



DPC: 22/30425832 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 15 February 2022

Origin: International

Latest date for receipt of comments: 30 March 2022

Project No. 2020/02257

Responsible committee: PEL/57 Power systems management and associated information exchange

Interested committees:

Title: Draft BS EN IEC 61850-7-410 Communication networks and systems for power utility automation. Part 7-410: Basic communication structure - Hydroelectric power plants - Communication for monitoring and control.

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 30 March 2022

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

PROJECT NUMBER: IEC 61850-7-410 ED3	
DATE OF CIRCULATION: 2022-02-04	CLOSING DATE FOR COMMENTS: 2022-04-29
SUPERSEDES DOCUMENTS: 57/2263/RR	

IEC TC 57 : POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE	
SECRETARIAT: Germany	SECRETARY: Mr Heiko Englert
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 4	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

NOTE FROM TC/SC OFFICERS:

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	10
1. Scope.....	11
1.1 General.....	11
1.2 Data model Namespace name and version	11
1.3 Data model Namespace Code Component distribution	11
1.4 Application of the logical node classes.....	12
2. Normative references	13
3. Terms and definitions	13
4. Abbreviated terms	13
5. Logical node classes	27
5.1 General.....	27
5.2 Classes list	28
5.3 Abbreviated Terms 7-410 (Abbreviations_7_410).....	34
5.3.1 General	34
5.3.2 Classes list.....	34
5.3.3 7-410 Abbreviated Terms (AbbrTerm_7_410 abbreviation enumeration)	34
5.4 Logical nodes for automatic control (LNGroupA_7_410).....	35
5.4.1 General	35
5.4.2 Classes list.....	37
5.4.3 LN: Balancing reserve operation Name: AROP	38
5.4.4 LN: Control mode selection Name: ACTM.....	41
5.4.5 LN: Joint control for power management Name: AJCL	42
5.4.6 LN: PSS 4 filter function Name: APSF	46
5.4.7 LN: PSS control, common information Name: APSS	51
5.4.8 LN: PSS 2 filter function Name: APST	52
5.5 Logical nodes for thermal power (LNGroupE_7_410)	55
5.5.1 General	55
5.5.2 Classes list.....	56
5.5.3 LN: Thermal turbine speed monitoring Name: ESPD.....	57
5.5.4 LN: Block coordination function Name: EBCF	59
5.5.5 LN: Fuel control valve Name: EFCV.....	60
5.5.6 LN: Gas turbine unit Name: EGTU	62
5.5.7 LN: Steam control valve Name: ESCV	63
5.5.8 LN: Steam turbine unit Name: ESTU.....	64
5.5.9 <<abstract>> LN: Thermal turbine Name: ThermalTurbineLN	66
5.5.10 <<abstract>> LN: Thermal control valve Name: ThermalValveLN.....	67
5.6 Logical nodes for functional blocks (LNGroupF_7_410)	69
5.6.1 General	69
5.6.2 Classes list.....	69
5.6.3 LN: Deadband filter Name: FDBF.....	70
5.6.4 LN: Functional heart beat Name: FHBT	71
5.6.5 LN: Trip matrix Name: FMTX	72
5.6.6 LN: Task manager Name: FTSK	74

5.6.7	LN: Functional priority status Name: FXPS	75
5.7	Generic logical nodes for hydro and thermal power plants (LNGroupG_7_410)	76
5.7.1	General	76
5.7.2	Classes list.....	77
5.7.3	LN: Generic maintenance and operational tag Name: GTAG.....	78
5.7.4	LN: Generic production unit Name: GUNT	79
5.8	Logical nodes for hydro power plants (LNGroupH_7_410).....	81
5.8.1	General	81
5.8.2	Classes list.....	86
5.8.3	LN: Turbine Name: HTUR.....	89
5.8.4	LN: Butterfly or ball valve Name: HVLV	91
5.8.5	LN: Water control Name: HWCL	93
5.8.6	<<deprecated,abstract>> LN: Brake Name: BrakeLN.....	95
5.8.7	<<abstract>> LN: Gate Name: GateLN	96
5.8.8	<<abstract>> LN: Hydropower control Name: HydroControlLN.....	97
5.8.9	<<abstract>> LN: Leakage level supervision Name: LeakageLevelSupervisionLN.....	99
5.8.10	<<abstract>> LN: <Something> turbine Name: SomethingTurbineLN.....	100
5.8.11	<<abstract>> LN: Turbine speed monitoring Name: TurbineSpeedMonitoringLN	101
5.8.12	<<abstract>> LN: Valve Name: ValveLN.....	103
5.8.13	LN: Hydro turbine speed monitoring Name: HSPD	105
5.8.14	LN: Turbine generator shaft bearing Name: HBRG	107
5.8.15	LN: Combinator Name: HCOM.....	108
5.8.16	LN: Hydropower dam Name: HDAM.....	109
5.8.17	LN: Deflector valve Name: HDFL	110
5.8.18	<<deprecated>> LN: Electrical brake Name: HEBR	112
5.8.19	LN: Governor control mode Name: HGOV.....	113
5.8.20	LN: Gate position indicator Name: HGPI.....	115
5.8.21	LN: Dam gate Name: HGTE.....	116
5.8.22	LN: Intake gate Name: HITG.....	118
5.8.23	LN: Leakage supervision (general) Name: HLKG	119
5.8.24	LN: Water level indicator Name: HLVL	120
5.8.25	LN: Mechanical brake Name: HMBR.....	122
5.8.26	LN: Needle control Name: HNDL	123
5.8.27	LN: Water net head data Name: HNHD.....	124
5.8.28	LN: Joint control for water management Name: HJCL.....	126
5.8.29	LN: Dam over-topping protection Name: HOTP.....	130
5.8.30	LN: Hydropower unit sequencer Name: HSEQ	131
5.8.31	LN: Hydropower water reservoir Name: HRES	132
5.8.32	LN: Surge shaft / Air vessel Name: HSST.....	133
5.8.33	LN: Guide vanes (wicket gate) Name: HTGV	135
5.8.34	LN: Runner blades Name: HTRB	137
5.8.35	LN: Trash rack Name: HTRK	138
5.9	Logical nodes for interfacing and archiving (LNGroupI_7_410).....	139
5.9.1	General	139

5.9.2	Classes list.....	140
5.9.3	LN: Fire detection and alarm Name: IFIR.....	140
5.9.4	LN: Hand interface Name: IHND	141
5.9.5	<<abstract>> LN: Alarm trip control Name: AlarmTripControlLN	143
5.10	Logical nodes for mechanical and non-electric primary equipment (LNGroupK_7_410).....	144
5.10.1	General	144
5.10.2	Classes list.....	144
5.10.3	LN: Bearing information Name: KBRG	145
5.10.4	LN: Clutch Name: KCTH	146
5.10.5	LN: Heater Name: KHTR	147
5.10.6	LN: Brake pad Name: KPAD	149
5.10.7	LN: Turning-gear Name: KTGR.....	150
5.11	Logical nodes for metering and measurement (LNGroupM_7_410)	151
5.11.1	General	151
5.11.2	Classes list.....	152
5.11.3	LN: Three phases related electric measurement extension Name: MMXUExt	152
5.12	Logical nodes for protections of power plants (LNGroupP_7_410)	154
5.12.1	General	154
5.12.2	Classes list.....	155
5.12.3	LN: Detection of under impedance Name: PTUI	155
5.13	Logical nodes for protection related functions (LNGroupR_7_410).....	157
5.13.1	General	157
5.13.2	Classes list.....	157
5.13.3	LN: Field breaker configuration Name: RFBC	157
5.14	Logical nodes for supervision and monitoring (LNGroupS_7_410).....	158
5.14.1	General	158
5.14.2	Classes list.....	159
5.14.3	LN: Supervision of electrical conductivity in water Name: SECW	160
5.14.4	LN: Supervision of media flow Name: SFLW	161
5.14.5	LN: Supervision of media level Name: SLVL	163
5.14.6	LN: Supervision of the position of a device Name: SPOS.....	165
5.14.7	<<abstract>> LN: Media supervision Name: MediaSupervisionLN.....	168
5.15	Logical nodes for transducers and instrument transformers (LNGroupT_7_410)	170
5.15.1	General	170
5.15.2	Classes list.....	171
5.15.3	LN: Measurement of electrical conductivity in water Name: TECW.....	171
5.16	Logical nodes for switchgear (LNGroupX_7_410).....	172
5.16.1	General	172
5.16.2	Classes list.....	173
5.16.3	LN: Switching control for field flashing Name: XFFL.....	173
5.17	Logical nodes from part 7-420 (LNFrom_7_420)	175
5.17.1	General	175
5.17.2	Classes list.....	176
5.17.3	<<abstract>> LN: LowPass Filter On Function Input LN Name: LowPassFilterOnFunctionInputLN	176

5.17.4	<<abstract>> LN: LowPass Filter On Function Output LN Name: LowPassFilterOnFunctionOutputLN	177
5.17.5	<<abstract>> LN: Function Name: ElectricalContextReferenceLN	179
5.17.6	<<abstract>> LN: Mode Management Name: OperationalFunctionLN	180
5.17.7	<<abstract>> LN: Function Name: RampRatesLN	182
5.17.8	<<abstract>> LN: Active power setting or limiting related LNs Name: ActivePowerLN	184
6.	Data object name semantics and enumerations	187
6.1	Data semantics	187
6.2	Enumerated data attribute types	212
6.2.1	General	212
6.2.2	Classes list	214
6.2.3	Balancing Reserve (BalancingReserveKind enumeration)	214
6.2.4	BearingUseKind enumeration	215
6.2.5	BlockStatusKind enumeration	215
6.2.6	BrakeStatusKind enumeration	216
6.2.7	ClutchKind enumeration	216
6.2.8	ControlPriorityKind enumeration	216
6.2.9	DamConstructionKind enumeration	217
6.2.10	ECP type (ECPConnKind enumeration)	217
6.2.11	FieldBreakerConfigurationKind enumeration	218
6.2.12	GateConstructionKind enumeration	218
6.2.13	GridModeKind enumeration	218
6.2.14	GridOperationStatusKind enumeration	219
6.2.15	HydroControlModeKind enumeration	219
6.2.16	Matrix Operation (MatrixOperationKind enumeration)	219
6.2.17	MediaKind enumeration	220
6.2.18	Position Change (PositionChangeKind enumeration)	220
6.2.19	PSS Model Number (PssModelKind enumeration)	220
6.2.20	Quadrant running state (QuadrantRunningStateKind enumeration)	221
6.2.21	RequestedStateKind enumeration	221
6.2.22	StartingQueueStatusKind enumeration	222
6.2.23	StartPriorityKind enumeration	222
6.2.24	SurgeTankSortKind enumeration	222
6.2.25	Tag Sort (TagSortKind enumeration)	223
6.2.26	<<deprecated>> Tag Type (TagStateKind enumeration)	223
6.2.27	TurbineConstructionKind enumeration	223
6.2.28	Unit Operation Mode (UnitOperationModeKind enumeration)	224
6.2.29	UnitOperationStatusKind enumeration	224
6.2.30	Valve Position Change (ValvePositionChangeKind enumeration)	225
7.	Common Data Classes -7-410	225
7.1	General	225
7.2	Classes list	225
7.3	Analogue settings	226
7.3.1	General	226
7.3.2	Classes list	226
7.3.3	<<deprecated>> Operational restriction (RST)	227

7.4	Controls	227
7.4.1	General	227
7.4.2	Classes list	228
7.4.3	<<deprecated>> Operational and maintenance tag (TAG)	228
8.	DAEnums -7-410	230
	Bibliography	232

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –****Part 7-410: Basic communication structure – Hydroelectric power plants,
steam and gas turbines – Logical node classes**

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.

IEC 61850-7-410 has been prepared by Working Group 18 of IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

This 3rd edition cancels and replaces the 2nd edition published in 2012, including Amendment 1:2016. This edition constitutes a technical revision.

Besides editorial improvements, this edition includes the following significant technical changes with respect to the previous edition:

- a) Addition of new Logical Nodes to cover systems and details of the power generation domain previously not modelled in a sufficient way;

- b) Review of existing Logical Nodes concerning structure, use of Common Data Classes and naming;
- c) Fixes and improvements of some names and descriptions of Data Objects;
- d) Improvements of the structure and enumerations within the Domain Logical Nodes;
- e) Addition of new Logical Nodes with respect to maintenance and supervision functionality;
- f) Updating of Logical Nodes for PSS functionality (LNs: APSS, APST and APSF) reflecting the updated PSS standard IEEE 421.5:2016;
- g) Amendment 1, including among other things the Group E Logical Nodes;
- h) Resolutions to all known UML Issues related to part -7-410;
- i) This 3rd edition is autogenerated from the UML file;
- j) Upon publication the updated part -7-410 NameSpace will be made as a Code Component on the TC57 web page.

The text of this International Standard is based on the following documents:

Draft	Report on voting
57/2227/DC	57/2263/RR

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications. This IEC standard includes Code Components i.e. components that are intended to be directly processed by a computer.

Such content is any text found between the markers <CODE BEGINS> and <CODE ENDS>, or otherwise is clearly labelled in this standard as a Code Component.

The purchase of this IEC standard carries a copyright license for the purchaser to sell software containing Code Components from this standard to end users either directly or via distributors, subject to IEC software licensing conditions, which can be found at: <http://www.iec.ch/CCv1>.

Table 1 shows all tracking information of IEC 61850-7-410:2022A namespace building-up

Table 1 – Tracking information of IEC 61850-7-410:2022A namespace building-up

Attribute	Content
Namespace IEC specific information	
Version of the UML model used for generating the document (informative)	WG18Built5.1
Date of the UML model used for generating the document (informative)	2022-01-30
Autogeneration software name and version(informative)	j61850DocBuilder 02 based on jCleanCim noNS beta9 (derived from jCleanCim 02-02)
Namespace Changes	
Version from which the list of Tissues is built	2022

Attribute	Content
Revision of the version from which the list of Tissues is built	A
List of Applied Tissues	wg18-0040 ; wg18-0041 ; wg18-0043 ; wg18-0049 ; wg18-0083 ; wg18-0090 ; wg18-0094 ; wg18-0095 ; wg18-0096 ; wg18-0098 ; wg18-0108 ; wg18-0112 ; wg18-0113 ; wg18-0130 ; wg18-0133 ; wg18-0137 ; wg18-0143 ; wg18-0147 ; wg18-0157 ; wg18-0162. wg10-0830 ; wg10-0831 ; wg10-0882 ; wg10-0883 ; wg10-0884 ; wg10-0885 ; wg10-0886. c-0003 ; c-0005 ; c-0006 ; c-0008 ; c-0009 ; c-0014 ; c-0017 ; c-0019 ; c-0022 ; c-0043.

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

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

INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent. IEC takes no position concerning the evidence, validity, and scope of this patent right.

The holder of this patent right has assured IEC that s/he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from the patent database available at patents.iec.ch/.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. IEC shall not be held responsible for identifying any or all such patent rights.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION

Part 7-410: Basic communication structure – Hydroelectric power plants, steam and gas turbines – Logical node classes

1. Scope

1.1 General

This part of IEC 61850 specifies the logical node classes for use in the domain of hydroelectric power plants, steam and gas turbines.

This IEC61850 domain information model standard utilizes the existing logical node classes defined in IEC 61850-7-4 *Basic communication structure – Compatible logical node classes and data object classes* where possible, while defining new and extended domain specific logical node classes to provide the necessary data objects for application to functions and systems in the domain of hydroelectric power plants, steam and gas turbines. The domain information model includes the interface towards a central operator centre's control functions.

The Scope related to steam and gas turbine specifics is limited to the overall control functions, generator and turbine control functions. For Hydroelectric power plants the Scope includes the entire power plant automation system.

1.2 Data model Namespace name and version

Table 2 shows all attributes of IEC 61850-7-410:2022A namespace.

Table 2 – Attributes of IEC 61850-7-410:2022A namespace

Attribute	Content
Namespace nameplate	
Namespace Identifier	IEC 61850-7-410
Version	2022
Revision	A
Full Namespace Name	IEC 61850-7-410:2022A
Full Code Component Name	IEC_61850-7-410.NSD.2022A.Full
Light Code Component Name	IEC_61850-7-410.NSD.2022A.Light
Namespace Type	domain
Namespace dependencies	
includes	IEC 61850-7-4:2007B version :2007 revision :B

1.3 Data model Namespace Code Component distribution

The Code Components are in light and full version:

- The full version is named: *IEC_61850-7-410.NSD.2022A.Full*. It contains definition of the whole data model defined in this standard with the documentation associated and access is restricted to purchaser of this part.
- The light version is named: *IEC_61850-7-410.NSD.2022A.Light*. It does not contain any documentation but contains the whole data model as per full version, and this light version is freely accessible on the IEC website for download at: <http://www.iec.ch/tc57/supportdocuments>, but the usage remains under the licensing conditions.

The Code Components for IEC 61850 data models are formatted in compliance with the NSD format defined by the standard IEC 61850-7-7. Each Code Component is a ZIP package containing:

- the electronic representation of the Code Component itself (possibly multiple files);
- the grammar files (XSD) enabling to check the consistency of the associated files against the defined version of NSD, but as well against the IEC 61850 flexibility rules in case of private extensions;
- a file describing the content of the package (IECManifest.xml).

The IECManifest contains different sections giving information on:

- The copyright notice;
- The identification of the code component;
- The publication related to the code component;
- The list of the electronic files which compose the code component;
- An optional list of history files to track changes during the evolution process of the code component.

The life cycle of a code component is not restricted to the life cycle of the related publication. The publication life cycle goes through two stages, Version (corresponding to an edition) and Revision (corresponding to an amendment). A third publication stage (Release) allows publication of Code Component in case of urgent fixes of InterOp Tissues, thus without need to publish an amendment.

Consequently new release(s) of the Code Component may be released, which supersede(s) the previous release, and will be distributed through the IEC TC57 web site at: <http://www.iec.ch/tc57/supportdocuments>.

The latest version/release of the document will be found by selecting the file named *IEC_61850-7-410.NSD.{VersionStateInfo}.Light* with the filed VersionStateInfo of the highest value.

1.4 Application of the logical node classes

Examples on modelling according to IEC61850 in the domain of hydroelectric power plants, steam and gas turbines is found in the IEC technical report IEC TR 61850-7-510. Part 7-510: Basic communication structure – Hydroelectric power plants, steam and gas turbines – Modelling concepts and guidelines.

2. Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61362:2012, *Guide to specification of hydraulic turbine governing systems*

IEC 61850-6:2009, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

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

IEC 61850-7-3:2010/AMD1:2020

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*

IEC 61850-7-4:2010/AMD1:2020.

3. Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at www.electropedia.org;
- ISO Online browsing platform: available at www.iso.org/obp.

4. Abbreviated terms

The terms listed in Table 3 are used to build concatenated Data Object Names in this document. The IEC 61850-7-410 inherits all the abbreviated terms described in Clause 4 of IEC 61850-7-4:2010.

NOTE Transition abbreviations belonging to 61850-7-410 part (to be included in a later edition of IEC 61850-7-4) are listed in the Table 6.

118 Table 3 shows normative terms that are
119 combined to create data object names.

120 **Table 3 – Normative abbreviations for**
121 **data object names**

Term	Description
A	Current; phase A (L1)
AC	AC, alternating current
AGC	Automatic generation control
ASG	Analogue setting CDC
AWatt	Wattmetric component of current
Abr	Abrasion
Abs	Absolute
Absb	Absorbing
Acc	Accuracy; acceleration (deprecated: use Accl instead)
Accl	Acceleration
Accm	Accumulated
Ack	Acknowledgement, acknowledge
Acs	Access
Act	Action, activity, active, activate
Actr	Actuator
Acu	Acoustic
Addr	Address
Adj	Adjustment
Admin	Administrative
Adp	Adapter, adaptation
Aff	Affected
Age	Ageing
Ahr	Ampere hours
Air	Air
Alg	Algorithm
Alm	Alarm, alarm trigger status
Als	Alarm trigger status set
Alt	Altitude
Altn	Alternate
Amnt	Amount
Amp	Ampere, current DC or non-phase-related AC
An	Analogue
Anc	Ancillary
Ane	Anemometer
Ang	Angle

Term	Description
Ap	Access point
Apc	Analogue point control
App	Apparent
Ar	Amperes reactive (reactive current)
Arc	Arc
Area	Area
Arr	Array
Asyn	Asynchronous
At	At
Auth	Authorisation
Auto	Automatic
Aux	Auxiliary
Av	Average
Avl	Availability
Ax	Axial
Azi	Azimuth
B	Bushing; phase B (L2)
BG	Before Gain
Bac	Binary-controlled analogue value
Bar	Barrier
Base	Base
Bat	Battery
Bck	Backup
Bec	Beacon
Beh	Behaviour
Ber	Bit error rate
Bias	Bias
Bl	Blade
Blb	Bulb
Blk	Block, blocked
Blow	Blowby
Bnd	Band, bandwidth
Boil	Boiler
Bot	Bottom
Brcb	Buffered report control block
Brg	Bearing
Brk	Brake
Bsc	Binary status control
Bst	Boost
Bt	Heartbeat
Bub	Bubbling

Term	Description
Bus	Bus
Byb	Bypass
C	Carbon; phase C (L3)
C2H2	Acetylene
C2H4	Ethylene
C2H6	Ethane
CB	Circuit breaker
CE	Cooling equipment (see also CI)
CG	Core ground
CH4	Methane
CHP	Combined heat and power
CO	Carbon monoxide
CO2	Carbon dioxide
Cab	Cable
Cal	Calorie, caloric
Cam	Cam, e.g. rotating non-circular disk
Can	Cancel
Cap	Capability, capacity
Capac	Capacitance
Car	Carrier
Cbr	Calibration
Ccw	Counter clockwise
Ccy	Currency
Cds	Condensation
Ceil	Ceiling
Cel	Cell
Cf	Crest factor
Cff	Coefficient
Cfg	Configuration
Cg	Combusted Gas
Ch	Channel
Cha	Charger
Chg	Change
Chk	Check
Chr	Characteristic
Chs	Chassis
Circ	Circulating, circuit
CI	Cooling, coolant, cooling system (see also CE)
Clc	Calculate, calculated
Clip	Clip

Term	Description
Clk	Clock
Cloud	Cloud
Clr	Clear
Cls	Close, closed
Cm	Centimetres
Cmbu	Combustible, combustion
Cmd	Command
Cmpl	Completed, completion, complete
Cmut	Commute, commutator
Cndct	Conductivity, Conducting
Cnt	Counter
Cntt	Contractual
Cnv	Converter
Col	Coil
Comm	Communication
Comp	Compensation
Conf	Configuration
ConfRev	Configuration revision (confRev from IEC 61850-7-2)
Conn	Connected, connections
Cons	Constant (general)
Cor	Correction
Core	Core
Cost	Cost
Crank	Crank
Crd	Coordination
Crit	Critical
Crl	Correlation
Crp	Creeping, slow movement
Crv	Curve
Csmp	Consumption, consumed
Ctl	Control
Ctr	Center
Cum	Cumulative
Cur	Current
Cut	Cut, cut-out, cut-in
Cvr	Cover, cover level
Cw	Clockwise
Cwb	Crowbar
Cyc	Cycle
D	Derivate

Term	Description
DC	DC, direct current
DER	Distributed energy resource
DExt	De-excitation
DPCSO	Double point controllable status output
DQ0	Direct, quadrature, and zero axis quantities
DS	Device state
DT	Daylight saving time
Dam	Dam
Damp	Damping
Date	Date, date and time of action
Day	Day
Db	Deadband
Dcl	DC-link
Dct	Direct
De	De (prefix)
Dea	Dead
Dec	Decrease
Deg	Degrees
Dehum	De-humidifier
Del	Delta
Den	Density
Dep	Dependent
Desc	Description
Det	Detected
Detun	Detuning
Dev	Device
Dew	Dew
Dff	Diffuse
Dfl	Deflector (used in Pelton turbines)
Dft	Default
Dia	Diaphragm
Diag	Diagnostics
Dif	Differential, difference
Dig	Digital
Dip	Dip
Dir	Direction
Dis	Distance
Dist	Distribution
Dith	Dither
DI	Delay

Term	Description
Dlt	Delete
Dlv	Delivery
Dmd	Demand
Dn	Down, downstream
Dpc	Double point control
Dpt	Departure
Drag	Drag hand
Dropout	Dropout
Drp	Droop
Drt	Derate
Drtb	Draft tube
Drv	Drive
Dsa	Disable, disabled
Dsc	Discrepancy
Dsch	Discharge
Dscon	Disconnected
Dsp	Displacement
Dtc	Detection
Dur	Duration
Dust	Dust
Dv	Deviation
Dw	Delta Omega
Dyn	Dynamic
EE	External equipment
EF	Earth fault
EFN	Earth-fault neutraliser (Petersen coil)
EMA	E-mobility Account
ENG	Enumerated status setting CDC
ENS	Enumerated status CDC
EPC	Emergency Power Control
EV	Electrical Vehicle
EVSE	EV Supply Equipment
Echo	Echo
Ecp	Electrical connection point
Edt	Edit, edited
Efc	Efficiency
EI	Elevation
Ela	Elasticity
Em	Emission
Emg	Emergency
En	Energy

Term	Description
Ena	Enabled, enable, allow operation
Enc	Enumerated control
Encl	Enclosure
End	End
Eng	Engine
Ent	Entity, entities
Entr	Entry, entries
Env	Environment
Eq	Equalization, equal, equivalent
Err	Error
Est	Estimated
Ev	Evaluation
Evn	Even
Evt	Event
Ex	External
ExIm	Export/import
Exc	Exceeded
Excl	Exclusion
Exp	Expired
Exps	Expansion
Expt	Export
Ext	Excitation
F	Float
FA	Fault arc
FPM	Fuel processing module
Fa	"Fire all" sequence (to thyristors)
Fact	Factor
Fail	Failure
Fan	Fan
Fbc	Field breaker configuration
Fer	Frame error rate
Fil	Filter, filtration system
Fire	Fire
Fish	Fish
Fix	Fixed
Fld	Field
Flk	Flicker
Fll	Fall
Flm	Flame
Flood	Flood
Flsh	Flash, flashing

Term	Description
Flt	Fault
Flush	Flush
Flw	Flow, flowing
Fol	Follower, following
Forc	Forced
Fu	Fuse
Fuel	Fuel
Full	Full
Fun	Function
Fwd	Forward
Gain	Gain
Gas	Gas
Gbx	Gearbox
Gdv	Guide vane
Gen	General
Glob	Global
Gm	Grand master
Gn	Generator
Gnd	Ground
GoCBRef	GOOSE control block reference
Gocb	GOOSE control block
Gr	Group
Gra	Gradient
Grd	Guard
Gri	Grid
Gross	Gross
Gs	Grease
Gte	Gate
Gust	Gust
H	Harmonics (phase-related)
H2	Hydrogen
H2O	Water (chemical aspect: liquid, steam, etc.)
HP	Hot point
HPh	Harmonics phase
Ha	Harmonics (non-phase-related AC)
Har	Harmonic
Hb	Harmonic bin
Hd	Head
Health	Health
Heat	Heater, heating, heat (see also Ht)

Term	Description
Hello	Hello signal, Live signal, "I am alive" signal
Hi	High, highest
Hlf	Half
Hold	Hold
Hor	Horizontal
Horn	Horn
Ht	Heating, heating system (see also Heat)
Htex	Heat-exchanger
Hub	Hub
Hum	Humidity
Hy	Hydraulic, hydraulic system
Hyd	Hydrological, hydro, water
Hys	Hysteresis
Hz	Frequency
Hz1	Frequency at side 1
Hz2	Frequency at side 2
I	Integral, integration
ING	Integer status setting CDC
INS	Integer status CDC
ISCSO	Integer status controllable status output
Ia	Information available
Iafm	Information available force majeure
Iano	Information available non-operative
Ianofa	Information available non-operative forced outage
Ianopca	Information available non-operative planned corrective action
Ianos	Information available non-operative suspended
Ianosm	Information available non-operative scheduled maintenance
Iao	Information available operative
Iaog	Information available operative generating
Iaogfp	Information available operative generating with full performance
Iaogpp	Information available operative generating with partial performance
Iaong	Information available operative non-generating
Iaongel	Information available operative non-generating out of electrical specification
Iaongen	Information available operative non-generating out of environment specification

Term	Description
Iaongrs	Information available operative non-generating requested shutdown
Iaongts	Information available operative non-generating technical standby
Ice	Ice
Id	Identity, identifier
Ieee	(deprecated) IEEE definition
IeeeKH	(deprecated) Proportional gain HF (High Frequency). Defined in IEEE 421.5
IeeeKH1	(deprecated) Proportional gain HF positive. Defined in IEEE 421.5
IeeeKH1 1	(deprecated) Lead gain HF positive. Defined in IEEE 421.5
IeeeKH1 7	(deprecated) Lead gain HF negative. Defined in IEEE 421.5
IeeeKH2	(deprecated) Proportional gain HF negative. Defined in IEEE 421.5
IeeeKI	(deprecated) Proportional gain IF (Intermediate Frequency). Defined in IEEE 421.5
IeeeKI1	(deprecated) Proportional gain IF positive. Defined in IEEE 421.5
IeeeKI11	(deprecated) Lead gain IF positive. Defined in IEEE 421.5
IeeeKI17	(deprecated) Lead gain IF negative. Defined in IEEE 421.5
IeeeKI2	(deprecated) Proportional gain IF negative. Defined in IEEE 421.5
IeeeKL	(deprecated) Proportional gain LF (Low Frequency). Defined in IEEE 421.5
IeeeKL1	(deprecated) Proportional gain LF positive. Defined in IEEE 421.5
IeeeKL11	(deprecated) Lead gain LF positive. Defined in IEEE 421.5
IeeeKL17	(deprecated) Lead gain LF negative. Defined in IEEE 421.5
IeeeKL2	(deprecated) Proportional gain LF negative. Defined in IEEE 421.5
IeeeKs1	(deprecated) Gain Ks1. Defined in IEEE 421.5
IeeeKs2	(deprecated) Gain Ks2. Defined in IEEE 421.5
IeeeKs3	(deprecated) Gain Ks3. Defined in IEEE 421.5
IeeeM	(deprecated) Ramtrack lowpass degree M. Defined in IEEE 421.5
IeeeN	(deprecated) Ramtrack overall degree N. Defined in IEEE 421.5
IeeeT1	(deprecated) Time constant T1. Defined in IEEE 421.5

Term	Description
IeeeT10	(deprecated) Time constant T10. Defined in IEEE 421.5
IeeeT11	(deprecated) Time constant T11. Defined in IEEE 421.5
IeeeT2	(deprecated) Time constant T2. Defined in IEEE 421.5
IeeeT3	(deprecated) Time constant T3. Defined in IEEE 421.5
IeeeT4	(deprecated) Time constant T4. Defined in IEEE 421.5
IeeeT7	(deprecated) Time constant T7. Defined in IEEE 421.5
IeeeT8	(deprecated) Time constant T8. Defined in IEEE 421.5
IeeeT9	(deprecated) Time constant T9. Defined in IEEE 421.5
IeeeTH1	(deprecated) Time constant TH1 (High frequency positive). Defined in IEEE 421.5
IeeeTH10	(deprecated) Time constant TH10 (High frequency negative). Defined in IEEE 421.5
IeeeTH11	(deprecated) Time constant TH11 (High frequency negative). Defined in IEEE 421.5
IeeeTH12	(deprecated) Time constant TH12 (High frequency negative). Defined in IEEE 421.5
IeeeTH2	(deprecated) Time constant TH2 (High frequency positive). Defined in IEEE 421.5
IeeeTH3	(deprecated) Time constant TH3 (High frequency positive). Defined in IEEE 421.5
IeeeTH4	(deprecated) Time constant TH4 (High frequency positive). Defined in IEEE 421.5
IeeeTH5	(deprecated) Time constant TH5 (High frequency positive). Defined in IEEE 421.5
IeeeTH6	(deprecated) Time constant TH6 (High frequency positive). Defined in IEEE 421.5
IeeeTH7	(deprecated) Time constant TH7 (High frequency negative). Defined in IEEE 421.5
IeeeTH8	(deprecated) Time constant TH8 (High frequency negative). Defined in IEEE 421.5
IeeeTH9	(deprecated) Time constant TH9 (High frequency negative). Defined in IEEE 421.5

Term	Description
IeeeTI1	(deprecated) Time constant TI1 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI10	(deprecated) Time constant TI10 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTI11	(deprecated) Time constant TI11 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTI12	(deprecated) Time constant TI12 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTI2	(deprecated) Time constant TI2 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI3	(deprecated) Time constant TI3 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI4	(deprecated) Time constant TI4 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI5	(deprecated) Time constant TI5 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI6	(deprecated) Time constant TI6 (Intermediate frequency positive). Defined in IEEE 421.5
IeeeTI7	(deprecated) Time constant TI7 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTI8	(deprecated) Time constant TI8 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTI9	(deprecated) Time constant TI9 (Intermediate frequency negative). Defined in IEEE 421.5
IeeeTL1	(deprecated) Time constant TL1 (Low frequency positive). Defined in IEEE 421.5
IeeeTL10	(deprecated) Time constant TL10 (Low frequency negative). Defined in IEEE 421.5
IeeeTL11	(deprecated) Time constant TL11 (Low frequency negative). Defined in IEEE 421.5
IeeeTL12	(deprecated) Time constant TL12 (Low frequency negative). Defined in IEEE 421.5
IeeeTL2	(deprecated) Time constant TL2 (Low frequency positive). Defined in IEEE 421.5
IeeeTL3	(deprecated) Time constant TL3 (Low frequency positive). Defined in IEEE 421.5

Term	Description
IeeeTL4	(deprecated) Time constant TL4 (Low frequency positive). Defined in IEEE 421.5
IeeeTL5	(deprecated) Time constant TL5 (Low frequency positive). Defined in IEEE 421.5
IeeeTL6	(deprecated) Time constant TL6 (Low frequency positive). Defined in IEEE 421.5
IeeeTL7	(deprecated) Time constant TL7 (Low frequency negative). Defined in IEEE 421.5
IeeeTL8	(deprecated) Time constant TL8 (Low frequency negative). Defined in IEEE 421.5
IeeeTL9	(deprecated) Time constant TL9 (Low frequency negative). Defined in IEEE 421.5
IeeeTw1	(deprecated) Time constant wash out Tw1. Defined in IEEE 421.5
IeeeTw2	(deprecated) Time constant wash out Tw2. Defined in IEEE 421.5
IeeeTw3	(deprecated) Time constant wash out Tw3. Defined in IEEE 421.5
IeeeTw4	(deprecated) Time constant wash out Tw4. Defined in IEEE 421.5
IeeeVHM _{ax}	(deprecated) Maximum limit set-point HF. Defined in IEEE 421.5
IeeeVHM _{in}	(deprecated) Minimum limit set-point HF. Defined in IEEE 421.5
IeeeVIMa _x	(deprecated) Maximum limit set-point IF. Defined in IEEE 421.5
IeeeVIMi _n	(deprecated) Minimum limit set-point IF. Defined in IEEE 421.5
IeeeVLM _{ax}	(deprecated) Maximum limit set-point LF. Defined in IEEE 421.5
IeeeVLMi _n	(deprecated) Minimum limit set-point LF. Defined in IEEE 421.5
IeeeVsi1 _{Max}	(deprecated) Input High Limit 1. Defined in IEEE 421.5
IeeeVsi1 _{Min}	(deprecated) Input Low Limit 1. Defined in IEEE 421.5
IeeeVsi2 _{Max}	(deprecated) Input High Limit 2. Defined in IEEE 421.5
IeeeVsi2 _{Min}	(deprecated) Input Low Limit 2. Defined in IEEE 421.5
IeeeVstM _{ax}	(deprecated) Output High Limit. Defined in IEEE 421.5
IeeeVstM _{in}	(deprecated) Output Low Limit. Defined in IEEE 421.5
Imb	Imbalance
Imp	Impedance non-phase-related AC

Term	Description
Impact	Impact
Impt	Import
In	Input
Ina	Inactivity
Inc	Integer control
Incl	Inclination
Incr	Increment, increase
Ind	Indication
Indp	Independent
Iner	Inertia
Inh	Inhibit
Inl	Inline
Inlet	Inlet
Inn	Inner
Ins	Insulation
Insol	Insolation
Inst	Instantaneous
Int	Integer
Intm	Intermediate
Intn	Internal
Intr	Interrupt, interruption
Intv	Interval
Inv	Inverter, inverted, inverse
Isc	Integer status control
Isld	Islanded
Iso	Isolation
Iu	Information unavailable
Ix	Index
Jmp	Jump
Jnt	Joint
K	Constant (regulation)
K0Fact	Zero-sequence (residual) compensation factor
KFact	K factor (harmonics)
Kck	Kicker
Key	Key, physical control device
L	Lower (action)
LDC	Line drop compensation
LDCR	Line drop compensation resistance
LDCX	Line drop compensation reactance
LDCZ	Line drop compensation impedance

Term	Description
LED	Light-emitting diode
LTC	Load tap changer
Last	Last
Ld	Lead
Ldp	Link discovery protocol
Leap	Leap (second)
Len	Length
Lev	Level
Lft	Lifting, lift
Lg	Lag
Life	Lifetime
Lim	Limit
Lin	Line
Liv	Live
Lkd	Locked
Lkg	Leakage
Ll	Last long (interval)
Lo	Low (state or value)
Loc	Local
Locb	Log control block
Lod	Load, loading
Log	Log
Lok	(use Lkd instead) Locked
Loop	Loop
Los	Loss
Ls	Last short (interval)
Lst	List
Lub	Lubrication
Lum	Luminosity
M	Minutes
MV	Measured value CDC
Mac	Media access control, MAC-address
Made	Made
Mag	Magnetic, magnitude
Maint	Maintenance
Man	Manual
Mat	Material
Mau	Medium access unit
Max	Maximum
Mbr	Membrane
Md	Motor drive

Term	Description
Mdul	Module
Meas	Measurement
Mech	Mechanical
Media	Media
Mem	Memory
Min	Minimum
Mir	Mirror
Mlt	Multiple
Mns	Mains
Mod	Mode
Mot	Motor
Mrg	Margin
Mrk	Market
Mst	Moisture
Msv	Main signaling voltage
Msvcb	Multicast sampled values control block
Mth	Method
Mult	Multiplier
Mvm	Movement, moving
N2	Nitrogen
NOx	Nitrogen oxide
NQS	Average partial discharge current
Nam	Name
Name	Name (reserved for use in data objects EEName and LNName only)
Ndl	Needle (used in Pelton turbines)
NdsCom	Needs commissioning
Neut	Neutral
Ng	Negative
Ngd	Negotiation
Nhd	Net head
Night	Night
No	No, not
Nom	Nominal, normalising
Num	Number
Nxt	Next
O2	Oxygen
O3	Ozon, trioxigen
Obl	Obligation
Oc	Open circuit
Odd	Odd

Term	Description
Of	Offline
Off	Off, device disengaged, not running
Ofs	Offset
Oil	Oil
On	On, device applied, running
Oo	Out of
Op	Operate, operating, operation
Operate	Operate order to any device
Opn	Open, opened
Ord	Order
Out	Output
Ov	Over, override, overflow
Ovl	Overload
Ox	Oxidant
P	Proportional
PF	Power factor
PH	Acidity, value of pH
PNV	Phase-to-neutral voltage
POW	Point on wave switching
PP	Phase to phase
PPV	Phase to phase voltage
PT1	Low-pass exponential time rate filter
Pa	Partial
Pair	Pair, paired
Pap	Paper
Par	Parallel
Pas	Passive
Path	Path
Pcb	Power quality classifier bin
Pct	Percent, percentage
Pdm	Power quality demodulation
Pe	Electric Power
Per	Periodic, period
Ph	Phase to reference
Phs	Phase
Phy	Physical
Pi	Instantaneous real power
Pin	Pin
Pipe	Pipe
Pk	Peak
Pl	Plant

Term	Description
Plg	Plug
Pls	Pulse
Plt	Plate; long-term flicker severity
Pmp	Pump
Po	Polar
Pol	Polarizing
Polytr	Polytropic
Port	Port
Pos	Position
Pot	Potentiometer
Prc	Price, pricing
Pre	Pre-
Prec	Precondition, initial status
Pres	Pressure
Prg	Progress, in progress
Prim	Primary
Prio	priority
Prm	Permissive
Pro	Protection
Proc	Process
Proxy	Proxy
Prs	Presence
Prt	Parts, part
Ps	Positive
Psk	Penstock
Pss	PSS, power system stabiliser function
Pst	Post, short-term flicker severity
Pt	Point
Pth	Pitch
Pwr	Power
Qty	Quantity
Qu	Queue
Qud	Quad
R	Raise, increase
Rad	Radiation
Ral	Rail
Ramp	Ramp
Rat	Ratio
Rb	Runner blade
Rcd	Record, recording
Rch	Reach

Term	Description
Rcl	Reclaim
Rct	Reaction
Rdy	Ready
Re	Retry
React	Reactance, reactive
Rec	Reclose
Rec1	Reclose after single phase fault
Rec13	Reclose after evolving fault
Rec3	Reclose after three phase fault
Recha	Recharge, recharging
Rect	Rectifier
Red	Redundant; (deprecated meaning) reduction
Ref	Reference
Reg	Regulation
Rel	Release
Req	Requested
Res	Residual
Reso	Resonance
Reuse	Reuse
Rev	Revision
Rf	Refreshment
Rin	Reinsertion
Ris	Resistance
RI	Relation, relative
Rm	Mutual resistance
Rmp	Ramping, ramp
Rms	Root mean square
Rn	Rain
Rnbk	Runback
Rng	Range
Rod	Rod
Root	Root
Rot	Rotation, rotor
Rpt	Repeat, repetition
Rs	Reset, resettable
Rsl	Result
Rst	Restraint, restriction
Rsv	Reserve
Rt	Ride-through
Rte	Rate

Term	Description
Rtg	Rating
Rub	Run-up/back
Run	Run
Rv	Reverse
Rvc	Rapid voltage change
Rvrt	Revert
Rwy	Runaway, e.g. in runaway speed
Rx	Receive, received
S10	Coefficient S1.0
S12	Coefficient S1.2
SM	Servo, servo-motor
SNL	Speed-no-load, connected but not generating
SOx	Sulphur oxide
SPCSO	Single point controllable status output
SPG	Single point setting CDC
SPS	Single point status CDC
SPI	Single pole/phase
ST	Standard time
Saf	Safety
Sag	Sag
Sar	Surge arrestor
Sat	Saturation
Sc	Short circuit
Scale	Scale
Schd	Schedule
Scnd	Secondary
Sco	Supply change over
Sec	Security
Sel	Select
Self	Self
Seq	Sequence
Ser	Series, serial
Set	Setting
Sgcb	Setting group control block
Sh	Shunt
Shar	Shared
Shft	Shaft
Shld	Shielded
Sig	Signal
Sign	Sign

Term	Description
Sim	Simulation, simulated
Sld	Solidity
Slnt	Salinity, saline content
Slp	Sleep; slip
Smok	Smoke
Smp	Sampling
Snd	Sound pressure
Snpt	Snapshot
Snr	Signal to noise ratio
Snw	Snow
Soc	State of charge
Sof	Switch on to fault
Spc	Single point control
Spcf	Specific
Spd	Speed
Spec	Spectra
Spir	Spiral
Spt	Setpoint
Sq	Square
Src	Source
Srfc	Surface
St	Status, state
Sta	Station, function at plant level
Stab	Stabilizer
Stat	Statistics
Stc	Stack
Std	Standard
Stdby	Standby
Step	Step
Stk	Stroke
Stl	Still, not moving
Stnd	Stand, standing
Sto	Storage, e.g. activity of storing data
Stop	Stop
Storm	Storm
Stow	Stow
Str	Start
Strg	String
Stt	Stator
Stuck	Stuck, cannot move
Sub	Sub

Term	Description
Sum	Sum
Sup	Supply
Sv	Sampled value
SvCBRef	SV control block reference
Svc	Service
Sw	Switch, switched
Swg	Swing
Swl	Power quality event swell
Syn	Synchronisation, synchronous, synchronism, synchrocheck
Sys	System
TP	Three pole/phase
Ta	Armature time constant
Tag	Tag (maintenance work in progress)
Tap	Tap
Task	Task
Td	Transformer derating
Td0p	Td0'
Td0s	Td0''
Tdd	Total demand distortion
Tdf	Transformer derating factor
Tdp	Td'
Tds	Td''
Tech	Technology
Term	Termination
Test	Test
Tgt	Target
Thd	Total harmonic distortion
Thm	Thermal
Ti	Telephone influence
Tilt	Tilt
Tm	Time
Tm1	Time constant 1
Tm2	Time constant 2
Tm3	Time constant 3
Tmh	Time in h
Tmm	Time in min
Tmms	Time in ms
Tmp	Temperature (°C)
Tms	Time in s
Tnk	Tank

Term	Description
Tns	Tension (stress)
Top	Top (position)
Topo	Topology
Torq	Torque
Tot	Total
Tow	Tower
Tp	Test Point
Tpc	Teleprotection
Tpy	Temporarily
Tq0p	Tq0'
Tq0s	Tq0''
Tqp	Tq'
Tqs	Tq''
Tr	Trip (electrical protection function)
Trf	Transformer
Trg	Trigger
Trip	Trip (non-electrical function)
Trk	Track, tracking
Trp	Transient Performance Class
Trs	Transient
Trunk	Trunk
Ts	Total signed
Tu	Total unsigned
Tun	Tuning
Tur	Turbine
Tx	Transmit, transmitted
Typ	Type
UPS	Uninterruptible power supply
UTC	Coordinated Universal Time
Udp	User Datagram Protocol
Uhf	Ultra-high-frequency
Un	Un-; under
Unav	Unavailable
Unb	Unbalanced
Unld	Unload
Unt	Unit, production unit
Up	Up, upstream
Ups	Uninterruptible Power Supply
Urcb	Unbuffered report control block
Use	Use
Used	Used

Term	Description
Usvcb	Unicast sampled values control block
Util	Utility
V	Voltage
V1	Voltage at side 1
V2	Voltage at side 2
VA	Apparent power (volt amperes)
VAh	Apparent energy
VAR	Reactive power (volt amperes reactive)
VARh	Reactive energy
Va	Variation
Vac	Vacuum
Val	Value
Vbr	Vibration
Ver	Vertical
Viol	Violation
Vis	Visibility
Visc	Viscosity
Vlan	VLAN
Vld	Valid, validate, validated
Vlm	Volume
Vlv	Valve
Vol	Voltage DC or non-phase-related AC
VolAmpr	Non-phase-related AC reactive power
Vss	Steady state voltage
W	Active power
W200	Watts peak at 200 W/m2
Wac	Watchdog
Wash	Washout
Watt	Active power non-phase-related AC
Wav	Wave, waveform
Wd	Wind
Week	Week
Wei	Weak end infeed
Wet	Wet
Wgt	Weight
Wh	Watt hours
Wid	Width
Win	Window
Wkup	Wake up
Wld	Welding
Wnd	Winding

Term	Description
Wrm	Warm
Wrn	Warning, warning trigger status
Wrs	Warning trigger status set
Wtr	Water (physical aspect: river, cooling, etc.)
Wup	Windup
X	Reactance (imaginary part of impedance)
X0	Zero sequence reactance
X1	Positive sequence reactance
X2	Negative sequence reactance X2
Xd	Synchronous reactance Xd
Xdir	X-direction
Xdp	Transient synchronous reactance Xd'
Xds	Subtransient reactance Xd''
Xm	Mutual reactance
Xq	Synchronous reactance Xq
Xqp	Transient synchronous reactance Xq'
Xqs	Subtransient reactance Xq''
Xsec	Cross-section
Ydir	Y-direction
Yw	Yaw
Z	Impedance
Zer	Zero
Zero	(use 'Zer' instead) Zero
Zm	Mutual impedance
Zn	Zone
Zro	Zero sequence
km	Kilometre
ppm	Parts per million

5. Logical node classes

5.1 General

This clause specifies Logical Nodes (LNs) defined in IEC 61850-7-410.

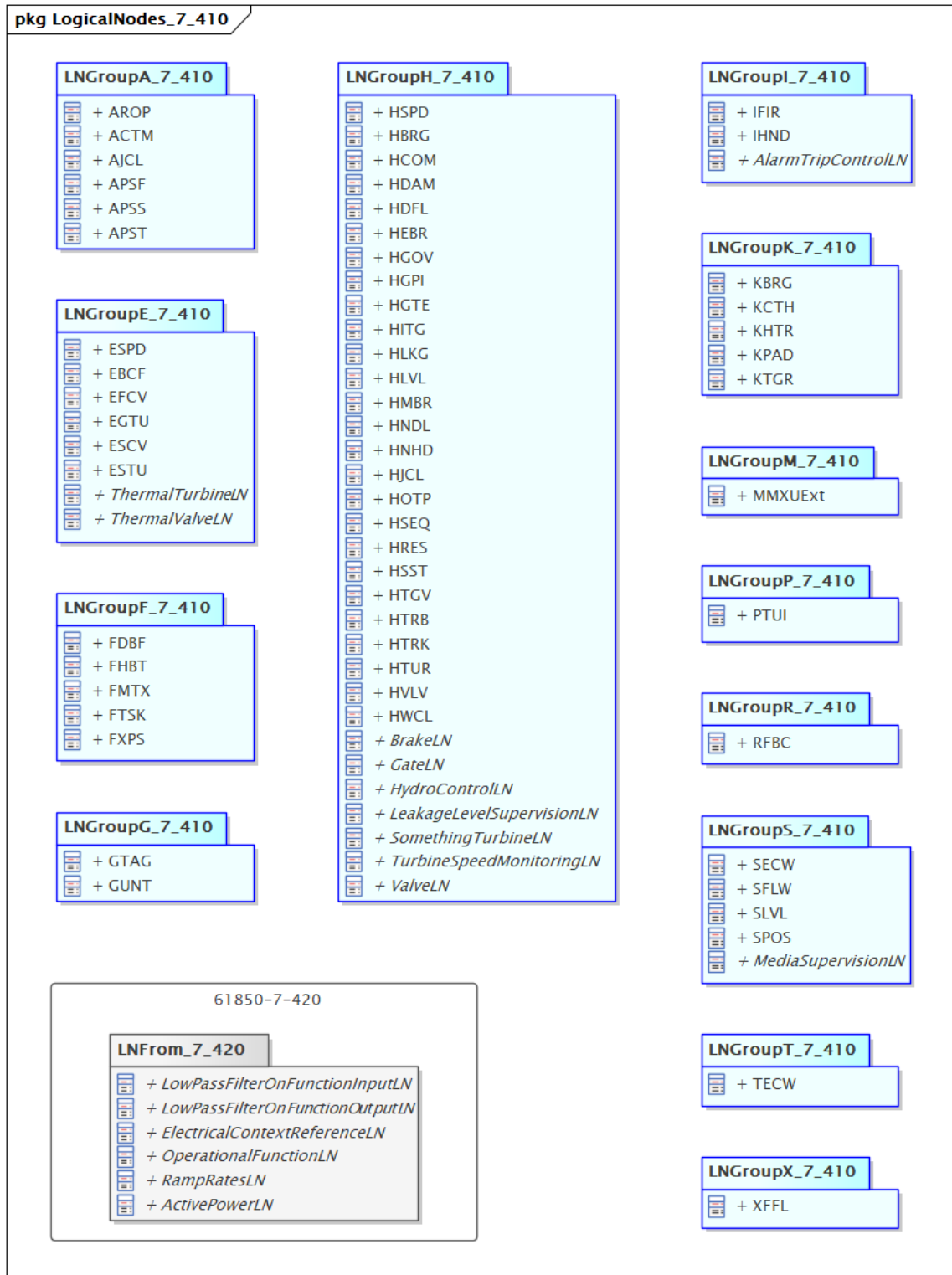


Figure 1 – Package diagram LogicalNodes_7_410::LogicalNodes_7_410

Figure 1: This diagram shows an overview of all the -7-410 logical node groups, with their respective logical nodes.

5.2 Classes list

Table 4 shows all classes defined in LogicalNodes_7_410 package.

Table 4 – List of classes defined in LogicalNodes_7_410 package

Name	Description
ACTM	This logical node is used to present information about different control modes of any control or regulating system. One instance must be created for each available control mode.
AJCL	The logical node AJCL (joint control) node is used to distribute power setpoints to individual production units selected to be running in the joint control mode. A typical implementation does, among other functions, optimise the sharing of power between the individual production units selected to run in the joint control mode. Use the logical node HJCL for hydroelectric power plants to control the water flow through individual production units and spillway gates.
APSF	This logical node is used to represent a PSS 4B filter as given by the IEEE Std 421.5-2005. Note that 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.
APSS	This logical node is used to represent common information and settings of a power system stabilizing (PSS) function.
APST	This logical node is used to represent a PSS 2 filter as given by the IEEE Std 421.5-2016. Note that 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.
AROP	This logical node shall be used to represent parameters to produce balancing service in cases where a production unit is used as reserve resource. An instance of AROP is created for each reserve type (e.g. secondary reserve, tertiary reserve) per a production unit.
AbbrTerm_7_410	Transition abbreviations belonging to 61850-7-410 part. Those abbreviations are used to build concatenated data object names.
ActivePowerLN	(Logical node from 7-420 part.) The ActivePowerLN abstract LN hosts the DOs which are common to all LNs setting or limiting Active Power of the DER.
AlarmTripControlLN	Abstract class, applied to IFIR and IHND alarms and trips.
BrakeLN	(deprecated) Abstract class, holding attributes common to logical nodes that model brakes (mechanical and electrical).
EBCF	This logical node shall be used to coordinate the control of the thermal pressure of the steam generator and the electrical power regulation of turbine / generator system.
EFCV	This logical node 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.
EGTU	This logical node 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 GUNT 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.

Name	Description
ESCV	This logical node 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.
ESPD	This logical node 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. Signals can come from TANG, TRTN or TFQR referred by InRef.
ESTU	This logical node 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 GUNT shall be used.
ElectricalContextReferenceLN	(Logical node from 7-420 part.) Correlation of DER with ECP.
FDBF	This logical node 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.
FHBT	This logical node 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.
FMTX	This logical node 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.
FTSK	This logical node is used to represent a task manager. The task manager is used to replace the operator when there are repetitive tasks or tasks on set dates in a calendar.
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 each equipment is located in the start priority.
GTAG	This logical node shall be used to manage the generic maintenance and operational tags associated to power systems equipment. For example, a tag can be logically affixed to primary equipment that is temporary taken out of operation.
GUNT	This logical node shall be used to represent the physical device of a large hydro or thermal production unit, that is, a generator and turbine combination with control 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. The logical node is also used to receive commands to change operating status of the unit.

Name	Description
GateLN	Abstract class, holding attributes common to logical nodes that model gates.
HBRG	This logical node 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.
HCOM	This logical node 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.
HDAM	This logical node 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.
HDFL	This logical node is used to represent the deflector control of a Pelton type turbine.
HEBR	(deprecated) This logical node is 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.
HGOV	This logical node 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.
HGPI	This logical node 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.
HGTE	This logical node 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 FCSD logical node that holds the relation between water level, opening and flow, should be included in the same logical device.
HITG	This logical node 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.
HJCL	This logical node 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 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.
HLKG	This logical node is used to represent a leakage supervision system for any purpose.

Name	Description
HLVL	This logical node 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.
HMBR	This logical node is used to represent the physical device brake. The brake is used to stop the rotation of the shaft during power down of the unit. It can be used together instances of KPAD logical node, to represent the brake pads.
HNDL	This logical node shall be used to represent the control of turbine needles for Pelton type of turbines.
HNHD	This logical node 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.
HOTP	This logical node is 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.
HRES	This logical node shall be used to represent the functional aspect of the reservoir in a hydropower plant. Note that the HRES Logical Node does not represent the physical aspect of the dam.
HSEQ	This logical node 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.
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. Signals can come from TANG, TRTN or TFQR referred by InRef.
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.
HTGV	This logical node 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.

Name	Description
HTRB	This logical node is used to represent the physical device of runner blades of a Kaplan type turbine where runner blades can be controlled. If required, some data objects may have multiple instances, to provide separate data objects for each runner blade.
HTRK	This logical node shall be used to represent the physical device of a trash rack.
HTUR	This logical node 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.
HVLV	This logical node 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 logical node 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).
HWCL	This logical node 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.
HydroControlLN	Abstract class, holding attributes common to logical nodes that allow to perform controls for hydro power plant physical devices such as valves and gates.
IFIR	This logical node 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.
IHND	This logical node 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.
KBRG	This logical node shall be used to represent a bearing, which is a mechanical structure intended to support a rotating shaft and if necessary to limit its axial movements. It can be used to represent both thrust and guide bearings. One instance shall be used per bearing.
KCTH	This logical node shall be used to represent a clutch, which is a mechanical device that engages and disengages power transmission from a turbine shaft to a generation shaft.
KHTR	This logical node shall be used to represent a heater.
KPAD	This logical node shall be used to represent a mechanical brake pad. One instance shall be used per brake pad.
KTGR	This logical node shall be used to represent a turning-gear (jacking-gear and barring-gear are other names), that is a manual or motor-operated device intended to rotate the shaft of a turbine at low speed. It is used to ensure uniform cool-down, to help inspection of shaft, turbine and associated machinery, and to help to maintain protective oil membrane. The turning-gear is also used in thermal generation to prevent shaft sagging.
LeakageLevelSupervisionLN	Abstract class, holding attributes common to logical nodes performing leakage supervision.
LowPassFilterOnFunctionInputLN	(Logical node from 7-420 part.) Low Pass Filter On Function Input.
LowPassFilterOnFunctionOutputLN	(Logical node from 7-420 part.) Low Pass Filter On Function Output.

Name	Description
MMXUExt	Set of data objects to extend the MMXU logical node. This logical node represents calculation of electric measurement such as currents, voltages, powers and impedances in a three-phase system. The main use is for operative applications. Note: the "Ext" suffix attached to the logical node name is only there for editorial purpose and is not present in the real model.
MediaSupervisionLN	Abstract class, holding attributes common to logical nodes for media supervision. When prefix and/or instantiation of data is used, this data shall be defined in the private name space. Pref (pref) shall, if used be either Hi or Lo to indicate if action is taken at decreasing or increasing values. Instantiation shall, if used, be indicated by numbers "1" to "9".
OperationalFunctionLN	(Logical node from 7-420 part.) Abstract type, holding attributes common to all of all the domain logical nodes that represent functions (i.e., they are not system or non-process interface logical nodes).
PTUI	This logical node shall be used for all kinds of resistance under-detection, intended for stator and rotor earth-fault detection by voltage injection.
RFBC	This logical node shall be used to represent common information and settings of a field breaker.
RampRatesLN	(Logical node from 7-420 part.) Abstract type, Ramp rates
SECW	This logical node 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.
SFLW	This logical node is used to represent devices that supervise the media flow in a plant object (e.g. a pipeline or tube). It provides alarm and trip/shutdown functions. If more than one sensor (TFLW) is connected, use one instance per sensor.
SLVL	This logical node shall be used to represent devices that supervise the level of 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.
SPOS	This logical node shall be used to represent devices that supervise the position of a plant objects. It provides alarm and trip/shutdown functions. If more than one sensor (TPOS) is connected, use one instance per sensor.
SomethingTurbineLN	Abstract class, holding attributes common to logical nodes representing runner blades of a Kaplan type turbine and guide vanes (wicket gate) of a hydro power turbine.
TECW	This logical node shall be used to represent devices that measure the electrical conductivity in water.
ThermalTurbineLN	Abstract class, holding attributes common to logical nodes that model thermal (gas or steam) turbines.
ThermalValveLN	Abstract class, holding attributes common to logical nodes that model thermal valves.
TurbineSpeedMonitoringLN	Abstract class, holding attributes common to logical nodes performing turbine speed monitoring. Applied to hydro and thermal turbines.
ValveLN	Abstract class, holding attributes common to logical nodes that model valves.
XFFL	This logical node shall be used to represent the control of switches used for initial excitation (field flashing) of a generator.

5.3 Abbreviated Terms 7-410 (Abbreviations_7_410)

5.3.1 General

Transition abbreviations belonging to 61850-7-410 part. The -7-410 AbbrTerms are used to build concatenated data object names.

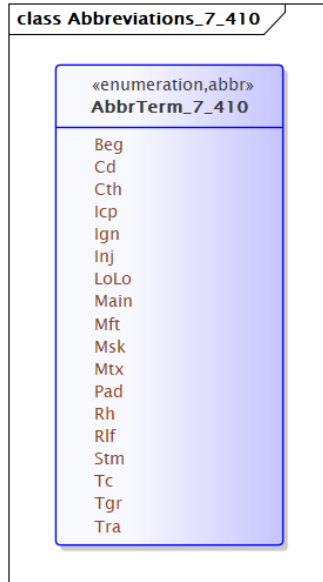


Figure 2 – Class diagram Abbreviations_7_410::Abbreviations_7_410

Figure 2: Transition abbreviations belonging to 61850-7-410 part (to be included in a later edition of IEC 61850-7-4).

5.3.2 Classes list

Table 5 shows all classes defined in Abbreviations_7_410 package.

Table 5 – List of classes defined in Abbreviations_7_410 package

Name	Description
AbbrTerm_7_410	Transition abbreviations belonging to 61850-7-410 part. Those abbreviations are used to build concatenated data object names.

5.3.3 7-410 Abbreviated Terms (AbbrTerm_7_410 abbreviation enumeration)

Transition abbreviations belonging to 61850-7-410 part. Those abbreviations are used to build concatenated data object names.

Table 6 shows all enumeration items of AbbrTerm_7_410.

Table 6 – Literals of AbbrTerm_7_410

AbbrTerm_7_410	
enumeration item	description
Beg	Begin
Cd	Code
Cth	Clutch
Icp	Intercept

AbbrTerm_7_410	
enumeration item	description
Ign	Ignition
Inj	Injected
LoLo	Very low
Main	Main
Mft	Main fuel trip
Msk	Mask
Mtx	Matrix
Pad	Pad
Rh	Re-heat
Rlf	Relief
Stm	Steam
Tc	Time constant
Tgr	Turning gear
Tra	Transducer

151

152 **5.4 Logical nodes for automatic control (LNGroupA_7_410)**153 **5.4.1 General**

154 This group of logical nodes represents automatic functions.

155 Note: Some of the logical nodes presented here are likely to be included in a later edition of -
156 7-4 part. When published, logical nodes specified in the IEC 61850-7-4 shall take precedence
157 over definition here.

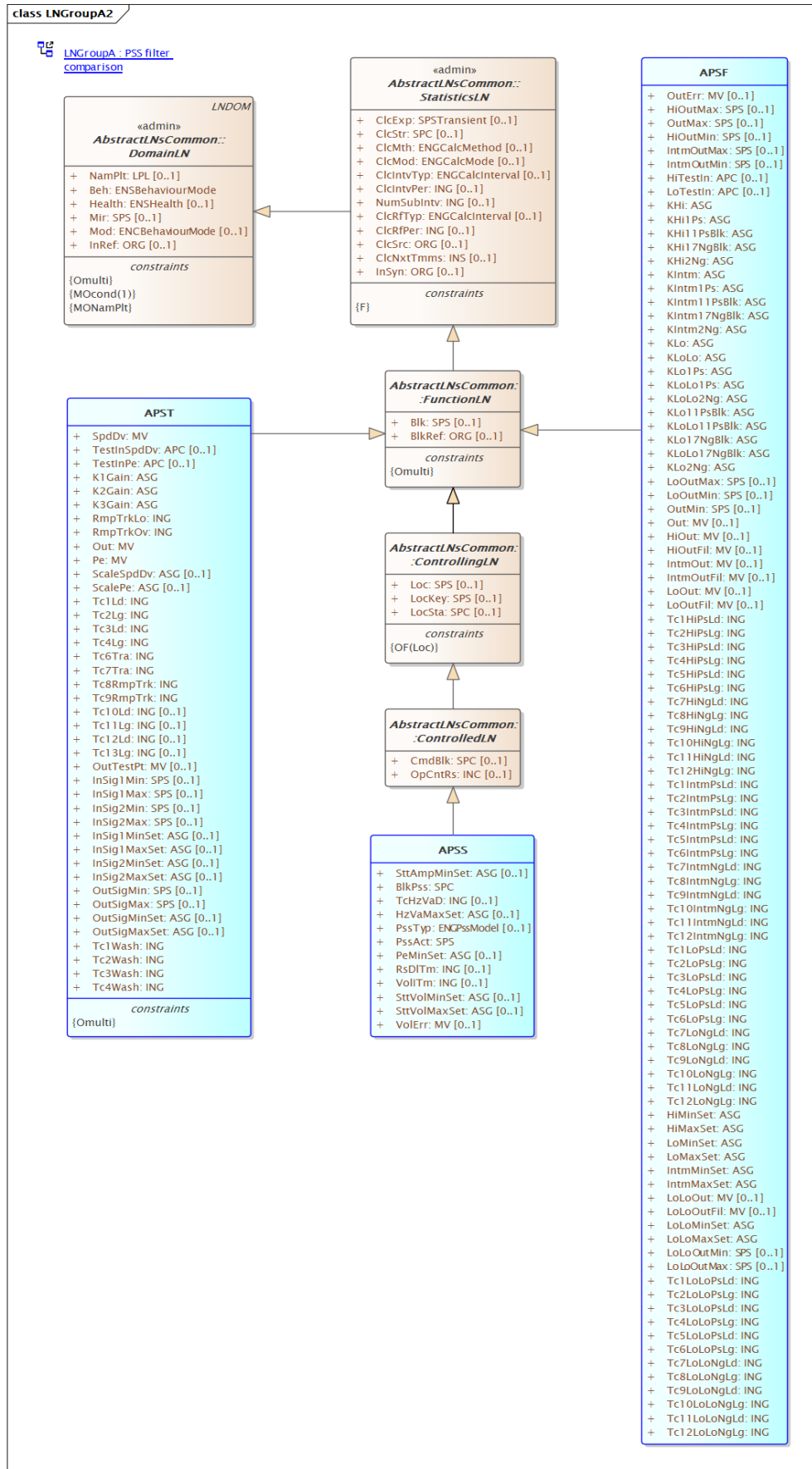


Figure 3 – Class diagram LNGroupA_7_410::LNGroupA2

Figure 3: This diagram shows second part of the concrete logical nodes of group A, PSS related, with the supertypes that factor their common attributes.

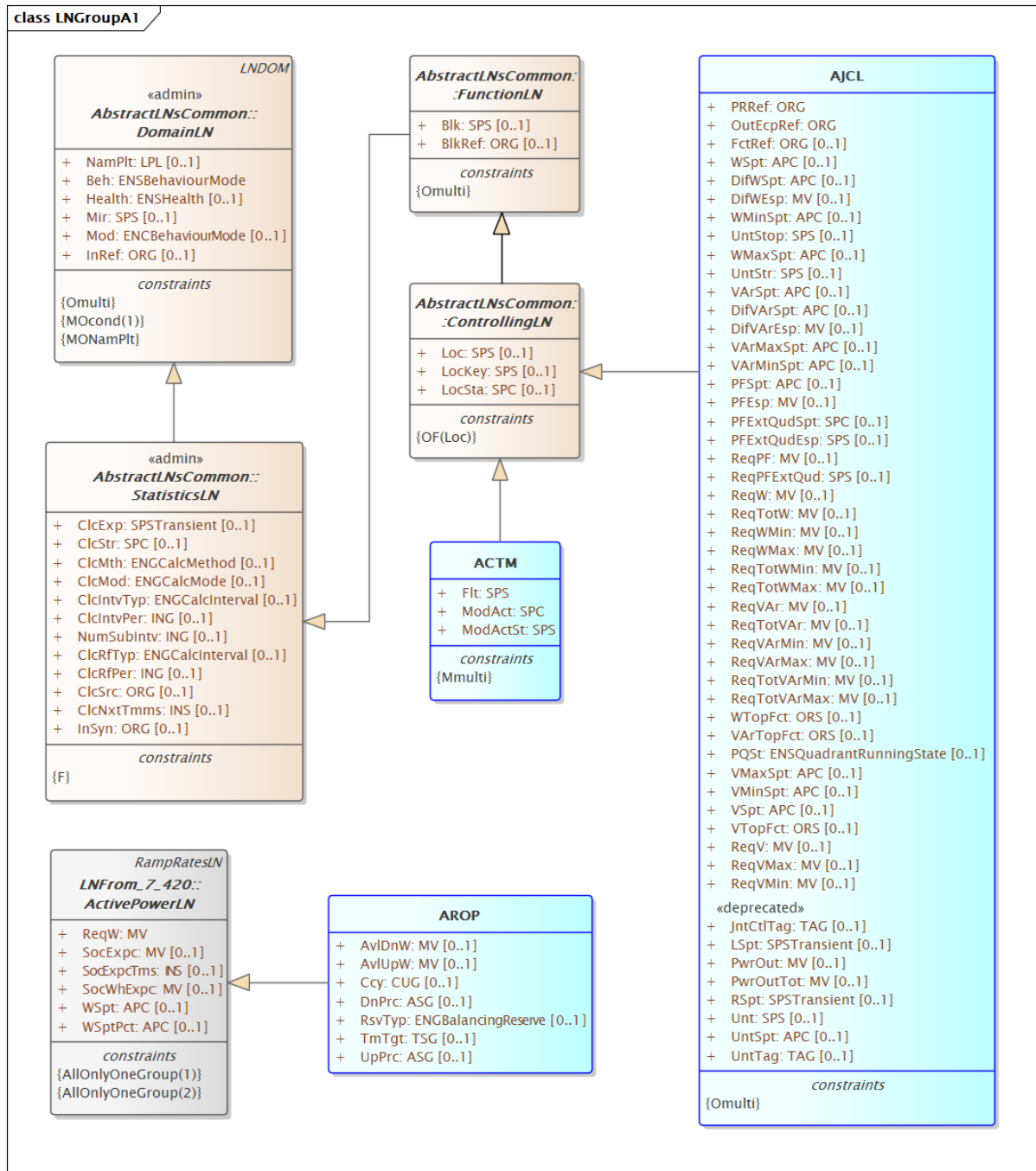
**Figure 4 – Class diagram LNGroupA_7_410::LNGroupA1**

Figure 4: This diagram shows first part of the concrete logical nodes of group A, with the supertypes that factor their common attributes.

5.4.2 Classes list

Table 7 shows all classes defined in LNGroupA_7_410 package.

168

Table 7 – List of classes defined in LNgrouPA_7_410 package

Name	Description
ACTM	This logical node is used to present information about different control modes of any control or regulating system. One instance must be created for each available control mode.
AJCL	The logical node AJCL (joint control) node is used to distribute power setpoints to individual production units selected to be running in the joint control mode. A typical implementation does, among other functions, optimise the sharing of power between the individual production units selected to run in the joint control mode. Use the logical node HJCL for hydroelectric power plants to control the water flow through individual production units and spillway gates.
APSF	This logical node is used to represent a PSS 4B filter as given by the IEEE Std 421.5-2005. Note that 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.
APSS	This logical node is used to represent common information and settings of a power system stabilizing (PSS) function.
APST	This logical node is used to represent a PSS 2 filter as given by the IEEE Std 421.5-2016. Note that 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.
AROP	This logical node shall be used to represent parameters to produce balancing service in cases where a production unit is used as reserve resource. An instance of AROP is created for each reserve type (e.g. secondary reserve, tertiary reserve) per a production unit.

169

170 5.4.3 LN: Balancing reserve operation Name: AROP

171 This logical node shall be used to represent parameters to produce balancing service in cases
 172 where a production unit is used as reserve resource. An instance of AROP is created for each
 173 reserve type (e.g. secondary reserve, tertiary reserve) per a production unit.

174 Table 8 shows all data objects of AROP.

175

Table 8 – Data objects of AROP

AROP				
Data object name	Common data class	T	Explanation	PresConds/ds
Descriptions				
NamPlt	LPL		inherited from: DomainLN	MONamPlt / MONamPlt
Status information				
SocExpTms	INS		inherited from: ActivePowerLN	O / O
RvrtTmExp	SPS	T	inherited from: OperationalFunctionLN	O / F
Loc	SPS		inherited from: ControllingLN	O / F
LocKey	SPS		inherited from: ControllingLN	OF(Loc) / F
Blk	SPS		inherited from: FunctionLN	O / F
ClcExp	SPS	T	inherited from: StatisticsLN	O / O
ClcNxtTmms	INS		inherited from: StatisticsLN	O / O

AROP				
Data object name	Common data class	T	Explanation	PresConds/ds
Beh	ENS (BehaviourModeKind)		inherited from: DomainLN	M / M
Health	ENS (HealthKind)		inherited from: DomainLN	O / O
Mir	SPS		inherited from: DomainLN	MOcond(1) / MOcond(1)
Measured and metered values				
AvlDnW	MV		Downward regulation capability for the designated balancing reserve. The measured value represents the difference between the minimum available active power and the current production. The mag and instMag in this data object shall be zero or positive even though the values indicate downward regulation capability.	O / O
AvlUpW	MV		Upward regulation capability for the designated balancing reserve. The measured value represents the difference between the maximum available active power and the current production. The mag and instMag in this data object shall be zero or positive.	O / O
ReqW	MV		inherited from: ActivePowerLN	M / O
SocExpc	MV		inherited from: ActivePowerLN	O / O
SocWhExpc	MV		inherited from: ActivePowerLN	O / O
Controls				
WSpt	APC		inherited from: ActivePowerLN	AllOnlyOneGroup(2) / O
WSptPct	APC		inherited from: ActivePowerLN	AllOnlyOneGroup(1) / O
ModPrio	INC		inherited from: OperationalFunctionLN	O / O
CmdBlk	SPC		inherited from: ControlledLN	O / F
OpCntRs	INC		inherited from: ControlledLN	O / O
LocSta	SPC		inherited from: ControllingLN	OF(Loc) / F
ClcStr	SPC		inherited from: StatisticsLN	O / O
Mod	ENC (BehaviourModeKind)		inherited from: DomainLN	O / O
Settings				
Ccy	CUG		ISO 4217 currency 3-character code.	O / F
DnPrc	ASG		Price per kW for downward balancing reserve.	O / F
RsvTyp	ENG (BalancingReserveKind)		The type of balancing reserve.	O / F
TmTgt	TSG		Target time to achieve the production to the level that the setpoint in WSptPct or WSpt indicates.	O / F
UpPrc	ASG		Price per kW for upward balancing reserve.	O / F
RmpRteUse	SPG		inherited from: RampRatesLN	M / F
RpuMax	ASG		inherited from: RampRatesLN	O / F
RpdMax	ASG		inherited from: RampRatesLN	O / F
ChaRpuMax	ASG		inherited from: RampRatesLN	O / F

AROP				
Data object name	Common data class	T	Explanation	PresConditions/ds
ChaRpdMax	ASG		inherited from: RampRatesLN	O / F
EmgRpuMax	ASG		inherited from: RampRatesLN	O / F
EmgRpdMax	ASG		inherited from: RampRatesLN	O / F
ChaEmgRpuMax	ASG		inherited from: RampRatesLN	O / F
ChaEmgRpdMax	ASG		inherited from: RampRatesLN	O / F
RpuMin	ASG		inherited from: RampRatesLN	O / F
RpdMin	ASG		inherited from: RampRatesLN	O / F
OutFilByp	SPG		inherited from: LowPassFilterOnFunctionOutputLN	O / F
OplTmsMax	ING		inherited from: LowPassFilterOnFunctionOutputLN	O / F
OplTmsMin	ING		inherited from: LowPassFilterOnFunctionOutputLN	O / F
InFilByp	SPG		inherited from: LowPassFilterOnFunctionInputLN	O / F
RspTmms	ING		inherited from: LowPassFilterOnFunctionInputLN	O / F
ActDITmms	ING		inherited from: OperationalFunctionLN	O / F
WinTms	ING		inherited from: OperationalFunctionLN	O / F
RvrtTms	ING		inherited from: OperationalFunctionLN	O / F
RmpTms	ING		inherited from: OperationalFunctionLN	O / F
ModPsAcc	ASG		inherited from: OperationalFunctionLN	O / F
ModNgAcc	ASG		inherited from: OperationalFunctionLN	O / F
SocUseMaxPct	ASG		inherited from: OperationalFunctionLN	O / F
SocUseMinPct	ASG		inherited from: OperationalFunctionLN	O / F
InEcpRef	ORG		inherited from: ElectricalContextReferenceLN	M / F
EcpConnTyp	ENG (ECPCConnKind)		inherited from: ElectricalContextReferenceLN	O / F
BlkRef	ORG		inherited from: FunctionLN	Omulti / F
ClcMth	ENG (CalcMethodKind)		inherited from: StatisticsLN	O / M
ClcMod	ENG (CalcModeKind)		inherited from: StatisticsLN	O / O
ClcIntvTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O
ClcIntvPer	ING		inherited from: StatisticsLN	O / O
NumSubIntv	ING		inherited from: StatisticsLN	O / O
ClcRfTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O
ClcRfPer	ING		inherited from: StatisticsLN	O / O
ClcSrc	ORG		inherited from: StatisticsLN	F / M
InSyn	ORG		inherited from: StatisticsLN	O / O
InRef	ORG		inherited from: DomainLN	Omulti / Omulti

5.4.4 LN: Control mode selection Name: ACTM

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

Table 9 shows all data objects of ACTM.

Table 9 – Data objects of ACTM

ACTM				
Data object name	Common data class	T	Explanation	PresCond nds/ds
Descriptions				
NamPlt	LPL		inherited from: DomainLN	MONamPlt / MONamPlt
Status information				
Flt	SPS		If true, controller {inst} has been faulted.	Mmulti / F
ModActSt	SPS		If true, the control mode is activated; otherwise the control mode is de-activated.	M / F
Loc	SPS		inherited from: ControllingLN	O / F
LocKey	SPS		inherited from: ControllingLN	OF(Loc) / F
Blk	SPS		inherited from: FunctionLN	O / F
ClcExp	SPS	T	inherited from: StatisticsLN	O / O
ClcNxtTmms	INS		inherited from: StatisticsLN	O / O
Beh	ENS (BehaviourModeKind)		inherited from: DomainLN	M / M
Health	ENS (HealthKind)		inherited from: DomainLN	O / O
Mir	SPS		inherited from: DomainLN	MOcond(1) / MOcond(1)
Controls				
ModAct	SPC		(controllable) If true, activate the control mode; otherwise de-activate the control mode.	M / F
LocSta	SPC		inherited from: ControllingLN	OF(Loc) / F
ClcStr	SPC		inherited from: StatisticsLN	O / O
Mod	ENC (BehaviourModeKind)		inherited from: DomainLN	O / O
Settings				
BlkRef	ORG		inherited from: FunctionLN	Omulti / F
ClcMth	ENG (CalcMethodKind)		inherited from: StatisticsLN	O / M
ClcMod	ENG (CalcModeKind)		inherited from: StatisticsLN	O / O
ClcIntvTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O
ClcIntvPer	ING		inherited from: StatisticsLN	O / O
NumSubIntv	ING		inherited from: StatisticsLN	O / O
ClcRfTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O
ClcRfPer	ING		inherited from: StatisticsLN	O / O
ClcSrc	ORG		inherited from: StatisticsLN	F / M
InSyn	ORG		inherited from: StatisticsLN	O / O

ACTM				
Data object name	Common data class	T	Explanation	PresConds/ds
InRef	ORG		inherited from: DomainLN	Omulti / Omulti

182

183 5.4.5 LN: Joint control for power management Name: AJCL

184 The logical node AJCL (joint control) node is used to distribute power setpoints to individual
 185 production units selected to be running in the joint control mode. A typical implementation does,
 186 among other functions, optimise the sharing of power between the individual production units
 187 selected to run in the joint control mode. Use the logical node HJCL for hydroelectric power
 188 plants to control the water flow through individual production units and spillway gates.

189 Table 10 shows all data objects of AJCL.

190

Table 10 – Data objects of AJCL

AJCL				
Data object name	Common data class	T	Explanation	PresConds/ds
Descriptions				
NamPlt	LPL		inherited from: DomainLN	MONamPlt / MONamPlt
Status information				
LSpt	SPS	T	(deprecated) Lower setpoint in IED for unit {inst} To be renamed WSptL To be rediscussed after Cmd TF decisions	Omulti / F
RSpt	SPS	T	(deprecated) Raise setpoint in IED for unit {inst} To be renamed WSptR To be rediscussed after Cmd TF decisions	Omulti / F
Unt	SPS		(deprecated) Generation unit {inst} contributing (true = contributing) To be moved to ProductionResourceLN	Omulti / F
UntStop	SPS		Generation unit {inst} stop.	Omulti / F
UntStr	SPS		Generation unit {inst} start.	Omulti / F
PFEExtQuEsp	SPS		Effective PFEextension considered by the AJCL LN : True = Underexcited; False = Overexcited	O / F
ReqPFExtQuid	SPS		Complementary parameter of the ReqPF of same instance : True = Underexcited; False = Overexcited	Omulti / F
WTopFct	ORS		Current top priority operational function driving the setting of the expected active power of the concerned energy resource.	Omulti / F
VArTopFct	ORS		Current top priority operational function driving the setting of the expected reactive power of the concerned energy resource.	Omulti / F
PQSt	ENS (QuadrantRunningStateKind)		Status of the power vector expressed through one of the 9 zones of the PQ diagram quadrant, based on the signing conventions set with PFSign and PFEExt, as requested from the attached energy resource.	O / F
VTopFct	ORS		Current top priority operational function driving the setting of the expected voltage of the concerned energy resource.	Omulti / F

AJCL				
Data object name	Common data class	T	Explanation	PresConds/ds
Loc	SPS		inherited from: ControllingLN	O / F
LocKey	SPS		inherited from: ControllingLN	OF(Loc) / F
Blk	SPS		inherited from: FunctionLN	O / F
ClcExp	SPS	T	inherited from: StatisticsLN	O / O
ClcNxtTmms	INS		inherited from: StatisticsLN	O / O
Beh	ENS (BehaviourModeKind)		inherited from: DomainLN	M / M
Health	ENS (HealthKind)		inherited from: DomainLN	O / O
Mir	SPS		inherited from: DomainLN	MOcond(1) / MOcond(1)
Measured and metered values				
PwrOut	MV		(deprecated) Contributing power output of the plant (included in the joint control) To be eventually moved to ProductionResourceLN, if necessary	O / O
PwrOutTot	MV		(deprecated) Total power output of the plant To be moved to ProductionResourceLN	O / O
DifWEsp	MV		Effective differential active power setpoint of the same instance considered by the AJCL LN	Omulti / O
DifVArEsp	MV		Effective differential reactive power setpoint of the same instance considered by the AJCL LN	Omulti / O
PFEsp	MV		Effective power factor setpoint considered by the AJCL LN	O / O
ReqPF	MV		Power Factor requested from either a (energy) resource controlled by this power management function or from a hierarchically lower Power Management function	Omulti / O
ReqW	MV		Active power requested from either an energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function	Omulti / O
ReqTotW	MV		Total active power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many ERs (units).	O / O
ReqWMin	MV		Minimum active power requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
ReqWMax	MV		Maximum active power requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
ReqTotWMin	MV		Minimum total active power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many ERs (units).	O / O
ReqTotWMax	MV		Maximum total active power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many ERs (units).	O / O

AJCL				
Data object name	Common data class	T	Explanation	PresConds/ds
ReqVAr	MV		Reactive power requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function	Omulti / O
ReqTotVAr	MV		Total reactive power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many DERs.	O / O
ReqVArMin	MV		Minimum reactive power requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
ReqVArMax	MV		Maximum reactive power requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
ReqTotVArMin	MV		Minimum total reactive power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many ERs (units).	O / O
ReqTotVArMax	MV		Maximum total reactive power requested to the energy resource associated to this power management function. This resource may be hierarchically composed of many ERs (units).	O / O
ReqV	MV		Voltage requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function	Omulti / O
ReqVMax	MV		Maximum voltage requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
ReqVMin	MV		Minimum voltage requested from either energy resource {inst} (unit) controlled by this power management function or from a hierarchically lower Power Management function.	Omulti / O
Controls				
WSpt	APC		Active power setpoint. Its mxVal attribute reflects the value of the setpoint that is requested.	Omulti / O
DifWSpt	APC		Active differential power setpoint. Its mxVal attribute reflects the value of the setpoint that is requested.	Omulti / O
UntSpt	APC		(deprecated) Setpoint for unit {inst} Replaced by ReqW	Omulti / O
WMinSpt	APC		Minimum limiting setpoint of the ER's active power. Its mxVal attribute reflects the value of the setpoint that is requested.	Omulti / O
WMaxSpt	APC		Limiting setpoint of the ER's active power. Its mxVal attribute reflects the value of the setpoint that is requested.	Omulti / O
VARspt	APC		Received reactive power setpoint. Its mxVal attribute reflects the value of the setpoint that is applied.	Omulti / O

AJCL				
Data object name	Common data class	T	Explanation	PresConds/ds
DifVArSpt	APC		Reactive differential power setpoint. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
VArMaxSpt	APC		(Permanent control) Maximum limiting setpoint of the ER's reactive power. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
VArMinSpt	APC		Minimum limiting setpoint of the ER's reactive power. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
PFSpt	APC		Power factor set point. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
PFExtQudSpt	SPC		Complementary PF setpoint parameter of the PFSpt of same instance: (controllable) True = Underexcited; False = Overexcited. Its stVal attribute reflects the value of the setpoint that is requested.	Omuli / F
VMaxSpt	APC		(Permanent control) Maximum limiting setpoint of the ER's voltage. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
VMinSpt	APC		Minimum limiting setpoint of the ER's voltage. Its mxVal attribute reflects the value of the setpoint that is requested.	Omuli / O
VSpt	APC		Received voltage setpoint. Its mxVal attribute reflects the value of the setpoint that is applied.	Omuli / O
LocSta	SPC		inherited from: ControllingLN	OF(Loc) / F
ClcStr	SPC		inherited from: StatisticsLN	O / O
Mod	ENC (BehaviourModeKind)		inherited from: DomainLN	O / O
JntCtlTag	TAG		(deprecated) Maintenance tag affixed to the equipment, for Joint Control purpose.	O / F
UntTag	TAG		(deprecated) Maintenance tag affixed to the unit {inst}.	Omuli / F
Settings				
PRRef	ORG		Reference to the production resource LN (a child of DERResourceLN?)	M / F
OutEcpRef	ORG		Reference to a Electrical Reference Point LN (a child of ElectricalReferencePointLN) which the power management function has an impact on, using its associated resource (located at the output of the resource).	M / F
FctRef	ORG		Reference to an Operational Function LN (a child of OperationalFunctionLN)	Omuli / F
BlkRef	ORG		inherited from: FunctionLN	Omuli / F
ClcMth	ENG (CalcMethodKind)		inherited from: StatisticsLN	O / M
ClcMod	ENG (CalcModeKind)		inherited from: StatisticsLN	O / O
ClcIntvTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O
ClcIntvPer	ING		inherited from: StatisticsLN	O / O
NumSubIntv	ING		inherited from: StatisticsLN	O / O
ClcRfTyp	ENG (CalcIntervalKind)		inherited from: StatisticsLN	O / O

AJCL				
Data object name	Common data class	T	Explanation	PresConds/ds
ClcRfPer	ING		inherited from: StatisticsLN	O / O
ClcSrc	ORG		inherited from: StatisticsLN	F / M
InSyn	ORG		inherited from: StatisticsLN	O / O
InRef	ORG		inherited from: DomainLN	Omulti / Omulti

5.4.6 LN: PSS 4 filter function Name: APSF

This logical node is used to represent a PSS 4B filter as given by the IEEE Std 421.5-2005. Note that 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.

custom PSS filter comparison						
FFIL	LoPg	LoNg	MePg	MeNg	HiPg	HiNg
Kp	KL1	KL2	KI1	KI2	KH1	KH2
Kld	KL11	KL17	KI11	KI17	KH11	KH17
Klg	n/a	n/a	n/a	n/a	n/a	n/a
T1	TL1	TL7	TI1	TI7	TH1	TH7
T1ld	TL2	TL8	TI2	TI8	TH2	TH8
T2	TL3	TL9	TI3	TI9	TH3	TH9
T2ld	TL4	TL10	TI4	TI10	TH4	TH10
T3	TL5	TL11	TI5	TI11	TH5	TH11
T3ld	TL6	TL12	TI6	TI12	TH6	TH12

Figure 5 – PSS filter comparison

Figure 5: This figure shows the comparison between data object names of FFIL and corresponding names in IEEE 421.5-2005.

Table 11 shows all data objects of APSF.

Table 11 – Data objects of APSF

APSF				
Data object name	Common data class	T	Explanation	PresConds/ds
Descriptions				
NamPlt	LPL		inherited from: DomainLN	MONamPlt / MONamPlt
Status information				
HiOutMax	SPS		If true, the high band filter output maximum limit VHmax has been reached.	O / F
OutMax	SPS		If true, the PSS output maximum limit VSTMax has been reached.	O / F
HiOutMin	SPS		If true, the high band filter output minimum limit VHmin has been reached.	O / F

APSF				
Data object name	Common data class	T	Explanation	PresConds/ds
IntmOutMax	SPS		If true, the intermediate band filter output maximum limit VImax has been reached.	O / F
IntmOutMin	SPS		If true, the intermediate band filter output minimum limit VImin has been reached.	O / F
LoOutMax	SPS		If true, the low band filter output maximum limit VLmax has been reached.	O / F
LoOutMin	SPS		If true, the low band filter output minimum limit VLmin has been reached.	O / F
OutMin	SPS		If true, the PSS output minimum limit VSTMin has been reached.	O / F
LoLoOutMin	SPS		If true, the very low band filter output minimum limit VVLmin has been reached.	O / F
LoLoOutMax	SPS		If true, the very low band filter output maximum limit VVLmax has been reached.	O / F
Blk	SPS		inherited from: FunctionLN	O / F
ClcExp	SPS	T	inherited from: StatisticsLN	O / O
ClcNxtTmms	INS		inherited from: StatisticsLN	O / O
Beh	ENS (BehaviourModeKind)		inherited from: DomainLN	M / M
Health	ENS (HealthKind)		inherited from: DomainLN	O / O
Mir	SPS		inherited from: DomainLN	MOcond(1) / MOcond(1)
Measured and metered values				
OutErr	MV		Output error.	O / O
Out	MV		PSS output.	O / O
HiOut	MV		High band filter output signal VH (after the gain and limiter).	O / O
HiOutFil	MV		High band filter output signal before the gain.	O / O
IntmOut	MV		Intermediate band filter output signal VI (after the gain and limiter).	O / O
IntmOutFil	MV		Intermediate band filter output signal before the gain.	O / O
LoOut	MV		Low band filter output signal VL (after the gain and limiter).	O / O
LoOutFil	MV		Low band filter output signal before the gain.	O / O
LoLoOut	MV		Very low band filter output signal VVL (after the gain and limiter).	O / O
LoLoOutFil	MV		Very low band filter output signal before the gain.	O / O
Controls				
HiTestIn	APC		High frequency test input.	O / O
LoTestIn	APC		Very low, low and intermediate frequency test input.	O / O
ClcStr	SPC		inherited from: StatisticsLN	O / O
Mod	ENC (BehaviourModeKind)		inherited from: DomainLN	O / O

APSF				
Data object name	Common data class	T	Explanation	PresConds/ds
Settings				
KHi	ASG		High band filter proportional gain KH.	M / F
KHi1Ps	ASG		High band positive filter proportional gain KH1.	M / F
KHi11PsBlk	ASG		High band positive filter lead-lag block coefficient KH11.	M / F
KHi17NgBlk	ASG		High band negative filter lead-lag block coefficient KH17.	M / F
KHi2Ng	ASG		High band negative filter proportional gain KH2.	M / F
KIntm	ASG		Intermediate band filter proportional gain KI.	M / F
KIntm1Ps	ASG		Intermediate band positive filter proportional gain KI1.	M / F
KIntm11PsBlk	ASG		Intermediate band positive filter lead-lag block coefficient KI11.	M / F
KIntm17NgBlk	ASG		Intermediate band negative filter lead-lag block coefficient KI17.	M / F
KIntm2Ng	ASG		Intermediate band negative filter proportional gain KI2.	M / F
KLo	ASG		Low band filter proportional gain KL.	M / F
KLoLo	ASG		Very low band filter proportional gain KVL.	M / F
KLo1Ps	ASG		Low band positive filter proportional gain KL1.	M / F
KLoLo1Ps	ASG		Very low band positive filter proportional gain KVL1.	M / F
KLoLo2Ng	ASG		Very low band negative filter proportional gain KVL2.	M / F
KLo11PsBlk	ASG		Low band positive filter lead-lag block coefficient KL11.	M / F
KLoLo11PsBlk	ASG		Very low band positive filter lead-lag block coefficient KVL11.	M / F
KLo17NgBlk	ASG		Low band negative filter lead-lag block coefficient KL17.	M / F
KLoLo17NgBlk	ASG		Very low band negative filter lead-lag block coefficient KVL17.	M / F
KLo2Ng	ASG		Low band negative filter proportional gain KL2.	M / F
Tc1HiPsLd	ING		High band positive filter (numerator) lead time constant TH1 [s].	M / F
Tc2HiPsLg	ING		High band positive filter (denominator) lag time constant TH2 [s].	M / F
Tc3HiPsLd	ING		High band positive filter (numerator) lead time constant TH3 [s].	M / F
Tc4HiPsLg	ING		High band positive filter (denominator) lag time constant TH4 [s].	M / F
Tc5HiPsLd	ING		High band positive filter (numerator) lead time constant TH5 [s].	M / F
Tc6HiPsLg	ING		High band positive filter (denominator) lag time constant TH6 [s].	M / F
Tc7HiNgLd	ING		High band negative filter (numerator) lead time constant TH7 [s].	M / F