pelton turbine
HDLS	Dam leakage supervision. Represents a device that will supervise and give alarm in case of dam leakage. The actual measurement can be based on water flow.
HEBR	Electrical brake. This logical node represents an electrical brake system of a turbine.
HGPI	Gate position indicator. A device that provides the position of a dam gate. The position is given either as an angular displacement in case of sector gates or as distance from fully closed position in case of straight gates. For aperture gates and valves where the position is given as percent of full opening, either the HVLV or the SPOS logical nodes are recommended.
HGOV	Governor control. A logical node that represents the overall control of a turbine governor and the various control modes.
HGTE	Dam gate. This LN is intended to hold information about the gate. It can also present a calculated water flow through the gate, in which case the FCSD LN shall be included in the same logical device, to provide the relations. Note that in this LN the position set-point is listed under <i>Controls</i> instead of <i>Settings</i> . The normal way of controlling a gate is to send a position set-point.
HITG	Intake gate. This LN can be used to represent intake gates. The gates will almost never be placed in any other position than fully closed or fully open. However to cater for step-wise or other controls, the gate is normally provided with a number of position switches.
HJCL	Power plant joint control function. In plants with more than one gate or several turbines, this LN will represent the joint control function that is used to supervise the total water flow or to maintain a constant water level. The LN shall be instantiated to provide one instance for each gate and each turbine to be supervised.

LN Class	Description
HLKG	Leakage supervision. This LN can be used to measure any leakage in the plant, it is more generic than HDLS
HLVL	Water level indicator. The LN represents the water level sensing device. The output is a distance including an offset from a base level (commonly the distance above sea).
HMBR	Mechanical brake for the generator shaft. This is a LN for the brake control. The brake is used for stopping the unit during shut-down and to hold the shaft still, once the unit is stopped.
HNDL	Needle control. A specialised LN that represents the control of needles in Pelton turbines.
HNHD	Net head data. A LN that can be used to present the calculated net head data (difference between upper and lower water levels) in a hydropower plant.
HOTP	Dam overtopping protection. A protection function that will act by opening one or more gates in case of a risk for overtopping the dam. The protection will sometimes include its own water measurement device; hence an optional measured value for water level.
HRES	Water reservoir. A logical node that is used to represent the logical function of a reservoir. If the content is to be calculated, the FSCD LN shall be used to provide the relation between water level and content.
HSPD	Speed monitoring. This LN is normally located in a stand-alone logical device, separated from but monitoring the turbine governor. It will also act as a placeholder for various speed limits and set-points used by the start sequencer and other control functions.
HSST	Surge shaft or surge tank. A function that is used to mitigate pressure surges in the system.
HTGV	Guide vanes (wicket gate). This logical node represents the physical device of guide vanes in a hydropower turbine.
HTRB	Runner blades. This logical node represents the physical device of runner blades in e.g. a Kaplan turbine where the runner blades can be controlled.
HTRK	Trash rack, used to prevent floating debris getting into the turbine.
HTUR	Turbine. This logical node holds extended rating plate data for a turbine in a hydropower plant.
HVLV	Valve. This logical node represents a large valve, e.g. a valve in a penstock, butterfly or ball type valve.
HWCL	Water control function. This LN will represent one physical device that can modify the water flow through the plant, either a gate or a turbine. In case of a plant with a joint control function, the HJCL LN will provide the flow set-point to be used by HWCL.

5.3.5 Group I – Interface and archiving

Table 7 – Logical nodes for interface and archiving

LN Class	Description
IFIR	Generic fire detection and alarm function.
IHND	Generic physical human – machine interface. E.g. a push-button or another physical device that can be used as input to a controller.

5.3.6 Group K – Mechanical and non-electrical primary equipment

Table 8 – Logical nodes for mechanical and non-electric primary equipment

LN Class	Description
KHTR	Heater. The LN represents a heater, cubicle heater or any other heater that can be controlled.

5.3.7 Group P – Protection functions

NOTE Most of the logical nodes that represent protective functions are defined in the substation part of the document series.

Table 9 – Logical nodes for protections

LN Class	Description
----------	-------------

PRTR	Rotor protection. Field short-circuit protection.
PTUR	Used for detection of under resistance, e.g. due to stator or rotor earth-faults.

5.3.8 Group R – Protection related functions

Table 10 – Logical nodes for protection related functions

LN Class	Description
RFBC	Field breaker configuration.

5.3.9 Group S – Supervision and monitoring

Table 11 – Logical nodes for supervision and monitoring

LN Class	Description
SECW	Supervision of electrical conductivity in water. This logical node represents a system for monitoring of electrical conductivity in water.
SFLW	Media flow supervision. This logical node represents a generic media flow supervision system that can provide alarm and trip signals. In an application, the LN shall be instantiated with one instance per flow being measured.
SLEV	Media level supervision. This logical node represents a generic level supervision system that can provide alarm and trip signals. In an application, the LN shall be instantiated with one instance per surface being measured.
SPOS	Device position supervision. This logical node represents a generic position supervision system that can provide alarm and trip signals. In an application, the LN shall be instantiated with one device being measured.
SPRS	Media pressure supervision. This logical node represents a generic pressure supervision system that can provide alarm and trip signals. In an application, the LN shall be instantiated with one instance per pressure point being measured.

5.3.13 Group T – Transducers and instrument transformers

Table 18 – Logical nodes for transducers

LN Class	Description
TECW	Measurement of electrical conductivity in water. This logical node represents a generic device for measuring the conductivity in water.

5.3.10 Group X – Switchgear

Table 12 – Logical nodes for switchgear

LN Class	Description
XFFL	Field flashing. A logical node to represent the switching control for start excitation (field flashing) of a generator.

5.4 Automatic control logical nodes LN group A

5.4.1 Modelling remarks

Logical nodes in this group are intended for automatic control functions of general use, i.e. not for any specific area of technology. The logical nodes APSS, APST and APSF below are intended for use in power system stabilizer (PSS) control functions used for large generators.

5.4.2 LN: Control mode selection**Name: ACTM**

Logical node ACTM shall be used to present information about different control modes of any control or regulating system. One logical node ACTM must be created for each available control mode.

ACTM class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
Flt	SPS	Fault in the controller {inst}		Mmulti
Controls				
LocSta	SPC	Remote control blocked		O
ModAct	SPC	If TRUE this mode is active		M

5.4.3 LN: Joint control**Name: AJCL**

The joint control logical node is used to co-ordinate the power production of a power plant with more than one production unit. The joint control function will normally try to optimise the power production between units already in operation. In this control mode, the power plant can be controlled as a single unit. The data attributes shall be instantiated to provide one instance per generating unit to be included in the joint control. Compare also with the HJCL logical node, which can be used to control water flow through a single object of a hydropower plant. Instantiated parts shall be defined in the extended private parts.

AJCL class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
Unt	SPS	Generation unit {inst} contributing (true = contributing)		Omulti
RSpt	SPS	Raise set-point in IED for unit {inst}	T	Omulti
LSpt	SPS	Lower set-point in IED for unit {inst}	T	Omulti
Measured values				
PwrOut	MV	Contributing power output of the plant (included in the joint control)		O
PwrOutTot	MV	Total power output of the plant		O
Controls				
LocSta	SPC	Remote control blocked		O
JCtlTag	TAG	Joint Control Maintenance tag affixed to the equipment		O
UntSpt	APC	Set-point for unit {inst}		Omulti
UntStr	SPC	Generation unit {inst} start		Omulti
UntStop	SPC	Generation unit {inst} stop		Omulti
UntTag	TAG	Maintenance tag affixed to the unit {inst}		Omulti
CmdBlk	SPC	Block operation		O
NOTE When both active power set-point (DA:AJCL.UntSpt) in logical node AJCL and active power setpoint (DA:HJCL.ClcPwrSpt) in logical node HJCL are used for power control, only one of the data attributes can be active the other has to be in tracking mode. Use prefixes W for active power and Var for reactive power control. E.g. W_AJCL and Var_AJCL.				

5.4.4 LN: PSS 4B filter function

Name: APSF

This logical node shall be used to represent a PSS 4B filter as given by the IEEE 421.5-2005. It is possible to use the generic filter function FFIL of IEC 61850-7-4 as an alternative, however the data object names will then not match the names of variables in the IEEE document. See reference [5]¹ for more details on PSS functions.

APSF class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Controls				
InputLIHz	APC	Test Input Low- and intermediate frequency		O
InputHHz	APC	Test Input high frequency		O
Status Information				
HiLim	SPS	High limit reached, PSS - filter output		O
LoLim	SPS	Low limit reached, PSS - filter output		O
LHiLim	SPS	High limit reached, LF output		O
LLoLim	SPS	Low limit reached, LF output		O
IHiLim	SPS	High limit reached, IF output		O
ILoLim	SPS	Low limit reached, IF output		O
HHiLim	SPS	High limit reached, HF output		O
HLoLim	SPS	Low limit reached, HF output		O
Measured values				
Out	MV	Output of PSS - filter		O
OutL	MV	Output of Low Frequency part		O
OutI	MV	Output of Intermediate Frequency part		O
OutH	MV	Output of High Frequency part		O
OutLBG	MV	Output of Low Frequency part before gain		O
OutIBG	MV	Output of Intermediate Frequency part before gain		O
OutHBG	MV	Output of High Frequency part before gain		O
ErrTerm	MV	Error term		O
Settings				
KL	ASG	Proportional gain LF (Low Frequency)		M
KL1	ASG	Proportional gain LF positive		M
KL2	ASG	Proportional gain LF negative		M
KL11	ASG	Lead gain LF positive		M
KL17	ASG	Lead gain LF negative		M
TL1Tms	ING	Time constant TL1 (low frequency positive)		M
TL2Tms	ING	Time constant TL2 (low frequency positive)		M
TL3Tms	ING	Time constant TL3 (low frequency positive)		M
TL4Tms	ING	Time constant TL4 (low frequency positive)		M
TL5Tms	ING	Time constant TL5 (low frequency positive)		M
TL6Tms	ING	Time constant TL6 (low frequency positive)		M
TL7Tms	ING	Time constant TL7 (low frequency negative)		M
TL8Tms	ING	Time constant TL8 (low frequency negative)		M
TL9Tms	ING	Time constant TL9 (low frequency negative)		M
TL10Tms	ING	Time constant TL10 (low frequency negative)		M
TL11Tms	ING	Time constant TL11 (low frequency negative)		M
TL12Tms	ING	Time constant TL12 (low frequency negative)		M
VLMMax	ASG	Maximum limit set-point LF		M
VLMMin	ASG	Minimum limit set-point LF		M
KI	ASG	Proportional gain IF (Intermediate Frequency)		M
KI1	ASG	Proportional gain IF positive		M
KI2	ASG	Proportional gain IF negative		M
KI11	ASG	Lead gain IF positive		M
KI17	ASG	Lead gain IF negative		M
Ti1Tms	ING	Time constant Ti1 (intermediate frequency positive)		M
Ti2Tms	ING	Time constant Ti2 (intermediate frequency positive)		M
Ti3Tms	ING	Time constant Ti3 (intermediate frequency positive)		M
Ti4Tms	ING	Time constant Ti4 (intermediate frequency positive)		M
Ti5Tms	ING	Time constant Ti5 (intermediate frequency positive)		M

¹ Numbers in square brackets refer to the Bibliography.

APSF class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
TI6Tms	ING	Time constant TI6 (intermediate frequency positive)		M
TI7Tms	ING	Time constant TI7 (intermediate frequency negative)		M
TI8Tms	ING	Time constant TI8 (intermediate frequency negative)		M
TI9Tms	ING	Time constant TI9 (intermediate frequency negative)		M
TI10Tms	ING	Time constant TI10 (intermediate frequency negative)		M
TI11Tms	ING	Time constant TI11 (intermediate frequency negative)		M
TI12Tms	ING	Time constant TI12 (intermediate frequency negative)		M
VIMax	ASG	Maximum limit set-point IF		M
VIMin	ASG	Minimum limit set-point IF		M
KH	ASG	Proportional gain HF (High Frequency)		M
KH1	ASG	Proportional gain HF positive		M
KH2	ASG	Proportional gain HF negative		M
KH11	ASG	Lead gain HF positive		M
KH17	ASG	Lead gain HF negative		M
TH1Tms	ING	Time constant TH1 (high frequency positive)		M
TH2Tms	ING	Time constant TH2 (high frequency positive)		M
TH3Tms	ING	Time constant TH3 (high frequency positive)		M
TH4Tms	ING	Time constant TH4 (high frequency positive)		M
TH5Tms	ING	Time constant TH5 (high frequency positive)		M
TH6Tms	ING	Time constant TH6 (high frequency positive)		M
TH7Tms	ING	Time constant TH7 (high frequency negative)		M
TH8Tms	ING	Time constant TH8 (high frequency negative)		M
TH9Tms	ING	Time constant TH9 (high frequency negative)		M
TH10Tms	ING	Time constant TH10 (high frequency negative)		M
TH11Tms	ING	Time constant TH11 (high frequency negative)		M
TH12Tms	ING	Time constant TH12 (high frequency negative)		M
VHMax	ASG	Maximum limit set-point HF		M
VHMin	ASG	Minimum limit set-point HF		M

A comparison between data object names of FFIL and corresponding names in IEEE 421.5-2005 are listed in Table 13.

Table 13 – PSS filter comparison

FFIL	LoPg	LoNg	MePg	MeNg	HiPg	HiNg
Kp	KL1	KL2	KI1	KI2	KH1	KH2
KId	KL11	KL17	KI11	KI17	KH11	KH17
KIg	not used	not used	not used	not used	not used	not used
T1	TL1	TL7	TI1	TI7	TH1	TH7
T1Id	TL2	TL8	TI2	TI8	TH2	TH8
T2	TL3	TL9	TI3	TI9	TH3	TH9
T2Id	TL4	TL10	TI4	TI10	TH4	TH10
T3	TL5	TL11	TI5	TI11	TH5	TH11
T3Id	TL6	TL12	TI6	TI12	TH6	TH12

5.4.5 LN: PSS control, common information

Name: APSS

This logical node shall be used to represent common information and settings of a power system stabilizing (PSS) function.

APSS class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
BlkPss	SPC	Blocking of the PSS		

Status Information				
PssAct	SPS	PSS is in action		M
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
Measured values				
VRefErr	MV	Reference voltage error		O
Settings				
PreSelPss	SPG	Pre-select PSS 4B if true, Pre-select PSS2A/2B if false		O
PwrMinSet	ASG	Minimum power setting		O
VMax	ASG	Maximum stator voltage		O
AmpMin	ASG	Minimum stator current		O
HzDTmms	ING	Frequency variation derivation time constant		O
HzVaMax	ASG	Maximum frequency variation		O
RsDTmms	ING	Time delay for reset		O
VMin	ASG	Minimum stator voltage		O
VIntTmms	ING	Voltage integration time		O

5.4.6 LN: PSS 2A/B filter function

Name: APST

This logical node shall be used to represent a PSS 2A/B filter as given by the IEEE 421.5-2005. It is possible to use the generic filter function FFIL of IEC 61850-7-4 as an alternative; however, the data object names will then not match the names of variables in IEEE document.

APST class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Controls				
InDw	APC	Test Input $\Delta\omega$		O
InPe	APC	Test Input Pe		O
Status Information				
VsiMaxLim	SPS	Input High Limit{inst} reached		Omulti
VsiMinLim	SPS	Input Low Limit{inst} reached		Omulti
VstMaxLim	SPS	Output High Limit reached		O
VstMinLim	SPS	Output Low Limit reached		O
Measured values				
ActualPe	MV	Actual electrical Power		M
ActualDw	MV	Actual $\Delta\omega$		M
ActualTp	MV	Actual output Test-point {inst}		Omulti
Out	MV	PSS output		M
Settings				
T1Tms	ING	Time constant T1, according to IEEE 421.5-2005		M
T2Tms	ING	Time constant T2, according to IEEE 421.5-2005		M
T3Tms	ING	Time constant T3, according to IEEE 421.5-2005		M
T4Tms	ING	Time constant T4, according to IEEE 421.5-2005		M
T10Tms	ING	Time constant T10, according to IEEE 421.5-2005		C
T11Tms	ING	Time constant T11, according to IEEE 421.5-2005		C
Ks1	ASG	Gain Ks1, according to IEEE 421.5-2005		M
T8Tms	ING	Time constant T8, according to IEEE 421.5-2005		M
T9Tms	ING	Time constant T9, according to IEEE 421.5-2005		M
N	ING	Ramtrack overall degree N, according to IEEE 421.5-2005		M
M	ING	Ramtrack lowpass degree M, according to IEEE 421.5-2005		M
Ks3	ASG	Gain Ks3, according to IEEE 421.5-2005		M
T7Tms	ING	Time constant T7, according to IEEE 421.5-2005		M
Ks2	ASG	Gain Ks2, according to IEEE 421.5-2005		M
TwTms	ING	Time constant wash out Tw{inst}, according to IEEE 421.5-2005		Mmulti
VsiMaxLimSpt	ASG	Input High Limit{inst} set-point		Omulti
VsiMinLimSpt	ASG	Input Low Limit{inst} set-point		Omulti
VstMaxLimSpt	ASG	Output High Limit set-point		O
VstMinLimSpt	ASG	Output Low Limit set-point		O
ScaleDw	ASG	Scaling for Test Input $\Delta\omega$		O
ScalePe	ASG	Scaling for Test Input Pe		O

5.13 Logical nodes for thermal power

LN group E

5.13.1 LN: Block coordination function

Name: EBCF

Logical node EBCF shall be used to coordinate the control of the thermal pressure of the steam generator and the electrical power regulation of turbine / generator system.

EBCF class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
GasTurUnt	SPS	Gas turbine generation unit {inst} contributing [True = contributing]		Omultip
StmTurUnt	SPS	Steam turbine generation unit {inst} contributing [True = contributing]		Omultip
BoilUnt	SPS	Boiler unit {inst} contributing [True = contributing]		Omultip
BlkOpSt	ENS	Status of the block.		M
		Operational condition	Value	
		Undefined	0	
		Coordinated	1	
		Boiler Follow	2	
		Steam Follow	3	
		Gas Follow	4	
GasTurErr	MV	Gas turbine generation unit {inst} error.		Omultip
StmTurErr	MV	Steam turbine generation unit {inst} error.		Omultip
BoilErr	MV	Boiler unit {inst} error.		Omultip
JntCtlTag	TAG	Joint control maintenance tag affixed to the equipment		O
UntTag	TAG	Maintenance tag affixed to the unit {inst}		Omultip
CmdBlk	SPC	Block operation		O
GasTurMft	ACT	Gas turbine generation unit {inst} main fuel trip	T	Omultip
BoilMft	ACT	Boiler unit {inst} main fuel trip	T	Omultip

5.13.2 LN: Fuel Control Valve

Name: EFCV

Logical Node EFCV shall be used to represent the physical device of fuel control valve related to the gas turbine in a thermal power plant. In case of individually controlled control valves, it is possible to instantiate the logical node for each control valve.

EFCV class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
PosCls	SPS	Control valve closed		M
PosOpn	SPS	Control valve fully open		M
Controls				
OpCntRs	INC	Resettable operation counter		O

PosSpt	APC	Position set-point		O
DithAct	SPC	Activate dither		O
Measured values				
PosPct	MV	High pressure control valve position as percent of full opening [%]		C
PosDegt	MV	High pressure control valve position in degrees [°]		C

Condition: either PosPct or PosDeg shall be used but not both.

5.13.3 LN Gas turbine unit

Name: EGTU

Logical node EGTU shall be used to represent the physical device of a gas turbine in a thermal power plant. The logical node serves as an extended rating plate only, for any operational status and runtime information, the logical node EUNT shall be used. In case of more than one turbine is used to form a single engine, the logical node shall be instantiated for each.

EGTU class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
OpTmh	INS	Operation time [h]		O
RotDir	ENS	Rotational direction (Clockwise Counter-clockwise Unknown)		O
Settings				
TurTyp	ENG	Turbine type		M
SpdRtg	ASG	Turbine rated speed [s^{-1}]		M
TurInert	ASG	Turbine moment of inertia J [kgm^2]		O
TurTrsSpd	ASG	Maximum transient overspeed [s^{-1}]		O
TurRwySpd	ASG	Runaway speed [s^{-1}]		O
PwrRtgTur	ASG	Rated power in turbine mode [MW]		O
FlwRtgTur	ASG	Rated flow in turbine mode [kg/s]		O
MaxPres	ASG	Maximum pressure [Pa]		O
RtgMaxTmp	ASG	Rated maximum temperature [K]		O
VlvClsTmms	ING	Control valve rated closing time [ms]		O

5.13.4 LN: Steam Control Valve

Name: ESCV

Logical Node ESCV shall be used to represent the physical device of inlet control valve related to the steam turbine in a thermal power plant. In case of individually controlled control valves, it is possible to instantiate the data objects for each control valve.

ESCV class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
PosCls	SPS	Control valve closed		M

PosOpn	SPS	Control valve fully open	O
SMLkdCls	SPS	Servomotor {inst} locked closed in position	Omulti
SMLkdMnt	SPS	Servomotor {inst} locked in maintenance position	Omulti
TripVlvOpn	SPS	Trip valve open	O
TripVlvCls	SPS	Trip valve closed	O
Controls			
OpCntRs	INC	Resetable operation counter	O
PosSpt	APC	Position set-point	O
DithAct	SPC	Activate dither	O
Measured values			
PosPct	MV	High pressure control valve position as percent of full opening [%]	C
PosDeg	MV	High pressure control valve position in degrees [°]	C

Condition: either PosPct or PosDeg shall be used but not both.

5.13.5 LN: Speed monitoring

Name: ESPD

Logical node ESPD shall be used to represent a speed monitoring device for a thermal turbine. The logical node is normally located in a stand-alone logical device, separated from but monitoring the turbine governor. It will also act as a placeholder for various speed limits and set-points used by the start sequencer and other control functions.

ESPD class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
SpdSrc	INS	Speed sensor {inst} fault		Omulti
StndStl	SPS	Stand still detection		O
SpdBrk	SPS	Brake operation allowed {inst}		Omulti
SpdIgn	SPS	Ignition Speed Reached		O
SpdExt	SPS	Point of operation for field breaker		O
SpdSyn	SPS	Point of operation for synchronising		O
SpdOv	SPS	Over-speed detection {inst}		Omulti
SpdMOv	SPS	Mechanical over-speed detection {inst}		Omulti
DirRot	SPS	Direction of rotation		O
Settings				
SpdBrkSpt	ASG	Braking allowed setting {inst}		Omulti
SpdExtSpt	ASG	Field breaker operation setting		O
SpdSynSpt	ASG	Synchronisation setting		O
SpdStlSpt	ASG	Standstill detection limit setting		O
SpdIgnSpt	ASG	Ignition speed detection setting		O
SpdHysSpt	ASG	Hysteresis limit setting		O
SpdOvSpt	ASG	Over-speed detection setting {inst}		Omulti
Measured values				

ESPD class				
Data Object Name	Common Data Class	Explanation	T	M/O
Spd	MV	Rotational speed of the shaft [s ⁻¹]		M

5.13.6 LN Steam turbine unit

Name: ESTU

Logical node ESTU shall be used to represent the physical device of a steam turbine in a thermal power plant. The logical node serves as an extended rating plate only, for any operational status and runtime information, the logical node EUNT shall be used.

ESTU class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
OpTmh	INS	Operation time [h]		O
RotDir	ENS	Rotational direction (Clockwise Counter-clockwise Unknown)		O
Settings				
TurTyp	ENG	Turbine type (steam, gas, oil)		M
SpdRtg	ASG	Turbine rated speed [s ⁻¹]		M
TurInert	ASG	Turbine moment of inertia J [kgm ²]		O
TurTrsSpd	ASG	Maximum transient overspeed [s ⁻¹]		O
TurRwySpd	ASG	Runaway speed [s ⁻¹]		O
TurPwrRtg	ASG	Rated power in turbine mode [MW]		O
FlwRtgTurb	ASG	Rated flow in turbine mode [kg/s]		O
HiPresMax	ASG	High pressure inlet maximum pressure [Pa]		O
IpMax	ASG	Intermediate pressure inlet maximum pressure [Pa]		O
LoPresMax	ASG	Low pressure inlet maximum pressure [Pa]		O
HiPresVlv	ASG	High pressure control valve rated oil pressure [Pa]		O
HpVlvClsTms	ING	High pressure control valve rated closing time [s]		O
IpVlvPres	ASG	Intermediate pressure control valve rated oil pressure [Pa]		O
MidVlvClsTms	ING	Intermediate pressure control valve rated closing time [s]		O
LpVlvPres	ASG	Low pressure control valve rated oil pressure [Pa]		O
LpVlvClsTms	ING	Low pressure control valve rated closing time [s]		O
IcpVlvPres	ASG	Intercept valve rated oil pressure [Pa]		O
MainStmTmpRtg	ASG	Turbine rated main steam temperature		O
RhStmTmp	ASG	Re-heat steam temperature		O
IcpVlvTms	ING	Intercept valve rated closing time [s]		O

5.5 ~~Functional~~ Logical nodes for functional blocks

LN Group F

5.5.1 Modelling remarks

This group of logical nodes represents various types of control function blocks. Logical node classes of this type do include some form of control algorithm. The LN's will normally be part of a logical device providing overall functionality within the system.

5.5.5 LN: Deadband filter

Name: FDBF

Logical Node FDBF shall be used to represent a dead band filter. The input value is compared by the limits Out+Db and Out-Db. Within these limits the output value “Out” is equal to the reference value. If one of the limits is exceeded, the output value “Out” is equal to the reference, +/- the deviation from the dead band. If “Ofs” is not used or used but equals zero, the output will be equal to the input, with the new output used as reference.

FDBF class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Settings				
Ofs	ASG	Offset value (to be used as + and – the input)		O
Db	ASG	Dead band value		M
Ref	ASG	Reference value		O
DbGain	ASG	Dead band gain setting		O
Measured values				
Out	MV	Output signal		M

5.5.6 LN: Trip Matrix

Name: FMTX

Logical Node FMTX shall be used to represent the functional matrix for a power plant. It describes the relation between combinations of input values to associated output values. This matrix can be used to initiate sequences or trips.

FMTX class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 19		
Data Objects				
Status information				
MtxOut	SPS	Output {inst} from trip matrix		Mmulti
Settings				
MskIn	ASG	Mask {inst} for input values		Mmulti
MskOut	ASG	Mask {inst} for output values		Mmulti

Example:

Most significant bit		Least significant bit	Most significant bit	Least significant bit				
InRef03	InRef02	InRef01	MtxOut02	MtxOut01	Data Object for masking input values	Value	Data Object for masking output values	Value
0	0	0	0	0	MskIn1.St.Val	0	MskOut1.St.Val	0
0	0	1	1	0	MskIn2.St.Val	1	MskOut2.St.Val	2
0	1	0	1	0	MskIn3.St.Val	2	MskOut3.St.Val	2
0	1	1	1	1	MskIn4.St.Val	3	MskOut4.St.Val	3
1	0	0	1	0	MskIn5.St.Val	4	MskOut5.St.Val	2
1	0	1	0	1	MskIn6.St.Val	5	MskOut6.St.Val	1
1	1	0	0	1	MskIn7.St.Val	6	MskOut7.St.Val	1
1	1	1	1	1	MskIn8.St.Val	7	MskOut8.St.Val	3

This functional matrix example has three InRefs and two matrix outputs (MtxOut). Each input mask (for example MskIn1.St.Val) validates the truth statement with respect to the associated InRefs to an outgoing output mask (for example MskOut1.St.Val) that enables the MtxOut of the matrix FMTX.

5.5.2 LN: Functional heartbeat

Name: FHBT

Logical node FHBT shall be used to represent a heartbeat. This logical node is used to validate that a task is still running. FHBT should be used with FXOT as a trip function.

FHBT class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Bt	SPS	Heartbeat		M
Cnt	INS	Heartbeat counter, no overflow action, starting at zero		O
Settings				
DIOntmms	ING	Delay on		O
DIOffTmms	ING	Delay Off		O

5.5.3 LN: Scheduler

Name: FSCH

Logical node FSCH shall be used to represent a task scheduler. The task scheduler is used to replace the operator when there are repetitive tasks or tasks on set dates in a calendar.

FSCH class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Loc	SPS	Local control behaviour		O
Settings				
DateStr	TSG	Start Date for task {inst}		Mmulti
Controls				
TaskOn	SPC	Task {inst} ON		Mmulti
Auto	SPC	Automatic / manual operation		M

5.5.4 LN: Functional priority status

Name: FXPS

This functional logical node represents the functional priority status of equipments or controller.

Examples of equipments are pumps, thermal elements, valves, and fans. In the case of controllers, this node may be used to control modular redundancy or in step controllers.

The control mode CtlMod determines which type of algorithm is used to determine the order with which the equipment or controller are used.

The master priority StrPrt of each equipment or controller determines in what order the master token is passed when the CtlMod is in Alternate mode.

The priority status will indicate where every piece of equipment is located in the start priority.

FXPS class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
StndQuSts	ENS	Standing in Starting queue{inst}		Omulti
		Standing in Starting queue	Value	
		First	1	
		Second	2	
		Third	3	
		Fourth	4	
		Fifth	5	
Controls				
CtlMod	ENC	Control mode for establishing a priority		M
		Control Mode	Value	
		None	1	
		Master/Slave	2	
		Lead/Lag	3	
		FIFO	4	
		LIFO	5	
		Alternate - FIFO	6	
		Alternate - LIFO	7	
Shuffle	8			
StrPrt	ENC	Start Priority{inst}		Omulti
		Start Priority	Value	
		Priority 1	1	
		Priority 2	2	
		Priority 3	3	
		Priority 4	4	
		Priority 5	5	

5.6 Hydropower specific logical nodes LN group H

5.6.1 Modelling remarks

This group of logical nodes covers functions that are specific for hydropower plants. Some may also be used for utility water supply systems or other types of larger reservoirs.

5.6.2 LN: Turbine – generator shaft bearing

Name: HBRG

Logical node HBRG shall be used to represent the physical device bearing. It can be used to represent both thrust and guide bearings. One instance shall be used per bearing.

HBRG class

Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
OpTmh	INS	Operation time		O
BrgTyp	ENS	Type of bearing		M
TmpAlm	SPS	Bearing temperature alarm		O
OilTmpHi	SPS	Lubrication oil temperature alarm		O

5.6.3 LN: Combinator

Name: HCOM

Logical node HCOM shall be used to represent the function that optimises the relation between net head, guide vane and runner blade positions in order to achieve best possible efficiency. It is normally a part of the governor logical device and the functionality is based on one or more 2-D curves. If more than one curve is defined, one instance shall be used per curve.

HCOM class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Loc	SPS	Local control behaviour		O
CrIAIm	SPS	Correlation deviation alarm		O
Settings				
CrvSet	CSG	Definition of three-dimensional curve as set of two-dimensional curves		O
Controls				
RbPosPct	APC	Runner blade position set-point		M

5.6.4 LN: Hydropower dam

Name: HDAM

Logical node HDAM shall be used to represent the dam of a hydropower plant. It is basically used to provide a reference tag for the dam holding basic design information. In case the functional aspect of the dam shall be represented, the logical node HRES shall be used, see 5.6.19.

HDAM class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Setting information				
DamTyp	ENG	Type of dam (construction)		M
		Dam Type	Value	
		Concrete structure	1	
		Stone core	2	
		Earth core	3	
		Mixed or special design	4	
Fused dam	5			

5.6.5 LN: Deflector control

Name: HDFL

Logical node HDFL shall be used to represent the deflector control of a Pelton turbine.

HDFL class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data Objects				
Status information				
OpCnt	INS	Operation counter		O
Loc	SPS	Local operation selected		M
LockKey	SPS	Local or remote key		O
PosCls	SPS	Closed end position reached (deflector cannot move further)		C ¹
PosOpn	SPS	Open end position reached (deflector cannot move further)		C ¹
Mvm	SPS	Deflector is moving		O
Stuck	SPS	Device is blocked through external influence		O
DflMan	SPS	Manual operation of deflector is active		O
Settings				
OpnLim	RST	Opening limit of deflector position (temporary restriction)		O
ClsLim	RST	Closing limit (temporary restriction)		O
Incr	ASG	Increment of position change for open / close commands		O
Measured values				
PosPct	MV	Deflector position given as 0 % to 100 %		C ²
PosDeg	MV	Deflector position given as 0 ° to 90 °		C ²
Flw	MV	Calculated liquid flow through the deflector [m ³ / s]		O
Controls				
LocSta	SPC	Remote control blocked		O
PosSpt	APC	Deflector position set-point		O
Opn	SPC	Deflector to full open position		O
Cls	SPC	Deflector to full closed position		O
PosChg	ENC	Change deflector position (stop, raise, lower)		C ²
PosChgIncr	BSC	Incremental change of position		C ²
BlkOpn	SPC	Block opening of the deflector		O
BlkCls	SPC	Block closing of the deflector		O
For data attributes with conditions C ¹ , one or both may be used, however the use of at least one is mandatory. Data attributes with conditions C ² are optional, but if used, only one can be selected.				

5.6.6 LN: Dam leakage supervision

Name: HDLS

Logical node HDLS shall be used to represent a leakage supervision system for a dam.

HDLS class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
OpCnt	INS	Operation counter		O
LkgAlm	SPS	Leakage alarm level reached		M
Settings				
LkgAlmVal	ASG	Alarm level set-point for leakage		M
Measured values				
Flw	MV	Water flow at point of measurement [m ³ /s]		O

5.6.7 LN: Electrical brake

Name: HEBR

Logical node HEBR shall be used to represent the physical device of an electrical brake. The brake is used to stop the rotation of the shaft during power down of the unit using electric power.

HEBR class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		

Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
BrkOn	SPS	Brake function is active		O
Controls				
OpCntRs	INC	Resetable operation counter		O
LocSta	SPC	Remote control blocked		O
Operate	SPC	Command to operate device		M
BlkOn	SPC	Brake function blocked		O

5.6.8 LN: Governor control mode

Name: HGOV

Logical node HGOV shall be used to present information about different control modes of a turbine governor. One logical node HGOV must be created for each possible operation mode.

HGOV class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Loc	SPS	Local control behaviour		O
LocKey	SPS	Local or remote key		O
Flt	SPS	Fault in the controller		O
Measured values				
Out	MV	Output of the controller		M
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
ModAct	SPC	If TRUE this mode is active		O
ExSptEna	SPC	If TRUE use external set-point		O
Settings				
Droop	ASG	Droop		O

5.6.9 LN: Gate position indicator

Name: HGPI

Logical node HGPI shall be used to represent a physical device that provides the position of a gate. It shall be used for gates where the full open position (or fully closed position) is dependent on the actual upper water level of the dam. The position is given either as a distance for straight gates or as an angular displacement for sector gates.

HGPI class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
PosUp	SPS	Upper end position reached		M
PosDn	SPS	Lower end position reached		M
Measured values				
GtePosRad	MV	Gate position given as angular displacement (rad)		C
GtePosDeg	MV	Gate position given as angular displacement (degrees)		C
GtePosCm	MV	Gate position given as distance from full closed (cm)		C
Controls				
OpCntRs	INC	Resetable operation counter		O
NOTE For data attributes with conditions C, normally only one would be used.				

5.6.10 LN: Dam gate

Name: HGTE

Logical node HGTE shall be used to represent a dam gate. It is intended for gates where the full open or full closed position is dependent on the water level of the dam. For gates inserted in a dam in such a way that the upper water level is always above the upper part of the gate, the valve logical node (HVLV) is recommended. For calculation of water flow, a FCS is required.

node that holds the relation between water level, opening and flow, should be included in the same logical device.

HGTE class					
Data Object Name	Common Data class	Explanation	T	M/O	
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.			
Data Objects					
Status information					
LocKey	SPS	Local or remote key		O	
Loc	SPS	Local control behaviour		O	
PosUp	SPS	Upper end position reached (gate cannot move further)		M	
PosDn	SPS	Lower end position reached (gate cannot move further)		M	
Mvm	SPS	Gate is moving		O	
GteBlk	SPS	Gate is blocked (cannot move from present position)		O	
Settings					
GteTyp	ENG	Type of gate		O	
		Gate type			Value
		Vertical gate			1
		Radial gate			2
		Sector gate			3
Needle gate	4				
GteUpLim	RST	Upper limit of gate position (temporary restriction)		O	
GteLoLim	RST	Lower limit of gate position (temporary restriction)		O	
Incr	ASG	Increment of position change for raise / lower commands		O	
Measured values					
Flw	MV	Calculated water flow through the gate [m³/s]		O	
Controls					
LocSta	SPC	Remote control blocked		O	
OpCntRs	INC	Resetable operation counter		O	
Opn	SPC	Gate to full open position		O	
Cls	SPC	Gate to full closed position		O	
PosChg	ENC	Change gate position (stop, raise, lower)		C	
PosChgIncr	BSC	Change gate position incrementally		C	
Tag	TAG	Maintenance tag affixed to the device		O	
BlkOpn	SPC	Block opening of the gate		O	
BlkCls	SPC	Block closing of the gate		O	

5.6.11 LN: Intake gate

Name: HITG

Logical node HITG shall be used to model the intake gates. If operated they will be either raised fully or lowered fully, mid positions are not used during continuous operation. However, start sequencers might need to operate the gate at different speeds during different parts of the movement or keep the gate at a certain position for some time, before continuing movement. To cater for this, intake gates are often provided with position switches. In order to not limit the number of switches, the position switches can be instantiated.

HITG class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
PosStep	INS	Integer representing the position		O
PosUp	SPS	Upper end position reached (gate cannot move further)		M
PosDn	SPS	Lower end position reached (gate cannot move further)		M
Mvm	SPS	Gate is moving		O
GteBlk	SPS	Gate is blocked (cannot move from present position)		O
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
Opn	SPC	Gate to full open position		O
Cls	SPC	Gate to full closed position		O
BlkOpn	SPC	Block opening of the gate		O
BlkCls	SPC	Block closing of the gate		O

5.6.12 LN: Joint control

Name: HJCL

Logical node HJCL shall be used when a hydropower plant is operated in a constant water flow or a constant upper water level mode. That is, the power production level is subordinated to the water control. The joint control logical node is used to co-ordinate the water flow through the plant, through turbines as well as gates. The joint control function will normally try to optimise the power output for a given flow. It can open or close gates that are not blocked from operation, it can increase or decrease the active power from turbines but it cannot start or stop a unit. Some data objects may be instantiated to provide one set of objects per turbine and gate to be included in the joint control. Compare also with the HWCL logical node, which can be used to control a single object.

HJCL class												
Data Object Name	Common Data Class	Explanation	T	M/O								
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.										
Data Objects												
Status information												
LocKey	SPS	Local or remote key		O								
Loc	SPS	Local control behaviour		O								
TotFlwMax	SPS	Total maximum flow reached		O								
TotFlwMin	SPS	Total minimum flow reached		O								
FlwMax	SPS	Maximum flow through the controlled object (gate or turbine)		O								
FlwMin	SPS	Minimum flow through the controlled object		O								
FlwLevAlm	SPS	Flow and level control settings in conflict		O								
Gte	SPS	Contributing gate{inst} (true = contributing)		Omulti								
Settings												
TotFlwMaxLim	ASG	Maximum flow limit (Maximum allowed flow)		O								
TotFlwMinLim	ASG	Minimum flow limit (Minimum allowed flow) – can be 0.		O								
FlwMaxLim	ASG	Maximum allowed flow through the controlled object		O								
FlwMinLim	ASG	Minimum allowed flow through the controlled object		O								
Measured values												
ClcFlw	MV	Calculated water flow through the controlled object (gate or turbine)		M								
ClcNhd	MV	Calculated net head (distance between upper and lower water levels)		O								
ClcTotFlw	MV	Calculated total water flow through the plant		O								
Controls												
LocSta	SPC	Remote control blocked		O								
PosChg	ENC	Change position of gate{inst} (stop – raise – lower)	T	Omulti								
ActPwrR	SPC	Increase active power (open guide vanes) {inst}	T	Omulti								
ClcPwrSpt	APC	Calculated active power set-point{inst}		Omulti								
ClcGteSpt	APC	Calculated gate{inst} set-point (Note)		Omulti								
ActPwrL	SPC	Decrease active power (close guide vanes) {inst}	T	Omulti								
HdrCtlMod	ENC	To indicate the control mode of the function <table><tr><th>Operating mode</th><th>Value</th></tr><tr><td>Off (no joint control)</td><td>1</td></tr><tr><td>Upper water level set-point control mode</td><td>2</td></tr><tr><td>Total flow set-point control mode</td><td>3</td></tr></table>	Operating mode	Value	Off (no joint control)	1	Upper water level set-point control mode	2	Total flow set-point control mode	3		O
Operating mode	Value											
Off (no joint control)	1											
Upper water level set-point control mode	2											
Total flow set-point control mode	3											
FlwSpt	APC	Total water flow set-point [m³/s]		O								
JCtlTag	TAG	Joint control maintenance tag affixed to the equipment		O								
LevSpt	APC	Upper water controllable level set-point [m]		O								
UntTag	TAG	Maintenance tag affixed to the unit {inst}		Omulti								
CmdBlk	SPC	Block operation		O								
The gate set-point unit shall be the same as provided by the HGPI logical node, i.e. cm, degrees or radians.												

5.6.13 LN: Leakage supervision

Name: HLKG

Logical node HLKG shall be used to represent a leakage supervision system for any purpose.

HLKG class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		

Data Objects				
Status information				
OpCnt	INS	Operation counter		O
LkgAlm	SPS	Leakage alarm		M
Settings				
LkgAlmVal	ASG	Alarm level for leakage		M
Measured values				
Flw	MV	Measured water (liquid) flow		O

5.6.14 LN: Water level indicator

Name: HLVL

Logical node HLVL shall be used to represent a water level indicator. The principles of measurement might vary, but the level will normally be given with an accuracy of 0,01 m. In order to compare different level measurements above and below the plant, an offset from a base level is added to the local measurement. The water level measurement is a typical example of situation where substitution of the measured value is commonly used, the measurement device is often blocked from operation e.g. by ice.

For a simple level measurement of e.g. a tank, where the level can be expressed as a percentage of full tank, the TLVL logical node should be used instead of HLVL.

HLVL class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Stuck	SPS	Device is blocked through external influence		O
Settings				
LevOfs	ASG	Offset from power plant base level		O
Measured values				
LevM	MV	Water level at the point of measuring (including offset if given)[m]		M

5.6.15 LN: Mechanical brake

Name: HMBR

Logical node HMBR shall be used to represent the physical device brake. The brake is used to stop the rotation of the shaft during power down of the unit.

HMBR class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
BrkOn	SPS	Brakes are applied (on)		O
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
BrkOff	SPS	Brakes are disengaged (off)		O
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
Operate	SPC	Command to operate device		M
OpRs	SPC	Reset a previous issued Operate command		M
BlkOn	SPC	Brake blocked		O

5.6.16 LN: Needle control

Name: HNDL

Logical node HNDL shall be used to represent the control of turbine needles for Pelton type turbines.

HNDL class

Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Loc	SPS	Local control behaviour		O
LocKey	SPS	Local or remote key		O
AOfsCam	SPS	A-servo offset CAM function is activated		O
NdlMan	SPS	Manual selection of number of needles is active		O
NdlErr	INS	Servo loop fault, Pelton turbine needle (needle number returned)		O
NdlAct	SPS	Indication of which needles{inst} are active		Omulti
NdlOpTmh	INS	Accumulated operation time of each needle{inst}		Omulti
Measurements				
Flw	MV	Water flow through the controlled object (m ³ /s)		O
FlwPct	MV	Water flow through the controlled object (% of rated flow)		O
Settings				
NdlManNum	ING	Manual number of needles, when in manual needle control		O
Crv	CSG	Characteristic curve		O
NdlMaxNum	ING	Maximum number of needle insertion		O
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
Auto	SPC	Automatic / manual operation		O
NdlAutSel	INC	Auto selection of number of active needles, select		O
NdlManSel	SPC	Manual selection of number of active needles, select		O
OfsCamEna	SPC	Enable runner offset		O
Operate	SPC	Command to operate device		O
Stop	SPC	Stop command		O

5.6.17 LN: Water net head data

Name: HNHD

Logical node HNHD shall be used to represent a function that calculates and presents net head data and some related information. The input measured values will in most cases be derived from logical nodes of class HLVL.

Separate logical nodes of HNHD class shall be used depending on the purpose of the net head value. The value used for control of a turbine will normally be based on measurements taken inside the intake gate and at the tail-race outlet. If a net head value is to be used for general water control, the measurements are taken at some distance from the power plant, both upstream and downstream.

HNHD class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Stuck	SPS	Device is blocked through external influence		O
Settings				
LevOfs	ASG	Offset from power plant base level		O
Metered values				
Nhd	MV	Calculated Nethead		M
DifPres	MV	Calculated Differential water pressure across trashrack		O

5.6.18 LN: Dam over-topping protection

Name: HOTP

Logical node HOTP shall be used to represent an over-topping protection for the dam. The normal action of the protection, when engaged, is to open one or more gates to full open position. One instance should be provided for each gate that is to be controlled.

HOTP class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		

Data Objects				
Status information				
OpLev	SPS	Operation level reached	T	M
Settings				
OpSpt	ASG	Operation level set-point		M
RsDtTmm	ING	Reset Operate delay time in minutes		O
Controls				
OpCntRs	SPC	Resetable operation counter		O
CmdBlk	SPC	Block the function from operation		O

5.6.19 LN: Hydropower / water reservoir**Name: HRES**

Logical node HRES shall be used to represent the functional aspect of the reservoir in a hydropower plant. The HRES logical node does not represent the physical aspect of the dam.

HRES class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Settings				
MaxLev	ASG	Maximum allowed water level		O
RegLevHi	ASG	Highest level during normal regulation mode		O
RegLevLo	ASG	Lowest level during normal regulation mode		O
MinLev	ASG	Minimum allowed water level		O
VlmCap	ASG	Maximum volume of the reservoir		O
VlmCrv	CSG	Curve to define relation between level and volume		O
Measured values				
Vlm	MV	Calculated volumetric content [m ³]		M

5.6.20 LN: Hydropower unit sequencer**Name: HSEQ**

Logical node HSEQ shall be used to represent actions of the unit sequencer. The logical node HSEQ should be instantiated for each dedicated sequence (e.g. start, stop, etc.). It will be part of the unit controller logical device.

HSEQ class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
PrecSeq	SPS	Preconditions for sequence fulfilled		O
SeqAct	SPS	The sequence is active		O
PrecStep	SPS	Preconditions for step {inst} fulfilled		Omulti
StepPos	INS	Active step within the sequence		O
StepTmOut	SPS	Step {inst} time-out		Omulti
SeqTmOut	SPS	Sequence time-out		O
SeqCmpl	SPS	Sequence completed	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
StepOp	SPC	Step by step mode enabled		O
StrCmd	SPC	Start order to the sequence		M
StrNxt	SPC	Start next step		O
Settings				
StepLimTms	ING	Time limit (s) for step{inst}		Omulti
SeqLimTms	ING	Time limit (s) for complete sequence		O

5.6.21 LN: Speed monitoring**Name: HSPD**

Logical node HSPD shall normally be part of a stand-alone logical device. It may act as a protective backup of the governor frequency control, but mainly as a placeholder for various speed limits and set-points used by the start sequencer and other functions.

NOTE Some of the data objects are modified to allow instantiation if more than one object of the same type is required.

HSPD class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
SpdSrc	INS	Speed sensor {inst} fault		Omulti
StndStl	SPS	Stand still detection		O
SpdCrp	SPS	Creep detection		O
SpdBrk	SPS	Brake operation allowed {inst}		Omulti
SpdLub	SPS	Point of operation{inst} for lubrication system		Omulti
SpdLft	SPS	Point of operation{inst} for lift pump (high pressure oil system)		Omulti
SpdRb	SPS	speed at which runner blades at start angle is reached		O
SpdExt	SPS	Point of operation for excitation system breaker		O
SpdSyn	SPS	Point of operation for synchronising		O
SpdOv	SPS	Over-speed detection {inst}		Omulti
SpdMOv	SPS	Mechanical over-speed detection {inst}		Omulti
DirRot	SPS	Direction of rotation		O
Settings				
SpdCrpSpt	ASG	Creep detection setting		O
SpdBrkSpt	ASG	Braking allowed setting {inst}		Omulti
SpdLubSpt	ASG	Lubrication system operation setting {inst}		Omulti
SpdLftSpt	ASG	Lift pump operation setting		Omulti
SpdRbSpt	ASG	Start angle setting		O
SpdExtSpt	ASG	Excitation breaker operation setting		O
SpdSynSpt	ASG	Synchronisation setting		O
SpdStlSpt	ASG	Standstill detection limit		O
SpdHysSpt	ASG	Hysteresis limit		O
SpdOvSpt	ASG	Over-speed detection setting {inst}		Omulti
Measured values				
Spd	MV	Rotational speed of the shaft [s ⁻¹]		C
SpdPct	MV	Rotational speed of the shaft [%]		C
Controls				
SpdCrpCtl	SPC	Creep detection, TRUE = enabled		O
Condition C: only one data object should be used.				

5.6.22 LN: Surge shaft

Name: HSST

This logical node is used to represent a surge shaft. The surge shaft is a protection device mainly used against water-hammer effect. It behaves as a free surface for wave reflection where the water level is a function of the discharge time history. If its cross-section area is relatively small, it is usually called surge tank. This logical node can also represent air vessels. Air vessels are used for mitigating pressure fluctuations induced in hydraulic systems by pumps, vortex shedding, valves, etc. Most of the measured section data objects can be logically estimated if the parameters of the settings sections are known. Levels and heads are more comprehensive when equally referenced.

HSST class				
Data Object Name	Common data class	Explanation	T	M/O/C
LNNName		The name shall be composed of the class name, the LN-Prefix and LNInstance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data objects				
Settings				
DiaHdLos	ASG	Head losses at the diaphragm		O
PipeHd	ASG	Head at the trijunction (piezometric head)		O
TnkDschr	ASG	Surge tank discharge		O
DiaHd	ASG	Absolute pressure at the diaphragm		O

HSST class				
Data Object Name	Common data class	Explanation	T	M/O/C
GasHd	ASG	Head of the gas		C
GasVlm	ASG	Volume of the gas		C
PipeArea	ASG	Linking pipe cross section area		O
DiaArea	ASG	Diaphragm contracted cross section area		O
TnkArea	CSG	Surge tank cross section area at the elevation TnkLev		O
DiaLosCff	ASG	Diaphragm losses coefficient		O
DiaLev	ASG	Diaphragm elevation		O
PolytrCff	ASG	Polytropic coefficient		C
HdrTnkTyp	ENG	Surge Tank type (0=Surge Tank; 1=Surge Shaft; 2=Air Vessel)		M
Condition C: These data objects are optional if HdrTnkTyp = 2 (Air Vessel), otherwise they are not applicable.				

5.6.23 LN: Guide vanes (wicket gate)

Name: HTGV

Logical node HTGV shall be used to represent the physical device of guide vanes (wicket gate) related to a hydropower turbine. In case of individually controlled guide vanes, it is possible to instantiate the data objects for each guide vane.

HTGV class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
PosCls	SPS	Gate closed		O
PosOpn	SPS	Gate full open		O
PosSNL	SPS	Gate speed no load position		O
SMLkdCls	SPS	Servomotor {inst} locked closed in position		Omulti
SMLkdMnt	SPS	Servomotor {inst} locked in maintenance position		Omulti
PinAlm	SPS	Shear pin {inst} alarm		Omulti
RodAlm	SPS	Buckling rod {inst} alarm		Omulti
DvWrn	SPS	Gate deviation {inst} warning		Omulti
DvAlm	SPS	Gate deviation {inst} alarm		Omulti
Controls				
OpCntRs	INC	Resetable operation counter		O
PosSpt	APC	Position set-point		O
DithAct	SPC	Activate dither		O
Settings				
PosSNLSet	ASG	Gate in speed no load position setting		O
DvWrnSpt	ASG	Gate deviation {inst} warning (margin)		Omulti
DvAlmSpt	ASG	Gate deviation {inst} alarm (margin)		Omulti
CbrRng	ASG	Calibration range		O
ClsLim	RST	Closing limit (temporary restriction)		O
ClsLimHys	ASG	Closing limit hysteresis		O
ClsTmsSet	ING	Closing time (s)		O
OpnTmsSet	ING	Opening time (s)		O
DithOfs	ASG	Dither offset		O
Measured values				
PosPct	MV	Position {inst} as percent of full opening [%]		Cmulti
PosDeg	MV	Position {inst} as opening angle [deg]		Cmulti
SMPres	MV	Servo motor pressure to move the guide vane {inst} [mPa]		Omulti
Condition: either PosPct or PosDeg per Position instance shall be used but not both.				

5.6.24 LN: Runner blades

Name: HTRB

Logical node HTRB shall be used to represent the physical device of runner blades of a Kaplan type turbine where runner blades positions can be measured. If required, some data objects may be instantiated to provide separate data objects for each runner blade.

HTRB class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
PosCls	SPS	Runner blades closed		O
PosOpn	SPS	Runner blades open		O
PosSNL	SPS	Runner speed no load position		O
DvWrn	SPS	Runner blade{inst} deviation warning	T	Omulti
DvAlm	SPS	Runner blade {inst} alarm	T	Omulti
Settings				
PosSNLSet	ASG	Runner blade start position setting		O
DvWrnSpt	ASG	Runner blade deviation {inst} warning (margin)		Omulti
DvAlmSpt	ASG	Runner blade deviation {inst} alarm (margin)		Omulti
Measured values				
PosDeg{inst}	MV	Position {inst} in degrees		O
PosPct{inst}	MV	Position {inst} in percent		O
Controls				
OpCntRs	INC	Resetable operation counter		O

5.6.25 LN: Trash rack

Name: HTRK

Logical node HTRK shall be used to represent the physical device of a trash rack.

HTRK class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
DifPresAlm	SPS	Differential pressure alarm		O
Settings				
DifPresSpt	ASG	Differential pressure alarm setting		O
Measured values				
DifPres	MV	Differential pressure across trash rack		M
Controls				
OpCntRs	INC	Resetable operation counter		O

5.6.26 LN: Turbine

Name: HTUR

Logical node HTUR shall be used to represent the physical device of a turbine in a hydro-power plant. The logical node serves as an extended rating plate only, for any operational status and runtime information, the logical node HUNT shall be used.

HTUR class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
OpTmh	INS	Operation time [h]		O
RotDir	ENS	Rotational direction (Clockwise Counter-clockwise Unknown)		O
RotDirPmp	ENS	Direction of rotation in pump mode – if different from RotDir (Clockwise Counter-clockwise Unknown)		O
Settings				
~~Trb~~ TurTyp	ENG	Turbine type (Francis, Helice, Kaplan, Pelton, Pump-Turbine)		M
SpdRtg	ASG	Turbine rated speed [s^{-1}]		M
~~Trb~~ TurInert	ASG	Turbine moment of inertia J [kgm^2]		O
~~Trb~~ TurTrsSpd	ASG	Maximum transient overspeed [s^{-1}]		O
~~Trb~~ TurRwySpd	ASG	Runaway speed [s^{-1}]		O
PwrRtg ~~Trb~~ Tur	ASG	Rated power in turbine mode [MW]		O
PwrRtgPmp	ASG	Rated power in pump mode [MW]		O
FlwRtg ~~Trb~~ Tur	ASG	Rated flow in turbine mode [m^3/s]		O
FlwRtgPmp	ASG	Rated flow in pump mode [m^3/s]		O
NhdRtg ~~Trb~~ Tur	ASG	Rated net head in turbine mode [m]		O
NhdRtgPmp	ASG	Rated net head in pump mode [m]		O
SpirMaxPres	ASG	Spiral case maximum pressure [Pa]		O
DrbtMaxPres	ASG	Draft tube maximum pressure [Pa]		O
ShftPres	ASG	Shaft seal water input rated pressure [Pa]		O
ShftFlw	ASG	Shaft seal water input rated flow [m^3/s]		O
ShftLkg	ASG	Shaft seal leakage rated flow [m^3/s]		O
GdvPres	ASG	Guide vane (needle) rated oil pressure [Pa]		O
DflPres	ASG	Blade (deflector) rated oil pressure [Pa]		O
GdvMinClsTms	ING	Guide vane (needle) minimum closing time [s]		O
DflMinClsTms	ING	Blade (deflector) minimum closing time [s]		O

5.6.27 ~~LN: Hydropower unit~~ Logical nodes for general purposes

Name: ~~HUNT~~
LN group G

Logical node ~~HUNT~~ GUNT shall be used to represent the physical device of a ~~hydropower~~ production unit, ~~that is, typically consisting of a turbine and generator combination with~~ including control and ancillary equipment. ~~It can be seen as an extended name plate, which allows temporary settings of data.~~ The logical node holds information about the present operational status of the unit; it shall also be used to receive commands to change the operational status. ~~The logical node is also used to receive commands to change operating status of the unit.~~ It is intended to replace the logical node HUNT, introduced in IEC 61850-7-410, to represent a hydro power unit.

~~HUNT~~ GUNT class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
LockKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
Iner	INS	Inertia of the unit (sum of turbine and generator inertia) [kgm^2]		O

HUNT GUNT class																																		
Data Object Name	Common Data Class	Explanation	T	M/O/C																														
UntOpSt	ENS	Status of the unit (numbers above 20 are free for user specific requests).		M																														
		<table><tr><th>Operational condition</th><th>Value</th></tr><tr><td>Blocked from operation (disabled)</td><td>1</td></tr><tr><td>Stopped (needs control sequence to start)</td><td>2</td></tr><tr><td>Starting (start-up in progress)</td><td>3</td></tr><tr><td>Auxiliaries started ~~(for pump turbine operation)~~</td><td>4</td></tr><tr><td>Generator running (speed no load, not excited)</td><td>5</td></tr><tr><td>Generator energised (speed no load, excited)</td><td>6</td></tr><tr><td>Synchronised, normal conditions</td><td>7</td></tr><tr><td>Stopping (shut-down in progress)</td><td>8</td></tr><tr><td>Creeping (~~slow movement~~ for hydro)</td><td>9</td></tr><tr><td>Ready for start (at stand-still)</td><td>10</td></tr><tr><td>Discharging (for hydro)</td><td>11</td></tr><tr><td>Cranking (air, motor, SFC) (for thermal)</td><td>12</td></tr><tr><td>Purging (for thermal)</td><td>13</td></tr><tr><td>Rotor barring (turning gear) (for thermal)</td><td>14</td></tr></table>			Operational condition	Value	Blocked from operation (disabled)	1	Stopped (needs control sequence to start)	2	Starting (start-up in progress)	3	Auxiliaries started ~~(for pump turbine operation)~~	4	Generator running (speed no load, not excited)	5	Generator energised (speed no load, excited)	6	Synchronised, normal conditions	7	Stopping (shut-down in progress)	8	Creeping (~~slow movement~~ for hydro)	9	Ready for start (at stand-still)	10	Discharging (for hydro)	11	Cranking (air, motor, SFC) (for thermal)	12	Purging (for thermal)	13	Rotor barring (turning gear) (for thermal)	14
		Operational condition			Value																													
		Blocked from operation (disabled)			1																													
		Stopped (needs control sequence to start)			2																													
		Starting (start-up in progress)			3																													
		Auxiliaries started ~~(for pump turbine operation)~~			4																													
		Generator running (speed no load, not excited)			5																													
		Generator energised (speed no load, excited)			6																													
		Synchronised, normal conditions			7																													
		Stopping (shut-down in progress)			8																													
		Creeping (~~slow movement~~ for hydro)			9																													
		Ready for start (at stand-still)			10																													
		Discharging (for hydro)			11																													
		Cranking (air, motor, SFC) (for thermal)			12																													
Purging (for thermal)	13																																	
Rotor barring (turning gear) (for thermal)	14																																	
UntOpMod	ENS	Operating mode of the unit <table><tr><th>Operational mode</th><th>Value</th></tr><tr><td>Generating mode</td><td>1</td></tr><tr><td>Synchronous condenser mode</td><td>2</td></tr><tr><td>Pumping mode (for pumped storage)</td><td>3</td></tr><tr><td>Launching mode (for back-to-back of another unit)</td><td>4</td></tr><tr><td>Discharge mode (for hydro)</td><td>5</td></tr></table>	Operational mode	Value	Generating mode	1	Synchronous condenser mode	2	Pumping mode (for pumped storage)	3	Launching mode (for back-to-back of another unit)	4	Discharge mode (for hydro)	5		M																		
Operational mode	Value																																	
Generating mode	1																																	
Synchronous condenser mode	2																																	
Pumping mode (for pumped storage)	3																																	
Launching mode (for back-to-back of another unit)	4																																	
Discharge mode (for hydro)	5																																	
GridMod	ENS	Grid mode e.g. the actual grid the unit meets when CB synchronises to the grid. <table><tr><th>Grid mode</th><th>Value</th></tr><tr><td>Normal conditions (normal frequency and voltage)</td><td>1</td></tr><tr><td>Islanded (varying frequency and / or voltage)</td><td>2</td></tr><tr><td>Line charging (black net start)</td><td>3</td></tr><tr><td>Local supply (no external network available)</td><td>4</td></tr></table>	Grid mode	Value	Normal conditions (normal frequency and voltage)	1	Islanded (varying frequency and / or voltage)	2	Line charging (black net start)	3	Local supply (no external network available)	4		O																				
Grid mode	Value																																	
Normal conditions (normal frequency and voltage)	1																																	
Islanded (varying frequency and / or voltage)	2																																	
Line charging (black net start)	3																																	
Local supply (no external network available)	4																																	
GridOpSt	ENS	Grid operational status, i.e. if there is a disturbance or not <table><tr><th>Grid operational status</th><th>Value</th></tr><tr><td>Normal conditions (no disturbance)</td><td>1</td></tr><tr><td>Disturbed (abnormal frequency and / or voltage level)</td><td>2</td></tr><tr><td>PSS control (PSS controller override)</td><td>3</td></tr></table>	Grid operational status	Value	Normal conditions (no disturbance)	1	Disturbed (abnormal frequency and / or voltage level)	2	PSS control (PSS controller override)	3		O																						
Grid operational status	Value																																	
Normal conditions (no disturbance)	1																																	
Disturbed (abnormal frequency and / or voltage level)	2																																	
PSS control (PSS controller override)	3																																	
PaOpnMod	SPS	Partial opening in condenser mode		⊖																														
LimAct	SPS	Turbine limitation is activated		O																														
StopVlv RlfVlv	SPS	Stop Relief valve position		O																														
Settings																																		
PwrRtgLim	RST	Temporary limitation of power output		O																														
VRtgLim	RST	Temporary limitation of operating voltage		O																														

HUNT GUNT class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
FlwRtgLim	RST	Temporary limitation of water flow		⊖
MaxFlwRtg	ASG	Rated maximum water flow per unit [m³/s]		⊖
MaxSpdLim	ASG	Maximum allowed rotational speed		O
PresCmpr	MV	Pressure after compressor (Pa) (for gas turbine)		O
Controls				
OpCntRs	INC	Resetable operation counter		O
LocSta	SPC	Remote control blocked		O
ReqSt	ENC	Requested state from operator (numbers above 20 are free for user specific requests)		O
		State requested	Value	
		Stop	1	
		Speed no load, not excited	2	
		Speed no load, excited	3	
		Generating	4	
		Generating condenser	5	
		Prepared for start in generating mode	6	
		Prepared for start in pump mode (for pump storage)	7	
		Pump condenser by SFC (for pump storage)	8	
		Pump condenser by back-to-back (for pump storage)	9	
		Pump condenser by self-excitation (for pump storage)	10	
		Pump by SFC (for pump storage)	11	
		Pump by back-to-back (for pump storage)	12	
		Pump by self-excitation (for pump storage)	13	
		Emergency shut-down (for pump storage)	14	
		Discharge (hydro)	15	
Purging	16			
ValnIGdv	ASG	Variable Inlet guide vane control (deg) (for gas turbines) ¹⁾		O
StepOp	SPC	Step by step operation of sequencer		O
StrNxt	SPC	Start next step		O
Tag	TAG	Maintenance tag affixed to the device		O

¹⁾ Variable Inlet Guide Vanes (ValnIGdv): The first 1 to 3 vane-stages of the compressor are usually controllable to control the amount of air passing through the turbine. This parameter indicates the control angle.

5.6.28 LN: Valve (butterfly valve, ball valve)

Name: HVLV

Logical node HVLV shall be used to represent e.g. a valve in the penstock. For calculation of water flow, a FCSD logical node that holds the relation between water level, opening and flow, should be included in the same logical device. This LN can also be used to represent a main control valve. For a simpler type of valve, the logical node KVLV is recommended (see IEC 61850-7-4).

HVLV class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
PosCls	SPS	Closed end position reached (valve cannot move further)		C ¹
PosOpn	SPS	Open end position reached (valve cannot move further)		C ¹
Mvm	SPS	Valve is moving		O
Stuck	SPS	Device is blocked through external influence		O
DvWrn	SPS	Position deviation warning		O
DvAlm	SPS	Position deviation alarm		O
Settings				
OpnLim	RST	Opening limit of valve position (temporary restriction)		O
ClsLim	RST	Closing limit (temporary restriction)		O
Incr	ING	Increment of position change for open / close commands		O
SldStrPs	ASG	Solidity compensation start in positive direction		O
SldStrNg	ASG	Solidity compensation start in negative direction		O
SldOfsPs	ASG	Solidity offset in positive direction		O
SldOfsNg	ASG	Solidity offset in negative direction		O
CbrRng	ASG	Calibration range		O
DvWrnSpt	ASG	Position deviation warning (margin)		O
DvAlmSpt	ASG	Position deviation alarm (margin)		O
Measured values				
PosPct	MV	Valve position given as 0 – 100 %		C ²
PosDeg	MV	Valve position given as 0° – 90°		C ²
Flw	MV	Calculated liquid flow through the valve [m ³ /s]		O
Controls				
LocSta	SPC	Remote control blocked		O
OpCntRs	INC	Resetable operation counter		O
PosSpt	APC	Valve position set-point		O
Opn	SPC	Valve to full open position		O
Cls	SPC	Valve to full closed position		O
PosChg	ENC	Change valve position (stop, raise, lower)		C ²
PosChgIncr	BSC	Incremental change of position		C ²
BlkOpn	SPC	Block opening of the valve		O
BlkCls	SPC	Block closing of the valve		O
For data attributes with conditions C ¹ , one or both may be used, however the use of at least one is mandatory. Data attributes with conditions C ² are optional, but if used, only one can be selected.				

5.6.29 LN: Water control

Name: HWCL

Logical node HWCL shall be used to represent the control of one physical device, dam gate or turbine, which can modify the water flow through the plant. Compare also with the LN for joint control (HJCL) that can be used for combined control.

HWCL class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
Loc	SPS	Local control behaviour		O
FlwMax	SPS	Maximum flow reached		O
FlwMin	SPS	Minimum flow reached		O
HiLevUp	SPS	Upper water (dam) high level		O
LoLevUp	SPS	Upper water (dam) low level		O
HiLevDn	SPS	Lower water (tailrace) high level		O
LoLevDn	SPS	Lower water (tailrace) low level		O
FlwLevAlm	SPS	Flow and level control settings in conflict		O
Settings				
FlwMaxLim	ASG	Maximum flow setting		O
FlwMinLim	ASG	Minimum flow setting		O
LevHiSpt	ASG	Upper water (dam) high level alarm set-point		O

HWCL class												
Data Object Name	Common Data Class	Explanation	T	M/O/C								
LevLoSpt	ASG	Upper water (dam) low level alarm set-point		O								
LevDnHiSpt	ASG	Lower water (tailrace) high level alarm set-point		O								
LevDnLoSpt	ASG	Lower water (tailrace) low level alarm set-point		O								
Measured values												
Flw	MV	Calculated water flow through the controlled object (m ³ /s)		O								
FlwPct	MV	Calculated water flow (%) of rated value taken from HUNT. FlwRtg		O								
PskPres	MV	Penstock pressure (Pa)		O								
Controls												
LocSta	SPC	Remote control blocked		O								
Auto	SPC	Automatic / manual operation		O								
HdrCtlMod	ENC	To indicate the control mode of the function		O								
		<table><tr><th>Operating mode</th><th>Value</th></tr><tr><td>Off (no joint control)</td><td>1</td></tr><tr><td>Upper water level set-point control mode</td><td>2</td></tr><tr><td>Total flow set-point control mode</td><td>3</td></tr></table>	Operating mode	Value	Off (no joint control)	1	Upper water level set-point control mode	2	Total flow set-point control mode	3		
Operating mode	Value											
Off (no joint control)	1											
Upper water level set-point control mode	2											
Total flow set-point control mode	3											
FlwSpt	APC	Water flow set-point (m ³ /s)		O								
LevSpt	APC	Upper water controllable level set-point (m)		O								
PosChg	ENC	Change gate position (stop, raise, lower)		C								
PosChgIncr	BSC	Change gate position incrementally		C								
ActPwrR	SPC	Increase active power (open guide vanes)	T	O								
ActPwrL	SPC	Decrease active power (close guide vanes)	T	O								
NOTE For data attributes with conditions C, the logical node will use either a value to raise or lower (DO:PosChgIncr) or a signal (stop, increase, decrease) (DO:PosChg) to control an opening position of a gate or a guide vane.												

NOTE For data attributes with conditions C, the logical node will use either a value to raise or lower (DO:PosChgIncr) or a signal (stop, increase, decrease) (DO:PosChg) to control an opening position of a gate or a guide vane.

5.7 Logical nodes for interface and archiving LN group I

5.7.1 Modelling remarks

This group of logical nodes represents human interfaces and other generic interfaces towards external entities. IEC 61850-7-4 defines some LN for this purpose (IARC, IHMI, ITCI, ITMI and ISAF).

5.7.2 LN: Fire detection and alarm

Name: IFIR

Logical node IFIR shall be used to represent a fire detection system. The data objects representing sensors and detection units may be instantiated in order to allow individual data from each device.

IFIR class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
FirAlm	SPS	Fire alarm		O
ArcDtc	SPS	Arc detection{Inst}		Omulti
FlmDtc	SPS	Flame detection{Inst}		Omulti
HeatDtc	SPS	Heat detection{Inst}		Omulti
SmokDtc	SPS	Smoke detection{Inst}		Omulti
Controls				
OpCntRs	INC	Resetable operation counter		O
TripRs	SPC	Trip signal reset		O
AlmReset	SPC	Alarm signal reset		O
Horn	SPC	Audible signal from horn		O

5.7.3 LN: Hand interface

Name: IHND

Logical node IHND shall be used to represent a local interface using e.g. push-button or any other physical device that is used to provide an action.

IHND class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Trip	SPS	Emergency switch trips unit or plant (1 = trip)	T	O
SafAlm	SPS	Safety alarm (1=On, 0=Off)	T	O
RCmd	SPS	Raise command		O
LCmd	SPS	Lower command		O
StrCmdBt	SPS	Start command		O
StopSt	SPS	Stop command		O
Opn	SPS	Open command		O
Cls	SPS	Close command		O
Sel	SPS	Selection command		O
CodeCmdSt	SPS	Codes{inst} for calls and audible alarms		Omulti
Controls				
TripRs	SPC	Trip signal reset		O
AlmReset	SPC	Alarm signal reset		O
Horn	SPC	Audible signal from horn		O

5.8 Logical nodes for mechanical and non-electric primary equipment LN group K

5.8.1 Modelling remarks

This group of logical nodes represents various devices that can be supervised, controlled or operated but that are not primarily of electrical nature. This group includes devices like tanks, valves, fans, etc.

5.8.2 LN: Heater, cubicle heater

Name: KHTR

Logical node KHTR shall be used to represent a heater.

KHTR class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
LocKey	SPS	Local or remote key		O
OpCntRs	INS	Resettable operation counter		O
Loc	SPS	Local Control Behaviour		O
HtrOn	SPS	Heater {inst} On		Omulti
OpnCircAlm	SPS	Open circuit alarm		O
Settings				
TmpSpt	ASG	Temperature setpoint (in case of controllable thermostat)		O
Controls				
LocSta	SPC	Remote control blocked		O
Auto	SPC	Automatic / manual operation		O
Operate	SPC	Command to operate device {inst}		Omulti
OpRs	SPC	Reset a previous issued Operate command {inst}		Omulti
Measurements				
Tmp	MV	Temperature		O

5.9 Logical nodes for protection functions

LN group P

5.9.1 Modelling remarks

This group of logical nodes represents electrical protections. IEC 61850-7-4 defines most of the electrical protections used in any type of plant, including hydropower. This document re-defines one specific logical node, rotor protection (PRTR).

5.9.2 LN: ~~Rotor protection~~ Detection of under impedance Name: ~~PRTR~~ PTUI

Logical node ~~PRTR~~ PTUI (time under impedance) shall be used ~~to represent a field short-circuit protection~~ for all kinds of resistance under-detection, intended for stator and rotor earth-fault detection by voltage injection. ~~The protection is normally included in the excitation system.~~

PRTR PTUI class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status Information				
CwbAmpDirPs	SPS	Crowbar current direction detection: positive		0
CwbAmpDirNg	SPS	Crowbar current direction detection: negative		0
CwbFlt	SPS	Crowbar fault		0
OverVFlt	SPS	Over-voltage fault		0
Str	ACD	Start	T	M 0
Op	ACT	Operate (~~trips both field and generator circuit-breakers~~)	T	M
MeasFlt	SPS	Measurement fault		0
Settings				
StrVal	ASG	Start value		0 M
TrgMaxCnt	ING	Max allowed forward conducting cycles		0
OpDITmms	ING	Operate delay time [ms]		0 M
RsDITmms	ING	Reset delay time [ms]		0
MinVolts	ASG	Minimum volts of injection system		0
Controls				
OpCntRs	INC	Resettable operation counter		0
Measured values				
RisGnd	MV	Calculated impedance to ground [Ω]		0
InjVol	MV	Measured injected voltage [V]		0
InjAmp	MV	Measured injected current [A]		0

5.10 Logical nodes for protection related functions

LN group R

5.10.1 Modelling remarks

This group of logical nodes represents functions that are related to electrical protections.

5.10.2 LN: Field breaker configuration

Name: RFBC

This logical node shall be used to represent common information and settings of a field breaker.

RFBC class				
Data Object Name	Common Data Class	Explanation	T	M/O/C
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Settings				
FbcTyp	ENG	Field breaker configuration		M
		Field Breaker Type	Value	
		AC field breaker only	1	
		DC field breaker only	2	
		AC and DC field breaker	3	
		Double AC infeed breaker	4	
		Double AC infeed breaker and DC breaker	5	
		DC breaker with separate DC breaker for emergency excitation	6	

5.11 Logical nodes for supervision and monitoring

LN group S

5.11.1 Modelling remarks

This group of logical nodes represents:

- a) functions that are related to electrical protections although not protections themselves, and
- b) protective functions that act on other physical measurements than electrical for their function.

The logical nodes in this group will normally provide an alarm signal if the measured level passes a set value. They can optionally provide a trip signal.

5.11.6 LN: Supervision of electrical conductivity in water

Name: SECW

Logical Node SECW shall be used to represent devices that supervise the electrical conductivity in water. If more than one sensor (LN TECW) is connected, the LN SECW shall be instantiated for each sensor.

When instantiation of data is used, this data shall be defined in the private namespace.

SECW class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2:2010, Clause 22		
Data Objects				
Status information				
Alm	SPS	alarm over level {Inst}		Omultip
Trip	SPS	trip at over level {Inst}		Omultip
Settings				
AlmSpt	ASG	alarm level set-point {Inst}		Omultip
TripSpt	ASG	trip level setting{Inst}		Omultip
Measured values				
Cdt	MV	Electrical conductivity [S]		M

5.11.2 LN: Supervision of media flow

Name: SFLW

Logical node SFLW shall be used to represent devices that supervise the media flow in a major plant object (e.g. a pipeline or tube). It provides alarm and trip/shutdown functions. If more than one sensor (LN TFLW) is connected, the LN SFLW shall be instantiated for each sensor.

When instantiation of data is used, this data shall be defined in the private namespace.

SFLW class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
Loc	SPS	Local control behaviour		O
LockKey	SPS	Local or remote key		O
HiAct	SPS	Hi Start action when over activation threshold {Inst}		Omultip
HiDeAct	SPS	Hi Stop action when overactivation threshold {Inst}		Omultip
HiInd	SPS	Hi Indication over level {Inst}		Omultip
HiAlm	SPS	Hi alarm over level {Inst}		Omultip
HiTrip	SPS	Hi trip over level {Inst}		Omultip
LoAct	SPS	Lo Start action when under activation threshold {Inst}		Omultip
LoDeAct	SPS	Lo Stop action when underactivation threshold {Inst}		Omultip

SFLW class					
Data Object Name	Common Data Class	Explanation		T	M/O
LoInd	SPS	Lo Indication under level {Inst}			Omulti
LoAlm	SPS	Lo alarm under level {Inst}			Omulti
LoTrip	SPS	Lo trip under level {Inst}			Omulti
Act	SPS	Start action when over activation threshold {Inst}			Omulti
DeAct	SPS	Stop action when overactivation threshold {Inst}			Omulti
Ind	SPS	Indication over level {Inst}			Omulti
Alm	SPS	alarm over level {Inst}			Omulti
Trip	SPS	trip at over level {Inst}			Omulti
Settings					
Media	ENG	Type of media being measured			O
		Type of media being acted/reported on	Value		
		Water	1		
		Oil	2		
		Air	3		
		Glycol	4		
		Hydrogen	5		
		Nitrogen	6		
		Fuel	7		
		Steam	8		
Gas (unspecified)	9				
Liquid (unspecified)	10				
HiActSpt	ASG	Hi Start action when activation threshold {Inst} set-point			Omulti
HiDeActSpt	ASG	Hi Stop action when activation threshold {Inst} set-point			Omulti
HiIndSet	ASG	Hi Indication alarm level {Inst} set-point			Omulti
HiAlmSpt	ASG	Hi alarm level {Inst} set-point			Omulti
HiTripSpt	ASG	Hi trip level {Inst} set-point			Omulti
HiIndDITms	ING	Hi delay time for indication (s) {Inst}			Omulti
HiAlmDITms	ING	Hi delay time for alarm (s) {Inst}			Omulti
HiTripDITm	ING	Hi delay time for trip (time unit given by application) {Inst}			Omulti
LoActSpt	ASG	Lo Start action when activation threshold {Inst} set-point			Omulti
LoDeActSpt	ASG	Lo Stop action when activation threshold {Inst} set-point			Omulti
LoIndSet	ASG	Lo Indication alarm level set-point {Inst}			Omulti
LoAlmSpt	ASG	Lo alarm level is set-point {Inst}			Omulti
LoTripSpt	ASG	Lo trip level set-point {Inst}			Omulti
LoIndDITms	ING	Lo delay time for indication (s) {Inst}			Omulti
LoAlmDITms	ING	Lo delay time for alarm (s) {Inst}			Omulti
LoTripDITm	ING	Lo delay time for trip (time unit given by application) {Inst}			Omulti
ActSpt	ASG	Start action when activation threshold {Inst} set-point			Omulti
DeActSpt	ASG	Stop action when activation threshold {Inst} set-point			Omulti
IndSet	ASG	Indication alarm level set-point {Inst}			Omulti
AlmSpt	ASG	alarm level set-point {Inst}			Omulti
TripSpt	ASG	trip level setting{Inst}			Omulti
IndDITms	ING	delay time for indication (s) {Inst}			Omulti
AlmDITms	ING	alarm delay time (s) {Inst}			Omulti
TripDITm	ING	trip delay time (time unit given by application) {Inst}			Omulti
Measured values					
Flw	MV	Flow-rate of media [m³/s]			O

5.11.3 LN: Supervision of media level

Name: SLVL

Logical node SLVL shall be used to represent devices that supervise the level of major plant objects (e.g. a tank). It provides alarm and trip/shutdown functions. If more than one sensor (LN TLVL) is connected, the LN SPOS shall be instantiated for each sensor.

When instantiation of data is used, this data shall be defined in the private namespace.

SLVL class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				
Status information				
HiAct	SPS	Hi Start action when over activation threshold {Inst}		Omulti
HiDeAct	SPS	Hi Stop action when under activation threshold {Inst}		Omulti
HiInd	SPS	Hi Indication over level {Inst}		Omulti

HiAlm	SPS	Hi alarm over level {Inst}		Omulti
HiTrip	SPS	Hi trip over level {Inst}		Omulti
LoAct	SPS	Lo Start action when under activation threshold {Inst}		Omulti
LoDeAct	SPS	Lo Stop action when underactivation threshold {Inst}		Omulti
LoInd	SPS	Lo Indication under level {Inst}		Omulti
LoAlm	SPS	Lo alarm under level {Inst}		Omulti
LoTrip	SPS	Lo trip under level {Inst}		Omulti
Activ	SPS	Start action when over activation threshold {Inst}		Omulti
DeAct	SPS	Stop action when under activation threshold {Inst}		Omulti
Ind	SPS	Indication over level {Inst}		Omulti
Alm	SPS	alarm over level {Inst}		Omulti
Trip	SPS	Trip at over level {Inst}		Omulti
Settings				
Media	ENG	Type of media being measured		O
		Type of media being acted/reported on	Value	
		Water	1	
		Oil	2	
		Air	3	
		Glycol	4	
		Hydrogen	5	
		Nitrogen	6	
		Fuel	7	
		Steam	8	
		Gas (unspecified)	9	
Liquid (unspecified)	10			
HiActSpt	ASG	Hi Start action activation threshold {Inst} set-point		Omulti
HiDeActSpt	ASG	Hi Stop action activation threshold {Inst} set-point		Omulti
HiIndSet	ASG	Hi Indication alarm level {Inst} set-point		Omulti
HiAlmSpt	ASG	Hi alarm level {Inst} set-point		Omulti
HiTripSpt	ASG	Hi trip level {Inst} set-point		Omulti
HiIndDITms	ING	Hi delay time for indication (s) {Inst}		Omulti
HiAlmDITms	ING	Hi delay time for alarm (s) {Inst}		Omulti
HiTripDITm	ING	Hi delay time for trip (time unit given by application) {Inst}		Omulti
LoActSpt	ASG	Lo Start action when activation threshold {Inst} set-point		Omulti
LoDeActSpt	ASG	Lo Stop action when activation threshold {Inst} set-point		Omulti
LoIndSet	ASG	Lo Indication alarm level set-point {Inst}		Omulti
LoAlmSpt	ASG	Lo alarm level is set-point {Inst}		Omulti
LoTripSpt	ASG	Lo trip level set-point {Inst}		Omulti
LoIndDITms	ING	Lo delay time for indication (s) {Inst}		Omulti
LoAlmDITms	ING	Lo delay time for alarm (s) {Inst}		Omulti
LoTripDITm	ING	Lo delay time for trip (time unit given by application) {Inst}		Omulti
ActSpt	ASG	Start action activation threshold {Inst} set-point		Omulti
DeActSpt	ASG	Stop action activation threshold {Inst} set-point		Omulti
IndSet	ASG	Indication alarm level set-point {Inst}		Omulti
AlmSpt	ASG	alarm level set-point {Inst}		Omulti
TripSpt	ASG	trip level setting{Inst}		Omulti
IndDITms	ING	delay time for indication (s) {Inst}		Omulti
AlmDITms	ING	alarm delay time (s) {Inst}		Omulti
TripDITm	ING	trip delay time (time unit given by application) {Inst}		Omulti
Measured values				
LevPct	MV	Media level (% of full capacity)		O

5.11.4 LN: Supervision of the position of a device

Name: SPOS

Logical node SPOS shall be used to represent devices that supervise the position of major plant objects. It provides alarm and trip/shutdown functions. If more than one sensor (LN TPOS) is connected, the LN SPOS shall be instantiated for each sensor.

When instantiation of data is used, this data shall be defined in the private namespace.

SPOS class				
Data Object Name	Common Data Class	Explanation	T	M/O
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to Clause 22 of IEC 61850-7-2:2010.		
Data Objects				