

**DIN EN 61850-7-4**

ICS 33.040.40

Ersatz für  
DIN EN 61850-7-4:2005-10  
Siehe Anwendungsbeginn

**Kommunikationsnetze und -systeme für die Automatisierung in der elektrischen Energieversorgung –  
Teil 7-4: Grundlegende Kommunikationsstruktur –  
Kompatible Logikknoten- und Datenklassen (IEC 61850-7-4:2010);  
Englische Fassung EN 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);  
English version EN 61850-7-4:2010

Réseaux et systèmes de communication pour l'automatisation des systèmes électriques –  
Partie 7-4: Structure de communication de base –  
Classes de nœud logique et classes de donnée objet compatibles (CEI 61850-7-4:2010);  
Version anglaise EN 61850-7-4:2010

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DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

## Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2010-06-01 angenommene Europäische Norm als DIN-Norm ist 2010-11-01.

Daneben darf DIN EN 61850-7-4:2005-10 noch bis 2013-06-01 angewendet werden.

## Nationales Vorwort

*Vorausgegangene Norm-Entwürfe: E DIN IEC 61850-7-4/A1:2006-09 und E DIN IEC 61850-7-4/A2:2006-09.*

Für diese Norm ist das nationale Arbeitsgremium K 952 „Netzleittechnik“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE ([www.dke.de](http://www.dke.de)) zuständig.

Die enthaltene IEC-Publikation wurde vom TC 57 „Power systems management and associated information exchange“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieser Publikation bis zu dem Datum (maintenance result date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu dieser Publikation angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees die Publikation

- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der EN 61850-7-4 veröffentlicht. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

## Änderungen

Gegenüber DIN EN 61850-7-4:2005-10 wurden folgende Änderungen vorgenommen:

- a) Erweiterungen für neue logische Knoten im Bereich der Spannungsqualität;
- b) Erweiterungen für das Modell der statistischen und historischen statistischen Daten;
- c) Erweiterungen bezüglich IEC 61850-90-1 (Station – Station Kommunikation);
- d) Erweiterungen für neue logische Knoten für die Überwachungsfunktion gemäß EN 62271;
- e) neue logische Knoten aus EN 61850-7-410 und EN 61850-7-420, wenn von allgemeinem Interesse.

## Frühere Ausgaben

DIN EN 61850-7-4: 2005-10

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Compatible logical node classes and data object classes  
(IEC 61850-7-4:2010)**

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Kommunikationsnetze und -systeme  
für die Automatisierung in der elektrischen  
Energieversorgung –  
Teil 7-4: Grundlegende  
Kommunikationsstruktur –  
Kompatible Logikknoten-  
und Datenklassen  
(IEC 61850-7-4:2010)

This European Standard was approved by CENELEC on 2010-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

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## Foreword

The text of document 57/1045/FDIS, future edition 2 of IEC 61850-7-4, prepared by IEC TC 57, Power systems management and associated information exchange, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61850-7-4 on 2010-06-01.

This European Standard supersedes EN 61850-7-4:2003.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The major technical changes with regard to EN 61850-7-4:2003 are as follows:

- corrections and clarifications according to information letter "IEC 61850-technical issues by the IEC TC 57" (see document 57/963/INF, 2008-07-18);
- extensions for new logical nodes for the power quality domain;
- extensions for the model for statistical and historical statistical data;
- extensions regarding IEC 61850-90-1 (substation-substation communication);
- extensions for new logical nodes for monitoring functions according to EN 62271;
- new logical nodes from EN 61850-7-410 and EN 61850-7-420 of general interest.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2011-03-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2013-06-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61850-7-4:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

|                 |                                    |
|-----------------|------------------------------------|
| IEC 60870-5-101 | NOTE Harmonized as EN 60870-5-101. |
| IEC 60870-5-103 | NOTE Harmonized as EN 60870-5-103. |
| IEC 61000-4-30  | NOTE Harmonized as EN 61000-4-30.  |

|                      |                                                        |
|----------------------|--------------------------------------------------------|
| IEC 61850-6          | NOTE Harmonized as EN 61850-6.                         |
| IEC 61850-7-410:2007 | NOTE Harmonized as EN 61850-7-410:2007 (not modified). |
| IEC 61850-7-420      | NOTE Harmonized as EN 61850-7-420.                     |
| IEC 61850-8 series   | NOTE Harmonized in EN 61850-8 series (not modified).   |
| IEC 61850-9 series   | NOTE Harmonized in EN 61850-9 series (not modified).   |
| IEC 61850-10         | NOTE Harmonized as EN 61850-10.                        |

## CONTENTS

|                                                                      |    |
|----------------------------------------------------------------------|----|
| INTRODUCTION.....                                                    | 10 |
| 1 Scope.....                                                         | 11 |
| 2 Normative references.....                                          | 12 |
| 3 Terms and definitions .....                                        | 13 |
| 4 Abbreviated terms.....                                             | 13 |
| 5 Logical node classes.....                                          | 19 |
| 5.1 Logical node groups .....                                        | 19 |
| 5.2 Interpretation of logical node tables .....                      | 20 |
| 5.3 System logical nodes LN group: L .....                           | 21 |
| 5.3.1 LN relationships.....                                          | 21 |
| 5.3.2 LN: Physical device information Name: LPHD.....                | 22 |
| 5.3.3 LN: common logical node Name: Common LN.....                   | 22 |
| 5.3.4 LN: Logical node zero Name: LLN0 .....                         | 24 |
| 5.3.5 LN: Physical communication channel supervision Name: LCCH..... | 24 |
| 5.3.6 LN: GOOSE subscription Name: LGOS .....                        | 25 |
| 5.3.7 LN: Sampled value subscription Name: LSVS.....                 | 25 |
| 5.3.8 LN: Time management Name: LTIM.....                            | 26 |
| 5.3.9 LN: Time master supervision Name: LTMS.....                    | 26 |
| 5.3.10 LN: Service tracking Name: LTRK.....                          | 27 |
| 5.4 Logical nodes for automatic control LN Group: A.....             | 27 |
| 5.4.1 Modelling remarks .....                                        | 27 |
| 5.4.2 LN: Neutral current regulator Name: ANCR .....                 | 28 |
| 5.4.3 LN: Reactive power control Name: ARCO.....                     | 29 |
| 5.4.4 LN: Resistor control Name: ARIS .....                          | 29 |
| 5.4.5 LN: Automatic tap changer controller Name: ATCC .....          | 30 |
| 5.4.6 LN: Voltage control Name: AVCO.....                            | 32 |
| 5.5 Logical nodes for control LN Group: C .....                      | 32 |
| 5.5.1 Modelling remarks .....                                        | 32 |
| 5.5.2 LN: Alarm handling Name: CALH .....                            | 32 |
| 5.5.3 LN: Cooling group control Name: CCGR.....                      | 33 |
| 5.5.4 LN: Interlocking Name: CILO.....                               | 34 |
| 5.5.5 LN: Point-on-wave switching Name: CPOW.....                    | 34 |
| 5.5.6 LN: Switch controller Name: CSWI.....                          | 34 |
| 5.5.7 LN: Synchronizer controller Name: CSYN.....                    | 35 |
| 5.6 Logical nodes for functional blocks LN group F .....             | 37 |
| 5.6.1 Modelling remarks .....                                        | 37 |
| 5.6.2 LN: Counter Name: FCNT .....                                   | 37 |
| 5.6.3 LN: Curve shape description Name: FCSD.....                    | 37 |
| 5.6.4 LN: Generic filter Name: FFIL .....                            | 38 |
| 5.6.5 LN: Control function output limitation Name: FLIM.....         | 38 |
| 5.6.6 LN: PID regulator Name: FPID .....                             | 39 |
| 5.6.7 LN: Ramp function Name: FRMP.....                              | 40 |
| 5.6.8 LN: Set-point control function Name: FSPT .....                | 40 |
| 5.6.9 LN: Action at over threshold Name: FXOT.....                   | 41 |
| 5.6.10 LN: Action at under threshold Name: FXUT.....                 | 41 |

|         |                                                                 |             |    |
|---------|-----------------------------------------------------------------|-------------|----|
| 5.7     | Logical nodes for generic references                            | LN Group: G | 42 |
| 5.7.1   | Modelling remarks                                               |             | 42 |
| 5.7.2   | LN: Generic automatic process control                           | Name: GAPC  | 42 |
| 5.7.3   | LN: Generic process I/O                                         | Name: GGIO  | 43 |
| 5.7.4   | LN: Generic log                                                 | Name: GLOG  | 43 |
| 5.7.5   | LN: Generic security application                                | Name: GSAL  | 44 |
| 5.8     | Logical nodes for interfacing and archiving                     | LN Group: I | 44 |
| 5.8.1   | Modelling remarks                                               |             | 44 |
| 5.8.2   | LN: Archiving                                                   | Name: IARC  | 44 |
| 5.8.3   | LN: Human machine interface                                     | Name: IHMI  | 45 |
| 5.8.4   | LN: Safety alarm function                                       | Name: ISAF  | 45 |
| 5.8.5   | LN: Telecontrol interface                                       | Name: ITCI  | 46 |
| 5.8.6   | LN: Telemonitoring interface                                    | Name: ITMI  | 46 |
| 5.8.7   | LN: Teleprotection communication interfaces                     | Name: ITPC  | 46 |
| 5.9     | Logical nodes for mechanical and non-electric primary equipment | LN group K  | 48 |
| 5.9.1   | Modelling remarks                                               |             | 48 |
| 5.9.2   | LN: Fan                                                         | Name: KFAN  | 48 |
| 5.9.3   | LN: Filter                                                      | Name: KFIL  | 48 |
| 5.9.4   | LN: Pump                                                        | Name: KPMP  | 49 |
| 5.9.5   | LN: Tank                                                        | Name: KTNK  | 49 |
| 5.9.6   | LN: Valve control                                               | Name: KVLV  | 50 |
| 5.10    | Logical nodes for metering and measurement                      | LN Group: M | 51 |
| 5.10.1  | Modelling remarks                                               |             | 51 |
| 5.10.2  | LN: Environmental information                                   | Name: MENV  | 51 |
| 5.10.3  | LN: Flicker measurement name                                    | Name: MFLK  | 52 |
| 5.10.4  | LN: Harmonics or interharmonics                                 | Name: MHAI  | 53 |
| 5.10.5  | LN: Non-phase-related harmonics or interharmonics               | Name: MHAN  | 54 |
| 5.10.6  | LN: Hydrological information                                    | Name: MHYD  | 56 |
| 5.10.7  | LN: DC measurement                                              | Name: MMDC  | 56 |
| 5.10.8  | LN: Meteorological information                                  | Name: MMET  | 56 |
| 5.10.9  | LN: Metering                                                    | Name: MMTN  | 57 |
| 5.10.10 | LN: Metering                                                    | Name: MMTR  | 58 |
| 5.10.11 | LN: Non-phase-related measurement                               | Name: MMXN  | 58 |
| 5.10.12 | LN: Measurement                                                 | Name: MMXU  | 58 |
| 5.10.13 | LN: Sequence and imbalance                                      | Name: MSQI  | 60 |
| 5.10.14 | LN: Metering statistics                                         | Name: MSTA  | 61 |
| 5.11    | Logical nodes for protection functions                          | LN Group: P | 61 |
| 5.11.1  | Modelling remarks                                               |             | 61 |
| 5.11.2  | LN: Differential                                                | Name: PDIF  | 62 |
| 5.11.3  | LN: Direction comparison                                        | Name: PDIR  | 63 |
| 5.11.4  | LN: Distance                                                    | Name: PDIS  | 64 |
| 5.11.5  | LN: Directional overpower                                       | Name: PDOP  | 64 |
| 5.11.6  | LN: Directional underpower                                      | Name: PDUP  | 65 |
| 5.11.7  | LN: Rate of change of frequency                                 | Name: PFRC  | 65 |
| 5.11.8  | LN: Harmonic restraint                                          | Name: PHAR  | 66 |
| 5.11.9  | LN: Ground detector                                             | Name: PHIZ  | 66 |
| 5.11.10 | LN: Instantaneous overcurrent                                   | Name: PIOC  | 67 |
| 5.11.11 | LN: Motor restart inhibition                                    | Name: PMRI  | 67 |
| 5.11.12 | LN: Motor starting time supervision                             | Name: PMSS  | 68 |

|         |                                                       |             |    |
|---------|-------------------------------------------------------|-------------|----|
| 5.11.13 | LN: Over power factor                                 | Name: POPF  | 68 |
| 5.11.14 | LN: Phase angle measuring                             | Name: PPAM  | 68 |
| 5.11.15 | LN: Rotor protection                                  | Name: PRTR  | 69 |
| 5.11.16 | LN: Protection scheme                                 | Name: PSCH  | 69 |
| 5.11.17 | LN: Sensitive directional earthfault                  | Name: PSDE  | 70 |
| 5.11.18 | LN: Transient earth fault                             | Name: PTEF  | 71 |
| 5.11.19 | LN: Thyristor protection                              | Name: PTHF  | 71 |
| 5.11.20 | LN: Time overcurrent                                  | Name: PTOC  | 71 |
| 5.11.21 | LN: Overfrequency                                     | Name: PTOF  | 72 |
| 5.11.22 | LN: Overvoltage                                       | Name: PTOV  | 73 |
| 5.11.23 | LN: Protection trip conditioning                      | Name: PTRC  | 73 |
| 5.11.24 | LN: Thermal overload                                  | Name: PTTR  | 74 |
| 5.11.25 | LN: Undercurrent                                      | Name: PTUC  | 74 |
| 5.11.26 | LN: Underfrequency                                    | Name: PTUF  | 75 |
| 5.11.27 | LN: Undervoltage                                      | Name: PTUV  | 75 |
| 5.11.28 | LN: Underpower factor                                 | Name: PUPF  | 76 |
| 5.11.29 | LN: Voltage controlled time overcurrent               | Name: PVOC  | 76 |
| 5.11.30 | LN: Volts per Hz                                      | Name: PVPH  | 77 |
| 5.11.31 | LN: Zero speed or underspeed                          | Name: PZSU  | 78 |
| 5.12    | Logical nodes for power quality events                | LN Group: Q | 78 |
| 5.12.1  | Modelling remarks                                     |             | 78 |
| 5.12.2  | LN: Frequency variation                               | Name: QFVR  | 78 |
| 5.12.3  | LN: Current transient                                 | Name: QITR  | 79 |
| 5.12.4  | LN: Current unbalance variation                       | Name: QIUB  | 79 |
| 5.12.5  | LN: Voltage transient                                 | Name: QVTR  | 80 |
| 5.12.6  | LN: Voltage unbalance variation                       | Name: QVUB  | 80 |
| 5.12.7  | LN: Voltage variation                                 | Name: QVVR  | 81 |
| 5.13    | Logical nodes for protection related functions        | LN Group: R | 81 |
| 5.13.1  | Modelling remarks                                     |             | 81 |
| 5.13.2  | LN: Disturbance recorder channel analogue             | Name: RADR  | 82 |
| 5.13.3  | LN: Disturbance recorder channel binary               | Name: RBDR  | 82 |
| 5.13.4  | LN: Breaker failure                                   | Name: RBRF  | 83 |
| 5.13.5  | LN: Directional element                               | Name: RDIR  | 83 |
| 5.13.6  | LN: Disturbance recorder function                     | Name: RDRE  | 84 |
| 5.13.7  | LN: Disturbance record handling                       | Name: RDRS  | 85 |
| 5.13.8  | LN: Fault locator                                     | Name: RFLO  | 85 |
| 5.13.9  | LN: Differential measurements                         | Name: RMXU  | 86 |
| 5.13.10 | LN: Power swing detection/blocking                    | Name: RPSB  | 86 |
| 5.13.11 | LN: Autoreclosing                                     | Name: RREC  | 87 |
| 5.13.12 | LN: Synchronism-check                                 | Name: RSYN  | 87 |
| 5.14    | Logical nodes for supervision and monitoring          | LN Group: S | 88 |
| 5.14.1  | Modelling remarks                                     |             | 88 |
| 5.14.2  | LN: Monitoring and diagnostics for arcs               | Name: SARC  | 89 |
| 5.14.3  | LN: Circuit breaker supervision                       | Name: SCBR  | 89 |
| 5.14.4  | LN: Insulation medium supervision (gas)               | Name: SIMG  | 90 |
| 5.14.5  | LN: Insulation medium supervision (liquid)            | Name: SIML  | 91 |
| 5.14.6  | LN: Tap changer supervision                           | Name: SLTC  | 92 |
| 5.14.7  | LN: Supervision of operating mechanism                | Name: SOPM  | 92 |
| 5.14.8  | LN: Monitoring and diagnostics for partial discharges | Name: SPDC  | 93 |

|         |                                                       |             |     |
|---------|-------------------------------------------------------|-------------|-----|
| 5.14.9  | LN: Power transformer supervision                     | Name: SPTR  | 94  |
| 5.14.10 | LN: Circuit switch supervision                        | Name: SSWI  | 94  |
| 5.14.11 | LN: Temperature supervision                           | Name: STMP  | 95  |
| 5.14.12 | LN: Vibration supervision                             | Name: SVBR  | 96  |
| 5.15    | Logical nodes for instrument transformers and sensors | LN Group: T | 97  |
| 5.15.1  | Modelling remarks                                     |             | 97  |
| 5.15.2  | LN: Angle                                             | Name: TANG  | 97  |
| 5.15.3  | LN: Axial displacement                                | Name: TAXD  | 97  |
| 5.15.4  | LN: Current transformer                               | Name: TCTR  | 98  |
| 5.15.5  | LN: Distance                                          | Name: TDST  | 98  |
| 5.15.6  | LN: Liquid flow                                       | Name: TFLW  | 99  |
| 5.15.7  | LN: Frequency                                         | Name: TFRQ  | 99  |
| 5.15.8  | LN: Generic sensor                                    | Name: TGSN  | 100 |
| 5.15.9  | LN: Humidity                                          | Name: THUM  | 100 |
| 5.15.10 | LN: Media level                                       | Name: TLVL  | 101 |
| 5.15.11 | LN: Magnetic field                                    | Name: TMGF  | 101 |
| 5.15.12 | LN: Movement sensor                                   | Name: TMVM  | 101 |
| 5.15.13 | LN: Position indicator                                | Name: TPOS  | 102 |
| 5.15.14 | LN: Pressure sensor                                   | Name: TPRS  | 102 |
| 5.15.15 | LN: Rotation transmitter                              | Name: TRTN  | 103 |
| 5.15.16 | LN: Sound pressure sensor                             | Name: TSND  | 103 |
| 5.15.17 | LN: Temperature sensor                                | Name: TTMP  | 104 |
| 5.15.18 | LN: Mechanical tension / stress                       | Name: TTNS  | 104 |
| 5.15.19 | LN: Vibration sensor                                  | Name: TVBR  | 105 |
| 5.15.20 | LN: Voltage transformer                               | Name: TVTR  | 105 |
| 5.15.21 | LN: Water acidity                                     | Name: TWPH  | 106 |
| 5.16    | Logical nodes for switchgear                          | LN Group: X | 106 |
| 5.16.1  | Modelling remarks                                     |             | 106 |
| 5.16.2  | LN: Circuit breaker                                   | Name: XCBR  | 106 |
| 5.16.3  | LN: Circuit switch                                    | Name: XSWI  | 107 |
| 5.17    | Logical nodes for power transformers                  | LN Group: Y | 108 |
| 5.17.1  | Modelling remarks                                     |             | 108 |
| 5.17.2  | LN: Earth fault neutralizer (Petersen coil)           | Name: YEFN  | 108 |
| 5.17.3  | LN: Tap changer                                       | Name: YLTC  | 109 |
| 5.17.4  | LN: Power shunt                                       | Name: YPSH  | 109 |
| 5.17.5  | LN: Power transformer                                 | Name: YPTR  | 109 |
| 5.18    | Logical nodes for further power system equipment      | LN Group: Z | 110 |
| 5.18.1  | Modelling remarks                                     |             | 110 |
| 5.18.2  | LN: Auxiliary network                                 | Name: ZAXN  | 110 |
| 5.18.3  | LN: Battery                                           | Name: ZBAT  | 111 |
| 5.18.4  | LN: Bushing                                           | Name: ZBSH  | 111 |
| 5.18.5  | LN: Power cable                                       | Name: ZCAB  | 111 |
| 5.18.6  | LN: Capacitor bank                                    | Name: ZCAP  | 112 |
| 5.18.7  | LN: Converter                                         | Name: ZCON  | 112 |
| 5.18.8  | LN: Generator                                         | Name: ZGEN  | 112 |
| 5.18.9  | LN: Gas insulated line                                | Name: ZGIL  | 113 |
| 5.18.10 | LN: Power overhead line                               | Name: ZLIN  | 113 |
| 5.18.11 | LN: Motor                                             | Name: ZMOT  | 114 |
| 5.18.12 | LN: Reactor                                           | Name: ZREA  | 114 |

|                                                                                                                                                                     |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 5.18.13 LN: Resistor Name: ZRES .....                                                                                                                               | 115 |
| 5.18.14 LN: Rotating reactive component Name: ZRRC .....                                                                                                            | 115 |
| 5.18.15 LN: Surge arrestor Name: ZSAR .....                                                                                                                         | 116 |
| 5.18.16 LN: Semi-conductor controlled rectifier Name: ZSCR .....                                                                                                    | 116 |
| 5.18.17 LN: Synchronous machine Name: ZSMC .....                                                                                                                    | 116 |
| 5.18.18 LN: Thyristor controlled frequency converter Name: ZTCF .....                                                                                               | 118 |
| 5.18.19 LN: Thyristor controlled reactive component Name: ZTCR .....                                                                                                | 118 |
| 6 Data object name semantics .....                                                                                                                                  | 118 |
| Annex A (normative) Interpretation of mode and behaviour .....                                                                                                      | 157 |
| Annex B (normative) Local / Remote concept .....                                                                                                                    | 159 |
| Annex C (informative) Deprecated logical node classes .....                                                                                                         | 161 |
| Annex D (informative) Relationship between this standard and IEC 61850-5 .....                                                                                      | 162 |
| Annex E (informative) Algorithms used in logical nodes for automatic control .....                                                                                  | 163 |
| Annex F (normative) Statistical calculation .....                                                                                                                   | 168 |
| Annex G (normative) Functional relationship of data objects of autorecloser RREC .....                                                                              | 173 |
| Annex H (normative) SCL enumerations .....                                                                                                                          | 174 |
| Bibliography .....                                                                                                                                                  | 180 |
| Annex ZA (normative) Normative references to international publications<br>with their corresponding European publications .....                                     | 181 |
| Figure 1 – Overview of this standard .....                                                                                                                          | 12  |
| Figure 2 – LOGICAL NODE relationships .....                                                                                                                         | 21  |
| Figure E.1 – Example of curve based on an indexed gate position providing water flow .....                                                                          | 163 |
| Figure E.2 – Example of curve based on an indexed guide vane position (x axis) vs. net<br>head (y axis) giving an interpolated runner blade position (Z axis) ..... | 164 |
| Figure E.3 – Example of a proportional-integral-derivate controller .....                                                                                           | 165 |
| Figure E.4 – Example of a power stabilisation system .....                                                                                                          | 166 |
| Figure E.5 – Example of a ramp generator .....                                                                                                                      | 166 |
| Figure E.6 – Example of an interface with a set-point algorithm .....                                                                                               | 167 |
| Figure F.1 – Statistical calculation of a vector .....                                                                                                              | 169 |
| Figure F.2 – Examples of statistical calculations .....                                                                                                             | 171 |
| Figure G.1 – Diagram of autorecloser function .....                                                                                                                 | 173 |
| Table 1 – List of logical node groups .....                                                                                                                         | 19  |
| Table 2 – Interpretation of logical node tables .....                                                                                                               | 20  |
| Table 3 – Relation between IEC 61850-5 and IEC 61850-7-4 for automatic control LNs .....                                                                            | 28  |
| Table 4 – Relation between IEC 61850-5 and IEC 61850-7-4 for control LNs .....                                                                                      | 32  |
| Table 5 – Conditional attributes in FPID .....                                                                                                                      | 40  |
| Table 6 – Relation between IEC 61850-5 and IEC 61850-7-4 for metering and measurement<br>LNs .....                                                                  | 51  |
| Table 7 – Relation between IEC 61850-5 and IEC 61850-7-4 (this standard) for protection<br>LNs .....                                                                | 61  |
| Table 8 – Relation between IEC 61850-5 and IEC 61850-7-4 for protection related LN .....                                                                            | 82  |
| Table 9 – Relation between IEC 61850-5 and IEC 61850-7-4 for supervision and monitoring<br>LNs .....                                                                | 88  |
| Table 10 – Description of data objects .....                                                                                                                        | 118 |
| Table A.1 – Values of mode and behaviour .....                                                                                                                      | 157 |

|                                                                                                    |     |
|----------------------------------------------------------------------------------------------------|-----|
| Table A.2 – Definition of mode and behaviour .....                                                 | 158 |
| Table B.1 – Relationship between Loc/Rem data objects and control authority .....                  | 160 |
| Table D.1 – Relationship between IEC 61850-5 and this standard for some miscellaneous<br>LNs ..... | 162 |

## INTRODUCTION

This Part of IEC 61850 is Part of a set of standards, the IEC 61850 series. IEC 61850 defines communication networks and systems for power utility automation, and more specially the communication architecture for subsystems such as substation automation systems. The sum of all subsystems may result also in the description of the communication architecture for the overall power system management. The defined architecture provided in specific parts of IEC 61850-7-x gives both a power utility specific data model and a substation domain specific data model with abstract definitions of data objects classes and services independently from the specific protocol stacks, implementations, and operating systems. The mapping of these abstract classes and services to communication stacks is outside the scope of IEC 61850-7-x and may be found in IEC 61850-8-x and in IEC 61850-9-x.

IEC 61850-7-1 gives an overview of the basic communication architecture to be used for all applications in the power system domain. IEC 61850-7-3 defines common attribute types and common data classes related to all applications in the power system domain. The attributes of the common data classes may be accessed using services defined in IEC 61850-7-2. These common data classes are used in this Part to define the compatible data object classes.

To reach interoperability, all data objects in the data model need a strong definition with regard to syntax and semantics. The semantics of the data objects is mainly provided by names assigned to common logical nodes defined in this Part and the data objects they contain, as defined in this basic part, and dedicated logical nodes defined in domain specific parts such as for hydro power control systems. Interoperability is easiest if as much as possible of the data objects are defined as mandatory. Because of different approaches and technical features, some data objects, especially settings, were declared as optional in this edition of the standard. There are also data objects which were declared as conditional, i.e. they will become mandatory under some well-defined conditions. After some experience has been gained with this standard, this decision may be reviewed in the next edition of this part.

It should be noted that data objects with full semantics are only one of the elements required to achieve interoperability. The standardized access to the data objects is defined in compatible, power utility and domain specific services (see IEC 61850-7-2). Since data objects and services are hosted by devices (IED), a proper device model is also needed. To describe both the device capabilities and the interaction of the devices in the related system, a configuration language is also needed, as defined in IEC 61850-6 by the substation configuration description language (SCL).

The compatible logical node name and data object name definitions found in this Part and the associated semantics are fixed. The syntax of the type definitions of all data objects classes is governed by abstract definitions provided in IEC 61850-7-2 and IEC 61850-7-3. Not all features of logical nodes are listed in this part; for example, data sets and logs are covered in IEC 61850-7-2.

## COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

### Part 7-4: Basic communication structure – Compatible logical node classes and data object classes

#### 1 Scope

This Part of IEC 61850 specifies the information model of devices and functions generally related to common use regarding applications in systems for power utility automation. It also contains the information model of devices and function-related applications in substations. In particular, it specifies the compatible logical node names and data object names for communication between intelligent electronic devices (IED). This includes the relationship between logical nodes and data objects.

The logical node names and data object names defined in this document are Part of the class model introduced in IEC 61850-7-1 and defined in IEC 61850-7-2. The names defined in this document are used to build the hierarchical object references applied for communicating with IEDs in systems for power utility automation and, especially, with IEDs in substations and on distribution feeders. The naming conventions of IEC 61850-7-2 are applied in this part.

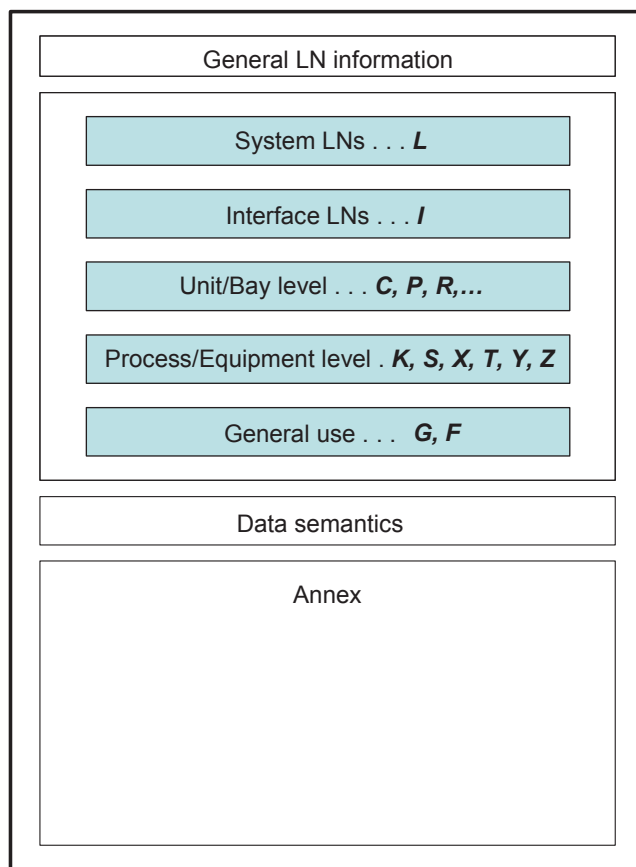
To avoid private, incompatible extensions, this Part specifies normative naming rules for multiple instances and private, compatible extensions of logical node (LN) classes and data object names. Any definition is based on IEC 61850 or on referenced well identified public documents.

This Part does not provide tutorial material. It is recommended to read parts IEC 61850-5 and IEC 61850-7-1 first, in conjunction with IEC 61850-7-3, and IEC 61850-7-2.

This standard is applicable to describe device models and functions of substation and feeder equipment. The concepts defined in this standard are also applied to describe device models and functions for:

- substation-to-substation information exchange,
- substation-to-control centre information exchange,
- power plant-to-control centre information exchange,
- information exchange for distributed generation,
- information exchange for distributed automation, or
- information exchange for metering.

Figure 1 provides a general overview of this standard. The groups of logical nodes defined in this standard are shown in Figure 1, ordered according to some semantic meaning, for instance different control levels such as plant level, unit level, etc. For convenience, the logical nodes are defined below in alphabetical order.



IEC 1102/03

**Figure 1 – Overview of this standard**

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*

IEC 61000-4-7:2002, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

IEC 61000-4-15, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*

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

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

IEC 61850-7-1:\_\_\_\_<sup>1</sup>, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models*

<sup>1</sup> To be published.

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

IEC 61850-7-3:\_\_\_<sup>3</sup>, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-9-2, *Communication networks and systems for power utility automation – Part 9-2: Specific Communication Service Mapping (SCSM) – Sampled values over ISO/IEC 8802-3*

IEEE C37.111:1999, *IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems*

IEEE 519:1992, *IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*

IEEE C37.2:1996, *Electrical Power System Device Function Numbers and Contact Designation*

IEEE 1459:2000, *IEEE Trial-Use Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions*

IEEE 1588, *Precision clock synchronization protocol for networked measurement and control systems*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61850-2 and IEC 61850-7-2 apply.

### 4 Abbreviated terms

The following terms are used to build concatenated data object names. For example, ChNum is constructed by using two terms "Ch" which stands for "Channel" and "Num" which stands for "Number". Thus the concatenated name represents a "channel number".

| Term | Description             | Term  | Description                     |
|------|-------------------------|-------|---------------------------------|
| A    | Current                 | Amp   | Current non-phase-related       |
| Acs  | Access                  | An    | Analogue                        |
| Abr  | Abrasion                | Ang   | Angle                           |
| Abs  | Absolute                | Ap    | Access point                    |
| AC   | AC, alternating current | App   | Apparent                        |
| Acc  | Accuracy                | Arc   | Arc                             |
| Act  | Action, activity        | Area  | Area                            |
| Acu  | Acoustic                | Auth  | Authorisation                   |
| Adj  | Adjustment              | Auto  | Automatic                       |
| Adp  | Adapter, adaptation     | Aux   | Auxiliary                       |
| Age  | Ageing                  | Av    | Average                         |
| Air  | Air                     | AWatt | Wattmetric component of current |
| Alg  | Algorithm               | Ax    | Axial                           |
| Alm  | Alarm                   | B     | Bushing                         |

<sup>2</sup> To be published.

<sup>3</sup> To be published.

| Term  | Description             | Term  | Description                                  |
|-------|-------------------------|-------|----------------------------------------------|
| Base  | Base                    | Col   | Coil                                         |
| Bat   | Battery                 | Conf  | Configuration                                |
| Beh   | Behaviour               | Cons  | Constant                                     |
| Ber   | Bit error rate          | Con   | Contact                                      |
| Bias  | Bias                    | Cor   | Correction                                   |
| Bin   | Binary                  | Core  | Core                                         |
| Blb   | Bulb                    | Crd   | Coordination                                 |
| Blk   | Block, blocked          | Crit  | Critical                                     |
| Bnd   | Band                    | Crv   | Curve                                        |
| Bo    | Bottom                  | CT    | Current transducer                           |
| Bst   | Boost                   | Ctl   | Control                                      |
| Bus   | Bus                     | Ctr   | Center                                       |
| C     | Carbon                  | Cur   | Current                                      |
| C2H2  | Acetylene               | Cvr   | Cover, cover level                           |
| C2H4  | Ethylene                | Cyc   | Cycle                                        |
| C2H6  | Ethane                  | D     | Derivate                                     |
| Cap   | Capability              | Day   | Day                                          |
| Capac | Capacitance             | dB    | Decibel                                      |
| Car   | Carrier                 | Dct   | Direct                                       |
| CB    | Circuit breaker         | Dea   | Dead                                         |
| Cdt   | Credit                  | Den   | Density                                      |
| CE    | Cooling equipment       | Det   | Detected                                     |
| Cel   | Cell                    | Detun | Detuning                                     |
| Cf    | Crest factor            | DExt  | De-excitation                                |
| Cff   | Coefficient             | Dew   | Dew                                          |
| Cfg   | Configuration           | Dff   | Diffuse                                      |
| CG    | Core ground             | Dgr   | Degree                                       |
| Ch    | Channel                 | Diag  | Diagnostics                                  |
| CH4   | Methane                 | Dif   | Differential, difference                     |
| Cha   | Charger                 | Dip   | Dip                                          |
| Chg   | Change                  | Dir   | Direction                                    |
| Chk   | Check                   | Dis   | Distance                                     |
| Chr   | Characteristic          | Dsp   | Displacement                                 |
| Circ  | Circulating, circuit    | DI    | Delay                                        |
| Clc   | Calculate, calculated   | Dlt   | Delete                                       |
| Clk   | Clock, clockwise        | Dmd   | Demand                                       |
| Cloud | Cloud                   | Dn    | Down                                         |
| Clr   | Clear                   | DPCSO | Double point controllable status output      |
| Clc   | Close                   | DQ0   | Direct, quadrature, and zero axis quantities |
| Cndct | Conductivity            | Drag  | Drag hand                                    |
| Cnt   | Counter                 | Day   | Day                                          |
| Cmbu  | Combustible, combustion | Drv   | Drive                                        |
| Cmd   | Command                 | DS    | Device state                                 |
| CO    | Carbon monoxide         | Dsc   | Discrepancy                                  |
| CO2   | Carbon dioxide          |       |                                              |

| Term    | Description                                       | Term   | Description                               |
|---------|---------------------------------------------------|--------|-------------------------------------------|
| Dsch    | Discharge                                         | Gn     | Generator                                 |
| Dur     | Duration                                          | Gnd    | Ground                                    |
| Dv      | Deviation                                         | Gr     | Group                                     |
| EC      | Earth Coil                                        | Grd    | Guard                                     |
| Echo    | Echo                                              | Grn    | Green                                     |
| EE      | External equipment                                | Gri    | Grid                                      |
| EF      | Earth fault                                       | Gust   | Gust                                      |
| Emg     | Emergency                                         | H      | Harmonics (phase-related)                 |
| Ems     | Emissions                                         | H2     | Hydrogen                                  |
| En      | Energy                                            | H2O    | Water                                     |
| Ena     | Enabled                                           | Ha     | Harmonics (non-phase-related)             |
| End     | End                                               | Health | Health                                    |
| Env     | Environment                                       | Heat   | Heater, heating                           |
| Eq      | Equalization, equal                               | Hi     | High, highest                             |
| Err     | Error                                             | Hor    | Horizontal                                |
| Ev      | Evaluation                                        | HP     | Hot point                                 |
| Evt     | Event                                             | Hum    | Humidity                                  |
| Ex      | External                                          | Hy     | Hydraulics, hydraulic system              |
| Exc     | Exceeded                                          | Hyd    | Hydrological, hydro, water                |
| Excl    | Exclusion                                         | Hz     | Frequency                                 |
| Exp     | Expired                                           | I      | Integral                                  |
| Ext     | Excitation                                        | Imb    | Imbalance                                 |
| F       | Float                                             | Imp    | Impedance non-phase-related               |
| FA      | Fault arc                                         | In     | Input                                     |
| Fact    | Factor                                            | Ina    | Inactivity                                |
| Fail    | Failure                                           | Iner   | Inertia                                   |
| Fan     | Fan                                               | Incr   | Increment                                 |
| Fer     | Frame error rate                                  | Ind    | Indication                                |
| Fil     | Filter, filtration                                | Inh    | Inhibit                                   |
| Fish    | Fish                                              | Ins    | Insulation                                |
| Fld     | Field                                             | Insol  | Insolation                                |
| Fll     | Fall                                              | Int    | Integer                                   |
| Flood   | Flood                                             | Intr   | Interrupt, interruption                   |
| Flt     | Fault                                             | Intv   | Interval                                  |
| Flush   | Flush                                             | ISCSO  | Integer status controllable status output |
| Flw     | Flow                                              | K      | Constant                                  |
| FPF     | Forward power flow                                | Kck    | Kicker                                    |
| Fu      | Fuse                                              | Key    | Key                                       |
| Full    | Full                                              | km     | Kilometre                                 |
| Fwd     | Forward                                           | L      | Lower                                     |
| Gas     | Gas                                               | Last   | Last                                      |
| Gen     | General                                           | Ld     | Lead                                      |
| Go      | Goose                                             | LD     | Logical device                            |
| GoCBRef | Goose control block reference (see IEC 61850-7-2) | LDC    | Line drop compensation                    |
|         |                                                   | LDCR   | Line drop compensation resistance         |

| <b>Term</b> | <b>Description</b>                                  | <b>Term</b> | <b>Description</b>                |
|-------------|-----------------------------------------------------|-------------|-----------------------------------|
| LDCX        | Line drop compensation reactance                    | Nit         | Nitrogen                          |
| LDCZ        | Line drop compensation impedance                    | Ng          | Negative                          |
| Leak        | Leakage                                             | Nom         | Nominal, normalising              |
| LED         | Light-emitting diode                                | Num         | Number                            |
| Len         | Length                                              | NSQ         | Average partial discharge current |
| Lev         | Level                                               | O2          | Oxygen                            |
| Lg          | Lag                                                 | O3          | Ozon, trioxygen                   |
| Lim         | Limit                                               | Ofs         | Offset                            |
| Lin         | Line                                                | Oil         | Oil                               |
| Liv         | Live                                                | Oo          | Out of                            |
| LN          | Logical node                                        | Op          | Operate, operating                |
| Lo          | Low                                                 | Opn         | Open                              |
| LO          | Lockout                                             | Out         | Output                            |
| Loc         | Local                                               | Ov          | Over, override, overflow          |
| Lod         | Load, loading                                       | Ovl         | Overload                          |
| Lok         | Locked                                              | P           | Proportional                      |
| Loop        | Loop                                                | Pa          | Partial                           |
| Los         | Loss                                                | Pap         | Paper                             |
| Lst         | List                                                | Par         | Parallel                          |
| LTC         | Load tap changer                                    | Pct         | Percent, percentage               |
| M           | Minutes                                             | Per         | Periodic, period                  |
| M/O/C       | Data object is mandatory or optional or conditional | PF          | Power factor                      |
| Made        | Made                                                | Ph          | Phase                             |
| Mag         | Magnetic, magnitude                                 | PH          | Acidity, value of pH              |
| Max         | Maximum                                             | PhsA        | Phase L1                          |
| Mbr         | Membrane                                            | PhsB        | Phase L2                          |
| Mem         | Memory                                              | PhsC        | Phase L3                          |
| Min         | Minimum                                             | PNV         | Phase-to-neutral voltage          |
| Mir         | Mirror                                              | Phy         | Physical                          |
| Mlt         | Multiplier, multiple                                | Pi          | Instantaneous P                   |
| Mod         | Mode                                                | PIs         | Pulse                             |
| Month       | Month                                               | Plt         | Plate, long-term flicker severity |
| Mot         | Motor                                               | Pmp         | Pump                              |
| Ms          | Milliseconds                                        | Po          | Polar                             |
| Mst         | Moisture                                            | Pol         | Polarizing                        |
| MT          | Main tank                                           | Pos         | Position                          |
| Mth         | Method                                              | PosA        | Position phase L1                 |
| Mvm         | Movement, moving                                    | PosB        | Position phase L2                 |
| N2          | Nitrogen dioxide                                    | PosC        | Position phase L3                 |
| Nam         | Name                                                | Pot         | Potentiometer                     |
| Name        | Name (see Note)                                     | POW         | Point on wave switching           |
| NdsCom      | Needs commissioning (see IEC 61850-7-2)             | PP          | Phase to phase                    |
| Net         | Net sum                                             | ppm         | Parts per million                 |
| Neut        | Neutral                                             | PPV         | Phase to phase voltage            |
|             |                                                     | Pre         | Pre-                              |

| Term  | Description                       | Term    | Description                                    |
|-------|-----------------------------------|---------|------------------------------------------------|
| Pres  | Pressure                          | S1      | Step one                                       |
| Prg   | Progress, in progress             | S10     | coefficient $S_{1.0}$                          |
| Pri   | Primary                           | S12     | coefficient $S_{1.2}$                          |
| Pro   | Protection                        | S2      | Step two                                       |
| Proxy | Proxy                             | Sar     | Surge arrestor                                 |
| Prt   | Parts, part                       | Sat     | Saturation                                     |
| Ps    | Positive                          | Sbs     | Subscription                                   |
| Pst   | Post, short-term flicker severity | Sch     | Scheme                                         |
| Pt    | Point                             | Sco     | Supply change over                             |
| Pwr   | Power                             | SCSM    | Specific communication service mapping         |
| Qty   | Quantity                          | Sec     | Security                                       |
| R     | Raise                             | Sel     | Select                                         |
| R0    | Zero sequence resistance          | Seq     | Sequence                                       |
| Rat   | Ratio                             | Set     | Setting                                        |
| Rcd   | Record, recording                 | Sig     | Signal                                         |
| Rch   | Reach                             | Sign    | Sign                                           |
| Rcl   | Reclaim                           | Sim     | Simulation, simulated                          |
| Rct   | Reaction                          | Sh      | Shunt                                          |
| Rdy   | Ready                             | SInt    | Salinity, saline content                       |
| Re    | Retry                             | Smok    | Smoke                                          |
| React | Reactance, reactive               | Snr     | Signal to noise ratio                          |
| Rec   | Reclose                           | Snw     | Snow                                           |
| Rect  | Rectifier                         | Spd     | Speed                                          |
| Red   | Reduction, redundant              | Spec    | Spectra                                        |
| Ref   | Reference                         | SPI     | Single pole                                    |
| Rel   | Release                           | SPCSO   | Single point controllable status output        |
| Rem   | Remote                            | Spt     | Setpoint                                       |
| Res   | Residual                          | Src     | Source                                         |
| Reso  | Resonance                         | St      | Status, state                                  |
| Rev   | Revision                          | Sta     | Station                                        |
| Rf    | Refreshment                       | Step    | Step                                           |
| Ris   | Resistance                        | Sto     | Storage e.g. activity of storing data          |
| RI    | Relation, relative                | Stat    | Statistics                                     |
| Rmp   | Ramping, ramp                     | Stop    | Stop                                           |
| RMS   | Root mean square                  | Std     | Standard                                       |
| Rnbk  | Runback                           | Stk     | Stroke                                         |
| Rot   | Rotation, rotor                   | Str     | Start                                          |
| Rs    | Reset, resetable                  | Stuck   | Stuck                                          |
| Rsl   | Result                            | Sup     | Supply                                         |
| Rst   | Restraint, restriction            | Svc     | Service                                        |
| Rsv   | Reserve                           | SvCBRef | SV control block reference (see IEC 61850-7-2) |
| Rte   | Rate                              | Sw      | Switch, switched                               |
| Rtg   | Rating                            | Swg     | Swing                                          |
| Rv    | Reverse                           | Syn     | Synchronisation                                |
| Rx    | Receive, received                 |         |                                                |

| Term | Description                 | Term  | Description                         |
|------|-----------------------------|-------|-------------------------------------|
| Tap  | Tap                         | VAr   | Volt amperes reactive               |
| Td   | Total distortion            | Ver   | Vertical                            |
| Tdf  | Transformer derating factor | Vbr   | Vibration                           |
| Tdp  | Td'                         | Viol  | Violation                           |
| Td0P | Td0'                        | Visc  | Viscosity                           |
| Td0S | Td0''                       | VIm   | Volume                              |
| Tds  | Td''                        | Vlv   | Valve                               |
| Term | Termination                 | Vol   | Voltage non-phase-related           |
| Test | Test                        | Volts | Voltage                             |
| Tgt  | Target                      | VT    | Voltage transducer                  |
| Thd  | Total harmonic distortion   | W     | Active power                        |
| Thm  | Thermal                     | Wac   | Watchdog                            |
| TiF  | Telephone influence factor  | Watt  | Active power non-phase-related      |
|      | Time                        | Wav   | Wave, waveform                      |
|      | Tmh = Time in h             | Wd    | Wind                                |
|      | Tmm = Time in min           | Week  | Week                                |
|      | Tms = Time in s             |       |                                     |
|      | Tmms = Time in ms           | Wei   | Weak end infeed                     |
| Tmp  | Temperature (°C)            | Wh    | Watt hours                          |
| Tnk  | Tank                        | Wid   | Width                               |
| To   | Top                         | Win   | Window                              |
| Tot  | Total                       | Wrm   | Warm                                |
| TP   | Three pole                  | Wrn   | Warning                             |
| Tpc  | Teleprotection              | X0    | Zero sequence reactance             |
| Tqp  | Tq'                         | X1    | Positive sequence reactance         |
| Tq0p | Tq0'                        | X2    | Negative sequence reactance X2      |
| Tq0s | Tq0''                       | Xd    | synchronous reactance Xd            |
| Tqs  | Tq ''                       | Xdp   | transient synchronous reactance Xd' |
| Tr   | Trip                        | Xds   | Reactance Xd''                      |
| Trd  | Trade                       | Xq    | synchronous reactance Xq            |
| Trip | Trip                        | Xqp   | transient reactance                 |
| Trg  | Trigger                     | Xqs   | sub-transient reactance Xq''        |
| Trk  | Track, tracking             | Year  | Year                                |
| Trs  | Transient                   | Z     | Impedance                           |
| Ts   | Total signed                | Z0    | Zero sequence impedance             |
| Tu   | Total unsigned              | Z1    | Positive sequence impedance         |
| Tun  |                             | Zer   | Zero                                |
| Tx   | Transmit, transmitted       | Zn    | Zone                                |
| Typ  | Type                        | Zro   | Zero sequence method                |
| Uhf  | Ultra-high-frequency        |       |                                     |
| Un   | Under                       |       |                                     |
| Up   | Up, upwards                 |       |                                     |
| V    | Voltage                     |       |                                     |
| VA   | Volt amperes                |       |                                     |
| Va   | Variation                   |       |                                     |
| Vac  | Vacuum                      |       |                                     |
| Val  | Value                       |       |                                     |

NOTE The abbreviation "Name" should only be used in data object EENAME and LNNAME.

## 5 Logical node classes

### 5.1 Logical node groups

Logical nodes are grouped according to the logical node groups listed in Table 1. The names of logical nodes shall begin with the character representing the group to which the logical node belongs. For modelling per phase (for example switches or instrument transformers), one instance per phase shall be created; for modelling protection per zone or level, one instance per zone or level shall be created also.

**Table 1 – List of logical node groups**

| Group indicator                                                                                                                                                                                                                                                                      | Logical node groups                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| A                                                                                                                                                                                                                                                                                    | Automatic control                               |
| B                                                                                                                                                                                                                                                                                    | Reserved                                        |
| C                                                                                                                                                                                                                                                                                    | Supervisory control                             |
| D                                                                                                                                                                                                                                                                                    | Distributed energy resources                    |
| E                                                                                                                                                                                                                                                                                    | Reserved                                        |
| F                                                                                                                                                                                                                                                                                    | Functional blocks                               |
| G                                                                                                                                                                                                                                                                                    | Generic function references                     |
| H                                                                                                                                                                                                                                                                                    | Hydro power                                     |
| I                                                                                                                                                                                                                                                                                    | Interfacing and archiving                       |
| J                                                                                                                                                                                                                                                                                    | Reserved                                        |
| K <sup>a</sup>                                                                                                                                                                                                                                                                       | Mechanical and non-electrical primary equipment |
| L                                                                                                                                                                                                                                                                                    | System logical nodes                            |
| M                                                                                                                                                                                                                                                                                    | Metering and measurement                        |
| N                                                                                                                                                                                                                                                                                    | Reserved                                        |
| O                                                                                                                                                                                                                                                                                    | Reserved                                        |
| P                                                                                                                                                                                                                                                                                    | Protection functions                            |
| Q                                                                                                                                                                                                                                                                                    | Power quality events detection related          |
| R                                                                                                                                                                                                                                                                                    | Protection related functions                    |
| S <sup>a</sup>                                                                                                                                                                                                                                                                       | Supervision and monitoring                      |
| T <sup>a</sup>                                                                                                                                                                                                                                                                       | Instrument transformer and sensors              |
| U                                                                                                                                                                                                                                                                                    | Reserved                                        |
| V                                                                                                                                                                                                                                                                                    | Reserved                                        |
| W                                                                                                                                                                                                                                                                                    | Wind power                                      |
| X <sup>a</sup>                                                                                                                                                                                                                                                                       | Switchgear                                      |
| Y <sup>a</sup>                                                                                                                                                                                                                                                                       | Power transformer and related functions         |
| Z <sup>a</sup>                                                                                                                                                                                                                                                                       | Further (power system) equipment                |
| <sup>a</sup> LNs of this group exist in dedicated IEDs if a process bus is used. Without a process bus, LNs of this group are the I/Os in the hardwired IED one level higher (for example in a bay unit) representing the external device by its inputs and outputs (process image). |                                                 |

## 5.2 Interpretation of logical node tables

The interpretation of the headings for the logical node tables is presented in Table 2.

**Table 2 – Interpretation of logical node tables**

| Column heading    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data object name  | Name of the data object                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Common data class | Common data class that defines the structure of the data object. See IEC 61850-7-3. For common data classes regarding the service tracking logical node (LTRK), see IEC 61850-7-2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Explanation       | Short explanation of the data object and how it is used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| T                 | <p>Transient data objects – the status of data objects with this designation is momentary and must be logged or reported to provide evidence of their momentary state. Some T may be only valid on a modelling level. The TRANSIENT property of DATA OBJECTS only applies to BOOLEAN process data attributes (FC=ST) of that DATA OBJECTS. A transient DATA OBJECT is identical to normal DATA OBJECT, except that for the process state change from TRUE to FALSE no event may be generated for reporting and for logging.</p> <p>For transient data objects, the falling edge is not reported if the transient attribute is set to true in the SCL-ICD file. It is recommended to report both states (TRUE to FALSE, and FALSE to TRUE), i.e. not to set the transient attribute in the SCL-ICD file for those DOs, and that the clients filter the transitions that are not "desired".</p>                                                                                                                                                                                 |
| M/O/C             | <p>This column defines whether a data object is mandatory (M) or optional (O) or conditional (C) for an instance of a specific logical node. When a data object is marked mandatory (M), it shall be contained in the instance of the logical node. When a data object is marked optional (O), it may be contained in the instance of the logical node; the decision if the data object is contained or not is outside the scope of this standard. The entry C is an indication that a condition exists for this data object, given in a note under the LN table. The condition decides what conditional data objects get mandatory. C may have an index to handle multiple conditions.</p> <p>NOTE1 Procurement specifications may require specific data objects marked optional to be provided for a particular project. The amount of optional information to be provided needs to be negotiated.</p> <p>NOTE 2 The attributes for data objects that are instantiated may also be mandatory or optional based on the CDC (attribute type) definition in IEC 61850-7-3.</p> |

The LNName attribute is inherited from Logical-Node class (see IEC 61850-7-2). The LN class names are individually given in the logical node tables. The LN instance name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.

All data object names are listed alphabetically in Clause 6. Despite some overlapping, the data objects in the logical node classes are grouped for the convenience of the reader into the following categories:

- Status information  
Status information contains data object, which show either the status of the process or of the function allocated to the LN class. This information is produced locally and cannot be changed via communication for operational reasons unless substitution is applicable. Data objects such as “start” or “trip” are listed in this category. Most of these data objects are mandatory.
- Measured and metered values  
Measured values are analogue data objects measured from the process or calculated in the functions such as currents, voltages, power, etc. This information is produced locally and cannot be changed remotely unless substitution is applicable.  
Metered values are analogue data objects representing quantities measured over time, for example energy. This information is produced locally and cannot be changed remotely unless substitution is applicable.

- Controls  
Controls contain data objects which are changed by commands such as switchgear state (ON/OFF), tap changer position or resettable counters. They are typically changed remotely, and are changed during operation much more often than settings.
- Settings  
Settings are data objects which configure the function for its operation. Since many settings are dependent on the implementation of the function, only a commonly agreed minimum is standardised. They may be changed from remote, but normally not very often.
- Descriptions  
Descriptions are data objects, which give information about the LN itself or an allocated device. This information consists of identification information and general properties like configuration revision, hard and software revisions, etc.

## 5.3 System logical nodes LN group: L

### 5.3.1 LN relationships

In this subclause, the system specific information is defined. This includes common logical node information (for example logical node behaviour, nameplate information, operation counters) as well as information related to the physical device (LPHD) implementing the logical devices and logical nodes. These logical nodes (LPHD and common LN) are independent of the application domain. All other logical nodes are domain specific, but inherit mandatory and optional data objects from the common logical node.

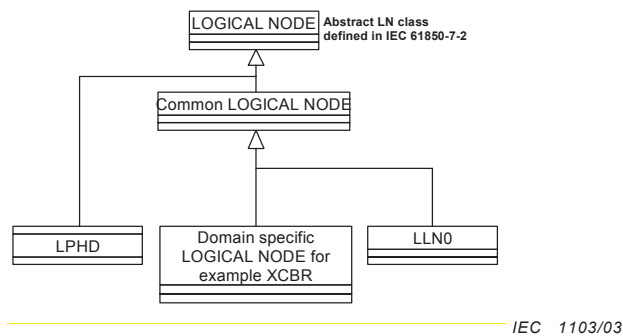


**Figure 2 – LOGICAL NODE relationships**

All logical node classes defined in this document inherit their structure from the GenLogicalNodeClass (LN, see Figure 2) defined in IEC 61850-7-2. Apart from the logical node class 'Physical Device Information' (LPHD), all logical node classes (LLN0 and domain specific LNs) defined in this document inherit at least the mandatory data objects of the common logical node (Common LN).

NOTE Common logical node will never be instantiated.

### 5.3.2 LN: Physical device information Name: LPHD

This LN is introduced in this Part to model common issues for physical devices.

| LPHD class                                                            |                   |                                           |   |       |
|-----------------------------------------------------------------------|-------------------|-------------------------------------------|---|-------|
| Data object name                                                      | Common data class | Explanation                               | T | M/O/C |
| <b>Data objects</b>                                                   |                   |                                           |   |       |
| <b>Descriptions</b>                                                   |                   |                                           |   |       |
| PhyNam                                                                | DPL               | Physical device name plate                |   | M     |
| <b>Status information</b>                                             |                   |                                           |   |       |
| PhyHealth                                                             | ENS               | Physical device health                    |   | M     |
| OutOv                                                                 | SPS               | Output communications buffer overflow     |   | O     |
| Proxy                                                                 | SPS               | Indicates if this LN is a proxy           |   | M     |
| InOv                                                                  | SPS               | Input communications buffer overflow      |   | O     |
| NumPwrUp                                                              | INS               | Number of power-ups                       |   | O     |
| WrmStr                                                                | INS               | Number of warm starts                     |   | O     |
| WacTrg                                                                | INS               | Number of watchdog device resets detected |   | O     |
| PwrUp                                                                 | SPS               | Power-up detected                         |   | O     |
| PwrDn                                                                 | SPS               | Power-down detected                       |   | O     |
| PwrSupAlm                                                             | SPS               | External power supply alarm               |   | O     |
| <b>Controls</b>                                                       |                   |                                           |   |       |
| RsStat                                                                | SPC               | Reset device statistics                   | T | O     |
| Sim                                                                   | SPC               | Receive simulated GOOSE or simulated SV   |   | O     |
| <b>Settings</b>                                                       |                   |                                           |   |       |
| <b>Data sets (see IEC 61850-7-2)</b>                                  |                   |                                           |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                           |   |       |
| <b>BufferedReportControlBlock (see IEC 61850-7-2)</b>                 |                   |                                           |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                           |   |       |
| <b>UnbufferedReportControlBlock (see IEC 61850-7-2)</b>               |                   |                                           |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                           |   |       |
| <b>Services (see IEC 61850-7-2)</b>                                   |                   |                                           |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                           |   |       |

### 5.3.3 LN: common logical node Name: Common LN

The common logical node class provides data objects which are mandatory or conditional to all dedicated LN classes. It contains also data which may be used in all dedicated logical node classes, such as input references and data objects for the statistical calculation methods (refer to Annex F).

| Common LN class                                                                                   |                   |                                                  |   |       |
|---------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------|---|-------|
| Data object name                                                                                  | Common data class | Explanation                                      | T | M/O/C |
| <b>Data objects</b>                                                                               |                   |                                                  |   |       |
| <b>Mandatory and conditional logical node information (shall be inherited by ALL LN but LPHD)</b> |                   |                                                  |   |       |
| <b>Descriptions</b>                                                                               |                   |                                                  |   |       |
| NamPlt                                                                                            | LPL               | Name plate                                       |   | C1    |
| <b>Status information</b>                                                                         |                   |                                                  |   |       |
| Beh                                                                                               | ENS               | Behaviour                                        |   | M     |
| Health                                                                                            | ENS               | Health                                           |   | C1    |
| Blk                                                                                               | SPS               | Dynamic blocking of function described by the LN |   | O     |
| <b>Controls</b>                                                                                   |                   |                                                  |   |       |
| Mod                                                                                               | ENC               | Mode                                             |   | C1    |

| Common LN class                                                                                                                                                                                |                   |                                                                                                                                                       |   |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                                                                               | Common data class | Explanation                                                                                                                                           | T | M/O/C |
| <b>Data objects</b>                                                                                                                                                                            |                   |                                                                                                                                                       |   |       |
| CmdBlk                                                                                                                                                                                         | SPC               | Blocking of control sequences and action triggers of controllable data objects                                                                        |   | C2    |
| <b>Settings</b>                                                                                                                                                                                |                   |                                                                                                                                                       |   |       |
| InRef1                                                                                                                                                                                         | ORG               | General input reference                                                                                                                               |   | O     |
| BlkRef1                                                                                                                                                                                        | ORG               | Blocking reference shows the receiving of dynamically blocking signal                                                                                 |   | O     |
| <b>Logical node information (statistical calculation specific – refer to Annex F)</b>                                                                                                          |                   |                                                                                                                                                       |   |       |
| <b>Status information</b>                                                                                                                                                                      |                   |                                                                                                                                                       |   |       |
| ClcExp                                                                                                                                                                                         | SPS               | Calculation period expired                                                                                                                            | T | C3    |
| <b>Controls</b>                                                                                                                                                                                |                   |                                                                                                                                                       |   |       |
| ClcStr                                                                                                                                                                                         | SPC               | Enables the calculation start at time operTm from the control model (if set) or immediately                                                           |   | O     |
| <b>Settings</b>                                                                                                                                                                                |                   |                                                                                                                                                       |   |       |
| ClcMth                                                                                                                                                                                         | ENG               | Calculation method of statistical data objects                                                                                                        |   | C3    |
| ClcMod                                                                                                                                                                                         | ENG               | Calculation mode. Allowed values: TOTAL, PERIOD, SLIDING                                                                                              |   | C4    |
| ClcIntvTyp                                                                                                                                                                                     | ENG               | Calculation interval type                                                                                                                             |   | C4    |
| ClcIntvPer                                                                                                                                                                                     | ING               | In case ClcIntvTyp equals to MS, PER-CYCLE, CYCLE, DAY, WEEK, MONTH, YEAR, number of units to consider to calculate the calculation interval duration |   | C4    |
| NumSubIntv                                                                                                                                                                                     | ING               | The number of sub-intervals a calculation period interval duration contains                                                                           |   | O     |
| ClcRfTyp                                                                                                                                                                                       | ENG               | Refreshment interval type                                                                                                                             |   | O     |
| ClcRfPer                                                                                                                                                                                       | ING               | In case ClcIntvTyp equals to MS, PER-CYCLE, CYCLE, DAY, WEEK, MONTH, YEAR, number of units to consider to calculate the refreshment interval duration |   | O     |
| ClcSrc                                                                                                                                                                                         | ORG               | Object reference to source logical node                                                                                                               |   | C5    |
| ClcNxTmms                                                                                                                                                                                      | ING               | Remaining time up to the end of the current calculation interval – expressed in milliseconds                                                          |   | O     |
| InSyn                                                                                                                                                                                          | ORG               | Object reference to the source of the external synchronization signal for the calculation interval                                                    |   | O     |
| <b>Data sets (see IEC 61850-7-2)</b>                                                                                                                                                           |                   |                                                                                                                                                       |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2)                                                                                                                          |                   |                                                                                                                                                       |   |       |
| <b>BufferedReportControlBlock (see IEC 61850-7-2)</b>                                                                                                                                          |                   |                                                                                                                                                       |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2)                                                                                                                          |                   |                                                                                                                                                       |   |       |
| <b>UnbufferedReportControlBlock (see IEC 61850-7-2)</b>                                                                                                                                        |                   |                                                                                                                                                       |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2)                                                                                                                          |                   |                                                                                                                                                       |   |       |
| <b>Services (see IEC 61850-7-2)</b>                                                                                                                                                            |                   |                                                                                                                                                       |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2)                                                                                                                          |                   |                                                                                                                                                       |   |       |
| Condition C1: Mod, Health and NamPlt shall be inherited by LLN0 of the root LD of a hierarchy as mandatory and by all other LN as optional.                                                    |                   |                                                                                                                                                       |   |       |
| Condition C2: CmdBlk shall be inherited as optional data object by all LNs which contain controllable data objects additionally to Mod, if there is no BlkOpn/BlkCls available (like in XCBR). |                   |                                                                                                                                                       |   |       |
| Condition C3: This data object is optional but mandatory when considering statistical calculation, especially the MMXU, MMXN LN.                                                               |                   |                                                                                                                                                       |   |       |
| Condition C4: These data objects are mandatory, except when ClcMth equals UNSPECIFIED.                                                                                                         |                   |                                                                                                                                                       |   |       |
| Condition C5: This data object is mandatory, if the considered LN is performing statistical calculation derived from another LN.                                                               |                   |                                                                                                                                                       |   |       |

All dedicated LN classes shall inherit all data objects, data objects sets, control blocks and services from this common logical node class, if applicable. The data object beh shall be inherited in any case as mandatory.

### 5.3.4 LN: Logical node zero Name: LLNO

This LN shall be used to address common issues for logical devices. For example, LLNO contains common information for the LD like health, mode and beh and NamPlt.

| LLNO class                                                            |                   |                                                                                                                                                   |   |       |
|-----------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                      | Common data class | Explanation                                                                                                                                       | T | M/O/C |
| <b>Data objects</b>                                                   |                   |                                                                                                                                                   |   |       |
| <b>Status information</b>                                             |                   |                                                                                                                                                   |   |       |
| OpTmh                                                                 | INS               | Operation time                                                                                                                                    |   | O     |
| LocKey                                                                | SPS               | Local operation for complete logical device                                                                                                       |   | O     |
| Loc                                                                   | SPS               | Local control behaviour                                                                                                                           |   | O     |
| <b>Controls</b>                                                       |                   |                                                                                                                                                   |   |       |
| LocSta                                                                | SPC               | Switching authority at station level                                                                                                              |   | O     |
| Diag                                                                  | SPC               | Run diagnostics                                                                                                                                   |   | O     |
| LEDRs                                                                 | SPC               | LED reset                                                                                                                                         | T | O     |
| <b>Settings</b>                                                       |                   |                                                                                                                                                   |   |       |
| GrRef                                                                 | ORG               | Reference to a higher level logical device                                                                                                        |   | O     |
| MitLev                                                                | SPG               | Select mode of authority for local control (True – control from multiple levels is allowed, False – no other control level allowed) (see Annex B) |   | O     |
| <b>SettingGroupControlBlock [0..1] (see IEC 61850-7-2)</b>            |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |
| <b>Log [0..n](see IEC 61850-7-2)</b>                                  |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |
| <b>LogControlBlock [0..n] (see IEC 61850-7-2)</b>                     |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |
| <b>GOOSEControlBlock [0..n] (see IEC 61850-7-2)</b>                   |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |
| <b>MulticastSampledValueControlBlock [0..n] (see IEC 61850-7-2)</b>   |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |
| <b>UnicastSampledValueControlBlock [0..n] (see IEC 61850-7-2)</b>     |                   |                                                                                                                                                   |   |       |
| Inherited and specialised from logical node class (see IEC 61850-7-2) |                   |                                                                                                                                                   |   |       |

### 5.3.5 LN: Physical communication channel supervision Name: LCCH

This LN is introduced in this Part to model common issues for physical communication channels. It is instantiated for each physical channel or each pair of link level redundant physical channels.

| LCCH class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data Objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| ChLiv                     | SPS               | Physical channel status; true, if channel receives telegrams within a specified time interval.                        |   | M     |
| RedChLiv                  | SPS               | Physical channel status of redundant channel                                                                          |   | C     |
| OutOv                     | SPS               | Output communications buffer overflow                                                                                 |   | O     |
| InOv                      | SPS               | Input communications buffer overflow                                                                                  |   | O     |

| LCCH class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                                                                                                                                                        |   |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Common data class | Explanation                                                                                                                                            | T | M/O/C |
| Fer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | INS               | Frame error rate on this channel; count of erroneous (or missed, in case of redundancy) messages for each 1 000 messages forwarded to the application. |   | O     |
| RedFer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | INS               | Frame error rate on redundant channel; count of missed messages on this channel for each 1 000 messages forwarded to the application.                  |   | O     |
| <b>Measured and metered values</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |                                                                                                                                                        |   |       |
| RxCnt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | BCR               | Number of received messages                                                                                                                            |   | O     |
| RedRxCnt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | BCR               | Number of received messages on redundant channel                                                                                                       |   | O     |
| TxCnt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | BCR               | Number of sent messages                                                                                                                                |   | O     |
| <b>Settings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                                                                                                                                                        |   |       |
| ApNam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | VSG               | Access point name to which this channel belongs; only needed, if more than one access point and more than one physical channel exist.                  |   | O     |
| ChLivTms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ING               | Timeout time for channel live supervision; default 5 s                                                                                                 |   | O     |
| <p>NOTE If channel redundancy with duplicate remove is used, the number of lost messages can be calculated as 'messages forwarded to application as result of both channels – messages received on this channel'. In this case, the FER is calculated by counting the received messages per channel, until 1 000 messages are forwarded to the application, and then using above formula per channel.</p> <p>Observe that in PRP any message received for a wrong channel is also forwarded to the application. Thus a wrong connection of cables to ports can be detected, if Fer and RedFer have a value around 500 (1 000 messages with wrong channel identification forwarded to application, 500 messages with wrong channel identification received on each channel).</p> <p>Condition C: is mandatory, if channel redundancy is used.</p> |                   |                                                                                                                                                        |   |       |

### 5.3.6 LN: GOOSE subscription Name: LGOS

The LN LGOS shall be used monitoring of GOOSE messages. There shall be one instance of LGOS per GOOSE subscription for a given GOOSE source. It allows for instance to diagnose the subscription state of a GOOSE message.

| LGOS class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| NdsCom                    | SPS               | Subscription needs commissioning                                                                                      |   | O     |
| St                        | SPS               | Status of the subscription (True = active, False=not active)                                                          |   | M     |
| SimSt                     | SPS               | Status showing that really Sim messages are received and accepted                                                     |   | O     |
| LastStNum                 | INS               | Last state number received                                                                                            |   | O     |
| ConfRevNum                | INS               | Expected configuration revision number                                                                                |   | O     |
| <b>Settings</b>           |                   |                                                                                                                       |   |       |
| GoCRef                    | ORG               | Reference to the subscribed GOOSE control block                                                                       |   | O     |

### 5.3.7 LN: Sampled value subscription Name: LSVS

The LN LSVS shall be used for diagnose and monitoring supervision of sampled value messages. There shall be one instance of LSVS per SV subscription for a given server. It allows for instance to diagnose the subscription of a SV message (status of subscription).

| LSVS class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| NdsCom                    | SPS               | Subscription needs commissioning                                                                                      |   | O     |
| St                        | SPS               | Status of the subscription (True = active, False = not active)                                                        |   | O     |
| SimSt                     | SPS               | Status showing that really Sim messages are received and accepted                                                     |   | O     |
| LastStNum                 | INS               | Last state number received                                                                                            |   | O     |
| ConfRevNum                | INS               | Expected configuration revision number                                                                                |   | O     |
| <b>Settings</b>           |                   |                                                                                                                       |   |       |
| SvCRef                    | ORG               | Reference to the subscribed SV control block                                                                          |   | O     |

### 5.3.8 LN: Time management Name: LTIM

The LN LTIM shall be use for diverse configurations regarding the local time of an IED.

| LTIM class                |                   |                                                                                                                                                  |   |       |
|---------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                                                      | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.                            |   |       |
| <b>Data objects</b>       |                   |                                                                                                                                                  |   |       |
| <b>Status information</b> |                   |                                                                                                                                                  |   |       |
| TmDT                      | SPS               | Indicating if for this location daylight saving time is in effect now                                                                            |   | M     |
| <b>Settings</b>           |                   |                                                                                                                                                  |   |       |
| TmOfsTmm                  | ING               | Offset of local time from UTC in minutes                                                                                                         |   | M     |
| TmUseDT                   | SPG               | Flag indicating if this location is using daylight saving time                                                                                   |   | M     |
| TmChgDayTm                | TSG               | Local time of next change to daylight saving time                                                                                                |   | O     |
| TmChgStdTm                | TSG               | Local time of next change to standard time                                                                                                       |   | O     |
| StrWeekDay                | ENG               | Day of the start of the local week for statistical calculation (Monday (default)   Tuesday   Wednesday   Thursday   Friday   Saturday   Sunday ) |   | O     |

### 5.3.9 LN: Time master supervision Name: LTMS

The LN LTMS shall be used for the configuration and supervision of the time synchronization function in an IED.

| LTMS class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| TmAcc                     | INS               | Number of significant bits in the Fraction Of Second in the time accuracy Part of the time stamp. See IEC 61850-7-2.  |   | O     |
| TmSrc                     | VSS               | Current time source                                                                                                   |   | M     |
| TmSyn                     | ENS               | Time synchronized according to IEC 61850-9-2                                                                          |   | O     |
| TmChSt1                   | SPS               | Time channel status (up/down)                                                                                         |   | O     |

| LTMS class       |                   |                                                                                                 |   |       |
|------------------|-------------------|-------------------------------------------------------------------------------------------------|---|-------|
| Data object name | Common data class | Explanation                                                                                     | T | M/O/C |
| <b>Settings</b>  |                   |                                                                                                 |   |       |
| TmSrcSet1        | VSG               | Time source setting ("1588" in case the time source is a IEEE 1588 source or dotted IP-address) |   | O     |

### 5.3.10 LN: Service tracking Name: LTRK

The LN LTRK allows to track service parameters. With this tracking, service parameters will stay visible after the execution of service. For this purpose, common data classes are needed which contain the parameters of the services according to IEC 61850-7-2.

| LTRK class                                                                                |                   |                                                                                                                       |   |       |
|-------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                                                                                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                                                       |                   |                                                                                                                       |   |       |
| <b>Control and access service tracking</b>                                                |                   |                                                                                                                       |   |       |
| SpcTrk                                                                                    | CTS               | Control service tracking for controllable single point                                                                |   | O     |
| DpcTrk                                                                                    | CTS               | Control service tracking for controllable double point                                                                |   | O     |
| IncTrk                                                                                    | CTS               | Control service tracking for controllable Integer                                                                     |   | O     |
| EncTrk1                                                                                   | CTS               | Control service tracking for enumerated controllable                                                                  |   | O     |
| ApcFTrk                                                                                   | CTS               | Control service tracking for controllable analogue set point with float command                                       |   | O     |
| ApcIntTrk                                                                                 | CTS               | Control service tracking for controllable analogue set point with Integer command                                     |   | O     |
| BscTrk                                                                                    | CTS               | Control service tracking for binary controlled step position information                                              |   | O     |
| IscTrk                                                                                    | CTS               | Control service tracking for integer controlled step position information                                             |   | O     |
| BacTrk                                                                                    | CTS               | Control service tracking for binary controlled analogue process value                                                 |   | O     |
| GenTrk                                                                                    | CST               | Common service tracking for all services for which no specific tracking data exists                                   |   | O     |
| UrcbTrk                                                                                   | UTS               | Access service tracking for unbuffered report control block                                                           |   | O     |
| BrcbTrk                                                                                   | BTS               | Access service tracking for buffered report control block                                                             |   | O     |
| LocbTrk                                                                                   | LTS               | Access service tracking for log control block                                                                         |   | O     |
| GocbTrk                                                                                   | GTS               | Access service tracking for goose control block                                                                       |   | O     |
| MsvcbTrk                                                                                  | MTS               | Access service tracking for multicast sampled values control block                                                    |   | O     |
| UsvcbTrk                                                                                  | NTS               | Access service tracking for unicast sampled values control block                                                      |   | O     |
| SgcbTrk                                                                                   | STS               | Access service tracking for setting group control block                                                               |   | O     |
| NOTE The common data classes for the data objects in LTRK are specified in IEC 61850-7-2. |                   |                                                                                                                       |   |       |

## 5.4 Logical nodes for automatic control LN Group: A

### 5.4.1 Modelling remarks

**Table 3 – Relation between IEC 61850-5 and IEC 61850-7-4 for automatic control LNs**

| Functionality                         | Defined in IEC 61850-5 by LN | Modelled in IEC 61850-7-4 by LN | Comments                                                                                                                                                                               |
|---------------------------------------|------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zero voltage tripping                 | AZVT                         | PTUV                            | The start value has to discriminate between live and dead. The delay time has to be reasonably long to discriminate between a transient voltage zero or a permanent switched off line. |
| Automatic neutral (starpoint) control | ANCR                         | ANCR<br>ARIS                    | Automatic control of suppression (Petersen) coil<br>Automatic wattmetric increase with thermal supervision                                                                             |

#### 5.4.2 LN: Neutral current regulator Name: ANCR

For a description of this LN, see IEC 61850-5. This LN shall be used for regulation of suppression coils (ASC / Petersen coil) as tap coils and plunger core coils.

| ANCR class                         |                   |                                                                                                                                                              |   |       |
|------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                                                                  | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.                                        |   |       |
| <b>Data objects</b>                |                   |                                                                                                                                                              |   |       |
| <b>Status information</b>          |                   |                                                                                                                                                              |   |       |
| LocKey                             | SPS               | Local or remote key                                                                                                                                          |   | O     |
| Loc                                | SPS               | Local control behaviour                                                                                                                                      |   | M     |
| HiCoIPos                           | INS               | High coil position                                                                                                                                           |   | O     |
| LoCoIPos                           | INS               | Low coil position                                                                                                                                            |   | O     |
| CoIPoR                             | SPS               | Change coil position rise                                                                                                                                    |   | O     |
| CoIPoL                             | SPS               | Change coil position lower                                                                                                                                   |   | O     |
| CoIChgOp                           | SPS               | Change coil position in operation                                                                                                                            |   | O     |
| StFixCoI                           | SPS               | Status of external fixcoil (True – fixcoil is connected, False – not connected)                                                                              |   | O     |
| StClcTun                           | ENS               | Result of tuning: not tuned , tuned, tuned but not compensated, Umax,Umax_nC(Umax- but not compensated), Umax_not compensated due to U continuous limitation |   | O     |
| PotAlm                             | SPS               | Potentiometer alarm                                                                                                                                          |   | O     |
| MotAlm                             | SPS               | Motor drive alarm due to no movement                                                                                                                         |   | O     |
| MotWrn                             | SPS               | Motor for Petersen coil operating time exceeded                                                                                                              |   | O     |
| ClcSeqWrn                          | SPS               | Number of calculation sequence exceeded in automatic/manual mode                                                                                             |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                                                              |   |       |
| CoIPosA                            | MV                | Coil position (usually as current in Ampere)                                                                                                                 |   | O     |
| AResoPt                            | MV                | Current at the resonance-point                                                                                                                               |   | O     |
| AWatt                              | MV                | Wattmetric Part of the residual current at the fault location                                                                                                |   | O     |
| ADetun                             | MV                | Detuning due to the actual coil position                                                                                                                     |   | O     |
| Damp                               | MV                | Damping of the network                                                                                                                                       |   | O     |
| CapacImb                           | MV                | Capacitive imbalance of the network                                                                                                                          |   | O     |
| VolResoPt                          | CMV               | Value of the voltage at the resonance point                                                                                                                  |   | O     |
| NeutVol                            | CMV               | Neutral to ground voltage                                                                                                                                    |   | O     |
| <b>Controls</b>                    |                   |                                                                                                                                                              |   |       |
| OpCntRs                            | INC               | Resettable operation counter                                                                                                                                 |   | O     |

| ANCR class                                                                                                                            |                   |                                                                                                                                                                                                         |   |       |
|---------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                      | Common data class | Explanation                                                                                                                                                                                             | T | M/O/C |
| LocSta                                                                                                                                | SPC               | Switching authority at station level                                                                                                                                                                    |   | O     |
| TapChg                                                                                                                                | BSC               | Change tap position (stop, higher, lower)                                                                                                                                                               |   | C1    |
| ColTapPos                                                                                                                             | ISC               | Move coil to specified discrete coil position                                                                                                                                                           |   | C1    |
| ColPos                                                                                                                                | APC               | Move coil to specified continuous coil position                                                                                                                                                         |   | C1    |
| RCol                                                                                                                                  | SPC               | Raise plunger coil position                                                                                                                                                                             |   | M     |
| LCol                                                                                                                                  | SPC               | Lower plunger coil position                                                                                                                                                                             |   | M     |
| Auto                                                                                                                                  | SPC               | Automatic / manual operation                                                                                                                                                                            |   | M     |
| StrClc                                                                                                                                | SPC               | Start calculation sequence                                                                                                                                                                              |   | O     |
| ParOp                                                                                                                                 | SPC               | Parallel/Independent operation (True – parallel, False – independent)                                                                                                                                   |   | O     |
| FixCol                                                                                                                                | APC               | Size of external fix coil                                                                                                                                                                               |   | O     |
| <b>Settings</b>                                                                                                                       |                   |                                                                                                                                                                                                         |   |       |
| ParColMod                                                                                                                             | ENG               | Mode of parallel operation of Petersen coil (Master/ Slave   Master/ Slave with fixed slave coil position   Master/ Slave with variable slave coil position   Parallel operation without communication) |   | M     |
| ParMod                                                                                                                                | ENG               | Set current regulator mode during control (master, slave, independent)                                                                                                                                  |   | O     |
| ADetunSpt                                                                                                                             | ASG               | Setpoint for the detuning of the suppression coil                                                                                                                                                       |   | O     |
| BndWid                                                                                                                                | ASG               | Band width voltage as voltage or percent of nominal voltage                                                                                                                                             |   | O     |
| Condition C1: at least one of the described attributes shall be used (either TapChg or ColTapPos) for controlling YEFN as a tap coil. |                   |                                                                                                                                                                                                         |   |       |

#### 5.4.3 LN: Reactive power control Name: ARCO

For a description of this LN, see IEC 61850-5. This LN shall be used for a reactive controller independent of the control method being used.

| ARCO class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | M     |
| VOvSt                     | SPS               | Voltage override status                                                                                               |   | O     |
| NeutAlm                   | SPS               | Neutral alarm is present                                                                                              |   | O     |
| DschBlk                   | SPS               | Bank switch close blocked due to discharge                                                                            | T | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| OpCntRs                   | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |
| TapChg                    | BSC               | Change reactive power (stop, higher, lower)                                                                           |   | M     |
| Auto                      | SPC               | Automatic operation                                                                                                   |   | O     |

#### 5.4.4 LN: Resistor control Name: ARIS

For a description of this LN, see IEC 61850-5. This LN should be used for the automatic wattmetric increase with thermal supervision.

| ARIS class                        |                   |                                                                                                                       |   |       |
|-----------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                  | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                            |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>               |                   |                                                                                                                       |   |       |
| <b>Status information</b>         |                   |                                                                                                                       |   |       |
| LocKey                            | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                               | SPS               | Local control behaviour                                                                                               |   | M     |
| ZBlk                              | SPS               | Blocked                                                                                                               |   | O     |
| TmpAlm                            | SPS               | Thermal alarm                                                                                                         |   | O     |
| <b>Controls</b>                   |                   |                                                                                                                       |   |       |
| OpCntRs                           | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                            | SPC               | Switching authority at station level                                                                                  |   | O     |
| Auto                              | SPC               | Parallel/Independent operation                                                                                        |   | O     |
| StrSeq                            | SPC               | Start sequence                                                                                                        |   | M     |
| <b>Measured an metered values</b> |                   |                                                                                                                       |   |       |
| NeutVol                           | CMV               | Neutral to ground voltage                                                                                             |   | O     |
| RisTmp                            | MV                | Resistance temperature for wattmetric increase                                                                        |   | O     |
| RisTmpClc                         | MV                | Resistance temperature calculated                                                                                     |   | O     |

#### 5.4.5 LN: Automatic tap changer controller Name: ATCC

For a description of this LN, see IEC 61850-5.

| ATCC class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| HiTapPos                  | INS               | High tap position                                                                                                     |   | O     |
| LoTapPos                  | INS               | Low tap position                                                                                                      |   | O     |
| TapOpR                    | SPS               | Change tap position raise                                                                                             | T | O     |
| TapOpL                    | SPS               | Change tap position lower                                                                                             | T | O     |
| TapOpStop                 | SPS               | Change tap position stop                                                                                              | T | O     |
| TapOpErr                  | SPS               | Tap change error or tap indication error (e.g. wrong BCD code)                                                        |   | O     |
| LTCBikVLo                 | SPS               | LTC inhibit due to under voltage                                                                                      |   | O     |
| LTCBikVHi                 | SPS               | LTC inhibit due to over voltage                                                                                       |   | O     |
| LTCBikAHi                 | SPS               | LTC inhibit due to over current                                                                                       |   | O     |
| EndPosR                   | SPS               | End position raise or highest allowed tap position reached                                                            |   | O     |
| EndPosL                   | SPS               | End position lower or lowest allowed tap position reached                                                             |   | O     |
| ErrPar                    | SPS               | Error of parallel operation                                                                                           |   | O     |

| ATCC class                                                                                                                                                                                                           |                   |                                                                             |   |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                                                                                                     | Common data class | Explanation                                                                 | T | M/O/C |
| <b>Measured and metered values</b>                                                                                                                                                                                   |                   |                                                                             |   |       |
| CtIV                                                                                                                                                                                                                 | MV                | Control voltage                                                             |   | M     |
| LodA                                                                                                                                                                                                                 | MV                | Load current (total transformer secondary current)                          |   | O     |
| CircA                                                                                                                                                                                                                | MV                | Circulating current                                                         |   | O     |
| PhAng                                                                                                                                                                                                                | MV                | Phase angle of LodA relative to CtIV at 1.0 power factor, FPF               |   | O     |
| HiCtIV                                                                                                                                                                                                               | MV                | Highest control voltage                                                     |   | O     |
| LoCtIV                                                                                                                                                                                                               | MV                | Lowest control voltage                                                      |   | O     |
| HiDmdA                                                                                                                                                                                                               | MV                | High current demand (load current demand)                                   |   | O     |
| <b>Controls</b>                                                                                                                                                                                                      |                   |                                                                             |   |       |
| OpCntRs                                                                                                                                                                                                              | INC               | Resettable operation counter                                                |   | O     |
| LocSta                                                                                                                                                                                                               | SPC               | Switching authority at station level                                        |   | O     |
| TapChg                                                                                                                                                                                                               | BSC               | Change tap position (stop, higher, lower)                                   |   | C1    |
| TapPos                                                                                                                                                                                                               | ISC               | Set tap position                                                            |   | C1    |
| BndCtrChg                                                                                                                                                                                                            | BAC               | Band centre change (raise, lower), no status                                |   | O     |
| ParOp                                                                                                                                                                                                                | SPC               | Parallel/Independent operation                                              |   | M     |
| LTCBlk                                                                                                                                                                                                               | SPC               | Block (Inhibit) automatic control                                           |   | O     |
| LTCDragRs                                                                                                                                                                                                            | SPC               | Reset LTC drag hands                                                        | T | O     |
| Auto                                                                                                                                                                                                                 | SPC               | Automatic/Manual operation                                                  |   | O     |
| VRed1                                                                                                                                                                                                                | SPC               | Voltage reduction step 1                                                    |   | O     |
| <b>Settings</b>                                                                                                                                                                                                      |                   |                                                                             |   |       |
| BndCtr                                                                                                                                                                                                               | ASG               | Band center voltage (FPF presumed)                                          |   | O     |
| BndWid                                                                                                                                                                                                               | ASG               | Band width voltage (as voltage or percent of nominal voltage, FPF presumed) |   | O     |
| CtIDITmms                                                                                                                                                                                                            | ING               | Control intentional time delay (FPF presumed)                               |   | O     |
| LDCR                                                                                                                                                                                                                 | ASG               | Line drop voltage due to line resistance component                          |   | O     |
| LDCX                                                                                                                                                                                                                 | ASG               | Line drop voltage due to line reactance component                           |   | O     |
| BlkLV                                                                                                                                                                                                                | ASG               | Control voltage below which auto lower commands blocked                     |   | O     |
| BlkRV                                                                                                                                                                                                                | ASG               | Control voltage above which auto raise commands blocked                     |   | O     |
| BlkVLo                                                                                                                                                                                                               | ASG               | Control voltage below which auto raise commands are blocked                 |   | O     |
| BlkVHi                                                                                                                                                                                                               | ASG               | Control voltage above which auto lower commands are blocked                 |   | O     |
| RnbkRV                                                                                                                                                                                                               | ASG               | Runback raise voltage                                                       |   | O     |
| LimLodA                                                                                                                                                                                                              | ASG               | Limit load current (LTC block load current)                                 |   | O     |
| LDC                                                                                                                                                                                                                  | SPG               | Line drop compensation is R&X or Z model                                    |   | O     |
| ParTraMod                                                                                                                                                                                                            | ENG               | Parallel transformer mode                                                   |   | O     |
| TmDlChr                                                                                                                                                                                                              | SPG               | Time delay linear or inverse characteristic                                 |   | O     |
| LDCZ                                                                                                                                                                                                                 | ASG               | Line impedance for line drop compensation                                   |   | O     |
| VRedVal                                                                                                                                                                                                              | ASG               | Reduction of band centre (percent) when voltage reduction step is active    |   | O     |
| TapBlkR                                                                                                                                                                                                              | ING               | Tap position of load tap changer where automatic raise commands are blocked |   | O     |
| TapBlkL                                                                                                                                                                                                              | ING               | Tap position of load tap changer where automatic lower commands are blocked |   | O     |
| Condition C1: depending on the tap-change method, at least one of the two controls, TapChg or TapPos shall be used for manual operation. BndCtrChg may be optionally used to change the value of BndCtr by commands. |                   |                                                                             |   |       |

#### 5.4.6 LN: Voltage control Name: AVCO

For a description of this LN, see IEC 61850-5. This LN shall be used for a voltage controller independent of the control method being used.

| AVCO class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | M     |
| BIKEF                     | SPS               | Blocked by earth fault                                                                                                |   | O     |
| BlkAOv                    | SPS               | Blocked by current limit overflow                                                                                     |   | O     |
| BlkVOv                    | SPS               | Blocked by voltage limit overflow                                                                                     |   | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| OpCntRs                   | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |
| TapChg                    | BSC               | Change voltage (stop, higher, lower)                                                                                  |   | M     |
| SptVol                    | APC               | Voltage setpoint                                                                                                      |   | O     |
| Auto                      | SPC               | Automatic operation                                                                                                   |   | O     |
| <b>Settings</b>           |                   |                                                                                                                       |   |       |
| LimAOv                    | ASG               | Current limit for overflow blocking                                                                                   |   | O     |
| LimVOv                    | ASG               | Voltage limit for overflow blocking                                                                                   |   | O     |

#### 5.5 Logical nodes for control LN Group: C

##### 5.5.1 Modelling remarks

Table 4 – Relation between IEC 61850-5 and IEC 61850-7-4 for control LNs

| Functionality                 | Defined in IEC 61850-5 by LN | Modelled in IEC 61850-7-4 by LN | Comments                                            |
|-------------------------------|------------------------------|---------------------------------|-----------------------------------------------------|
| Transformer including cooling | YPTR                         | CCGR                            | Dedicated cooling group control split off from YPTR |

##### 5.5.2 LN: Alarm handling Name: CALH

For a description of this LN, see IEC 61850-5. CALH allows the creation of group warnings, group indications and group alarms. The individual alarms, which are used to calculate the group indications/alarms/warnings, are subscribed from elsewhere. The calculation is a local issue, usually performed by a logic scheme.

| CALH class                                               |                   |                                                                                                                       |   |       |
|----------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                         | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                                                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                      |                   |                                                                                                                       |   |       |
| <b>Status information</b>                                |                   |                                                                                                                       |   |       |
| GrAlm                                                    | SPS               | Group alarm                                                                                                           |   | C     |
| GrWrn                                                    | SPS               | Group warning                                                                                                         |   | C     |
| GrInd                                                    | SPS               | Group indication                                                                                                      |   | C     |
| AlmLstOv                                                 | SPS               | Alarm list overflow                                                                                                   |   | O     |
| Condition C: At least one data object shall be modelled. |                   |                                                                                                                       |   |       |

### 5.5.3 LN: Cooling group control Name: CCGR

This LN class shall be used to control the cooling equipment. One instance per cooling group shall be used.

| CCGR class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Status information</b>          |                   |                                                                                                                       |   |       |
| OpTmh                              | INS               | Operation time                                                                                                        |   | O     |
| FanOvCur                           | SPS               | Fan overcurrent trip                                                                                                  |   | O     |
| PmpOvCur                           | SPS               | Pump overcurrent trip                                                                                                 |   | O     |
| PmpAlm                             | SPS               | Loss of pump                                                                                                          |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| EnvTmp                             | MV                | Temperature of environment                                                                                            |   | O     |
| OilTmpIn                           | MV                | Oil temperature cooler in                                                                                             |   | O     |
| OilTmpOut                          | MV                | Oil temperature cooler out                                                                                            |   | O     |
| OilMotA                            | MV                | Oil circulation motor drive current                                                                                   |   | O     |
| FanFlw                             | MV                | Air flow in fan                                                                                                       |   | O     |
| CETmpIn                            | MV                | Temperature of secondary cooling medium in                                                                            |   | O     |
| CETmpOut                           | MV                | Temperature of secondary cooling medium out                                                                           |   | O     |
| CEPres                             | MV                | Pressure of secondary cooling medium                                                                                  |   | O     |
| CEFlw                              | MV                | Flow of secondary cooling medium                                                                                      |   | O     |
| FanA                               | MV                | Motor drive current fan                                                                                               |   | O     |
| <b>Controls</b>                    |                   |                                                                                                                       |   |       |
| CEBIk                              | SPC               | Control of automatic / manual operation (blocking)                                                                    |   | O     |
| CECtl                              | SPC               | Control of complete cooling group (pumps and fans)                                                                    |   | O     |
| PmpCtlGen                          | ENC               | Control of all pumps                                                                                                  |   | O     |
| PmpCtl                             | ENC               | Control of a single pump                                                                                              |   | O     |
| FanCtlGen                          | ENC               | Control of all fans                                                                                                   |   | O     |
| FanCtl                             | ENC               | Control of a single fan                                                                                               |   | O     |
| Auto                               | SPC               | Automatic or manual                                                                                                   |   | O     |
| <b>Settings</b>                    |                   |                                                                                                                       |   |       |
| OilTmpSet                          | ASG               | Set point for oil temperature                                                                                         |   | O     |

#### 5.5.4 LN: Interlocking Name: CILO

For a description of this LN, see IEC 61850-5. This LN shall be used to “enable” a switching operation if the interlocking conditions are fulfilled. One instance per switching device is needed. At least all related switchgear positions have to be subscribed. The interlocking algorithm is a local issue.

| CILO class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| EnaOpn                    | SPS               | Enable Open                                                                                                           |   | M     |
| EnaCls                    | SPS               | Enable Close                                                                                                          |   | M     |

#### 5.5.5 LN: Point-on-wave switching Name: CPOW

For a description of this LN, see IEC 61850-5. This LN shall be used if the circuit breaker is able to perform point-on-wave switching. In this case, the start signal for CPOW is OpOpn or OpCls to be subscribed from CSWI. Then CPOW shall perform its entire dedicated algorithm using data objects from the allocated TCTR or local and remote TVTR (local issue) and shall then release a “Time Activated Control” (see IEC 61850-7-2) to XCBR. OpOpn and OpCls shall be used if no “Time Activated Control” services is available between CPOW and XCBR. Alternatively, CPOW may be started by a control service acting on data object Pos.

| CPOW class                |                   |                                                                                                                      |   |       |
|---------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                          | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22 |   |       |
| <b>Data objects</b>       |                   |                                                                                                                      |   |       |
| <b>Status information</b> |                   |                                                                                                                      |   |       |
| TmExc                     | SPS               | Maximum allowed time exceeded                                                                                        |   | M     |
| StrPOW                    | SPS               | CPOW started                                                                                                         |   | O     |
| OpOpn                     | ACT               | Open switch                                                                                                          | T | O     |
| OpCls                     | ACT               | Close switch                                                                                                         | T | O     |
| <b>Controls</b>           |                   |                                                                                                                      |   |       |
| Pos                       | DPC               | Switch, general                                                                                                      |   | O     |
| PosA                      | DPC               | Switch L1                                                                                                            |   | O     |
| PosB                      | DPC               | Switch L2                                                                                                            |   | O     |
| PosC                      | DPC               | Switch L3                                                                                                            |   | O     |
| <b>Settings</b>           |                   |                                                                                                                      |   |       |
| MaxDITmms                 | ING               | Maximum allowed delay time                                                                                           |   | O     |

#### 5.5.6 LN: Switch controller Name: CSWI

For a description of this LN, see IEC 61850-5. This LN class shall be used to control all switching conditions above process level. CSWI shall subscribe the data object POWCap (“point-on-wave switching capability”) from XCBR if applicable. If a switching command (for example Select-before-Operate) arrives and point-on-wave switching capability” is supported by the breaker, the command

shall be passed to CPOW. OpOpn and OpCls shall be used if no Control Service is available between CSWI and XCBR (see GSE in IEC 61850-7-2).

| CSWI class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| OpOpn                     | ACT               | Operation "Open switch"                                                                                               | T | O     |
| SelOpn                    | SPS               | Selection "Open switch"                                                                                               |   | O     |
| OpCls                     | ACT               | Operation "Close switch"                                                                                              | T | O     |
| SelCls                    | SPS               | Selection "Close switch"                                                                                              |   | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| OpCntRs                   | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |
| Pos                       | DPC               | Switch, general                                                                                                       |   | M     |
| PosA                      | DPC               | Switch L1                                                                                                             |   | O     |
| PosB                      | DPC               | Switch L2                                                                                                             |   | O     |
| PosC                      | DPC               | Switch L3                                                                                                             |   | O     |

### 5.5.7 LN: Synchronizer controller Name: CSYN

For a description of this LN, see IEC 61850-5. This LN class shall be used to control the synchronizing conditions i.e. voltage, frequency and phase.

| CSYN class                         |                   |                                                                                                                      |   |       |
|------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                          | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22 |   |       |
| <b>Data objects</b>                |                   |                                                                                                                      |   |       |
| <b>Status information</b>          |                   |                                                                                                                      |   |       |
| LocKey                             | SPS               | Local or remote key                                                                                                  |   | O     |
| Loc                                | SPS               | Local control behaviour                                                                                              |   | O     |
| Cmd                                | SPS               | Breaker closing command                                                                                              |   | C     |
| Rel                                | SPS               | Breaker closing command released                                                                                     |   | C     |
| RV                                 | SPS               | Raise voltage                                                                                                        |   | O     |
| LV                                 | SPS               | Lower voltage                                                                                                        |   | O     |
| RHz                                | SPS               | Raise frequency (increase speed)                                                                                     |   | O     |
| LHz                                | SPS               | Lower frequency (lower speed)                                                                                        |   | O     |
| VInd                               | SPS               | Voltage difference indicator                                                                                         |   | O     |
| AngInd                             | SPS               | Angle difference indicator                                                                                           |   | O     |
| HzInd                              | SPS               | Frequency difference indicator                                                                                       |   | O     |
| RotDir                             | ENS               | Rotational direction (Clockwise   Counter-clockwise   Unknown)                                                       |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                      |   |       |
| DifVCIC                            | MV                | Calculated difference in voltage (amplitude value)                                                                   |   | O     |
| DifHzCIC                           | MV                | Calculated difference in frequency                                                                                   |   | O     |

| CSYN class       |                   |                                                                                              |   |       |
|------------------|-------------------|----------------------------------------------------------------------------------------------|---|-------|
| Data object name | Common data class | Explanation                                                                                  | T | M/O/C |
| DifAngClc        | MV                | Calculated difference of phase angle                                                         |   | O     |
| V1Clc            | MV                | Amplitude value $U_1$                                                                        |   | O     |
| V2Clc            | MV                | Amplitude value $U_2$                                                                        |   | O     |
| Hz1Clc           | MV                | Frequency $f_1$                                                                              |   | O     |
| Hz2Clc           | MV                | Frequency $f_2$                                                                              |   | O     |
| AccClc           | MV                | Acceleration                                                                                 |   | O     |
| AccClcDev        | MV                | Acceleration deviation                                                                       |   | O     |
| <b>Controls</b>  |                   |                                                                                              |   |       |
| OpCntRs          | INC               | Resettable operation counter                                                                 |   | O     |
| LocSta           | SPC               | Switching authority at station level                                                         |   | O     |
| SynPrg           | SPC               | Start and stop synchronising progress                                                        |   | O     |
| RelDeaBus        | SPC               | Releasing dead bus / dead line function                                                      |   | O     |
| OpModSyn         | ENC               | Operating mode selection (Automatic-synchronizing   Automatic-parallelizing   Manual   Test) |   | O     |
| <b>Settings</b>  |                   |                                                                                              |   |       |
| VNom             | ASG               | Nominal secondary voltage                                                                    |   | O     |
| HzNom            | ASG               | Nominal frequency                                                                            |   | O     |
| VAdpFact         | ASG               | Adaptation factor $U_1 / U_2$                                                                |   | O     |
| AdpAngDeg        | ASG               | Adaptation angle (e.g. setting group compensation)                                           |   | O     |
| DI Tmms          | ING               | Supervision time for paralleling (delay time)                                                |   | O     |
| MltCmd           | SPG               | Multiple command generation                                                                  |   | O     |
| DifVNg           | ASG               | Difference voltage (amplitude value) negative                                                |   | O     |
| DifVPs           | ASG               | Difference voltage (amplitude value) positive                                                |   | O     |
| DifHzNg          | ASG               | Difference frequency negative                                                                |   | O     |
| DifHzPs          | ASG               | Difference frequency positive                                                                |   | O     |
| DifAngNg         | ASG               | Difference phase angle negative                                                              |   | O     |
| DifAngPs         | ASG               | Difference phase angle positive                                                              |   | O     |
| MinVSyn          | ASG               | Minimum voltage for live synchronisation                                                     |   | O     |
| MaxVSyn          | ASG               | Maximum voltage for live synchronisation                                                     |   | O     |
| DetSyn           | ASG               | Detection of synchronism ( $\Delta f$ )                                                      |   | O     |
| LivDeaMod        | ENG               | Live dead mode                                                                               |   | O     |
| DeaLinVal        | ASG               | Dead line value                                                                              |   | O     |
| LivLinVal        | ASG               | Live line value                                                                              |   | O     |
| DeaBusVal        | ASG               | Dead bus value                                                                               |   | O     |
| LivBusVal        | ASG               | Live bus value                                                                               |   | O     |
| VAdj             | SPG               | Voltage matcher ON / OFF                                                                     |   | O     |
| VChr             | ASG               | Voltage adjustment characteristic                                                            |   | O     |
| VInvTmms         | ING               | Voltage adjustment pulse interval                                                            |   | O     |
| MinVTmms         | ING               | Minimum voltage adjustment pulse time                                                        |   | O     |
| MaxVTmms         | ING               | Maximum voltage adjustment pulse time                                                        |   | O     |
| HzAdj            | SPG               | Frequency matcher ON / OFF                                                                   |   | O     |
| HzChr            | ASG               | Frequency adjustment characteristic                                                          |   | O     |
| HzIntvTmms       | ING               | Frequency adjustment pulse interval                                                          |   | O     |

| CSYN class                                                              |                   |                                                     |   |       |
|-------------------------------------------------------------------------|-------------------|-----------------------------------------------------|---|-------|
| Data object name                                                        | Common data class | Explanation                                         | T | M/O/C |
| MinHzTmms                                                               | ING               | Minimum frequency adjustment pulse time             |   | O     |
| MaxHzTmms                                                               | ING               | Maximum frequency adjustment pulse time             |   | O     |
| HzTgtVal                                                                | ASG               | Frequency matcher target value                      |   | O     |
| KckPIs                                                                  | SPG               | Kicker pulse ON / OFF                               |   | O     |
| DISynTmms                                                               | ING               | Delay of synchronization process after start signal |   | O     |
| TotTmms                                                                 | ING               | Total time of synchronising process                 |   | O     |
| Condition C: at least one of the data objects (Cmd, Rel) shall be used. |                   |                                                     |   |       |

## 5.6 Logical nodes for functional blocks LN group F

### 5.6.1 Modelling remarks

This group of logical nodes represents various types of control function blocks. Logical node classes of this type do include some form of control algorithm. The LNs will normally be Part of a logical device providing overall functionality within the system. Therefore, no description and requirements for the logical nodes of group F are given in IEC 61850-5. The LNs of the F-group are never located at the border to the process.

The LN classes of the F-group shall be used only if another LN class from other groups does not fit to the semantic and function to be modelled.

### 5.6.2 LN: Counter Name: FCNT

Logical node FCNT shall be used to count incoming pulses not related to the electrical network.

| FCNT class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Status information</b>          |                   |                                                                                                                       |   |       |
| Up                                 | SPS               | Last count direction upward                                                                                           |   | O     |
| Dn                                 | SPS               | Last count direction downward                                                                                         |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| CntRs                              | BCR               | Counter                                                                                                               |   | M     |

### 5.6.3 LN: Curve shape description Name: FCSD

Logical node FCSD shall comprise the data object classes that represent curve shaped output values. The values can be dynamically modified online. The curves entered in the table can be based on statistics obtained following a series of index tests.

The logical node is used to adapt an incoming value to a specified curve function. For example, it can be used 2-dimensionally to adjust nonlinear transmitters to the correct physical values or, by instantiation, can be used for 3-dimensional surface mapping.

| FCSD class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                            |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| Out                                | MV                | Output                                                                                                                |   | M     |
| <b>Settings</b>                    |                   |                                                                                                                       |   |       |
| Crv                                | CSG               | Curve shape                                                                                                           |   | M     |

#### 5.6.4 LN: Generic filter Name: FFIL

Logical node FFIL shall be used to filter an incoming value. For a more detailed description of the functionality behind FFIL, see Annex A of IEC 61850-7-410.

| FFIL class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                            |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| Out                                | MV                | Output                                                                                                                |   | M     |
| ErrTerm                            | MV                | Control loop termination error value                                                                                  |   | O     |
| <b>Settings</b>                    |                   |                                                                                                                       |   |       |
| FilTyp                             | ENG               | Filter type                                                                                                           |   | M     |
| KP                                 | ASG               | Proportional gain                                                                                                     |   | O     |
| KLd                                | ASG               | K lead                                                                                                                |   | O     |
| KLg                                | ASG               | K lag                                                                                                                 |   | O     |
| Tm1ms                              | ING               | Time 1 [ms]                                                                                                           |   | O     |
| Tm1ldms                            | ING               | Time 1 (lead) [ms]                                                                                                    |   | O     |
| Tm2ms                              | ING               | Time 2 [ms]                                                                                                           |   | O     |
| Tm2ldms                            | ING               | Time 2 (lead) [ms]                                                                                                    |   | O     |
| Tm3ms                              | ING               | Time 3 [ms]                                                                                                           |   | O     |
| DeaBnd                             | ASG               | Deadband                                                                                                              |   | O     |

#### 5.6.5 LN: Control function output limitation Name: FLIM

This logical node is used to set temporary or permanent operational limits to an output signal (MV) from a control function. The FLIM logical node should not be used to replace FXOT or FXUT.

| FLIM class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Status information</b>          |                   |                                                                                                                       |   |       |
| HiLim                              | SPS               | High limit reached (input signal equal to or above limit)                                                             |   | O     |
| LoLim                              | SPS               | Low limit reached (input signal equal to or below limit)                                                              |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| Out                                | MV                | Output signal                                                                                                         |   | M     |
| <b>Settings</b>                    |                   |                                                                                                                       |   |       |
| HiLimSpt                           | ASG               | High limit setpoint                                                                                                   |   | O     |
| LoLimSpt                           | ASG               | Minimum limit setpoint                                                                                                |   | O     |

### 5.6.6 LN: PID regulator Name: FPID

Logical node FPID shall comprise the data objects classes that represent proportional, integral and derivative information for a PID controller. For a more detailed description of the functionality behind FPID, see Annex E.

| FPID class                                                                                                                                  |                   |                                                                                                                       |   |       |
|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                            | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                                                                                                                                      |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                                                                                                         |                   |                                                                                                                       |   |       |
| <b>Measured and metered values</b>                                                                                                          |                   |                                                                                                                       |   |       |
| Out                                                                                                                                         | MV                | PID output                                                                                                            |   | M     |
| PAct                                                                                                                                        | MV                | Proportional action                                                                                                   |   | C     |
| IAct                                                                                                                                        | MV                | Integral action                                                                                                       |   | C     |
| DAct                                                                                                                                        | MV                | Derivative action                                                                                                     |   | C     |
| ErrTerm                                                                                                                                     | MV                | Control loop termination error value                                                                                  |   | O     |
| <b>Settings</b>                                                                                                                             |                   |                                                                                                                       |   |       |
| PIDAlg                                                                                                                                      | ENG               | P I D PI PD ID PID                                                                                                    |   | M     |
| KP                                                                                                                                          | ASG               | Proportional gain                                                                                                     |   | C     |
| KI                                                                                                                                          | ASG               | Integral gain                                                                                                         |   | C     |
| ITmms                                                                                                                                       | ING               | Integral time (ms)                                                                                                    |   | C     |
| KD                                                                                                                                          | ASG               | Derivative gain                                                                                                       |   | C     |
| DTmms                                                                                                                                       | ING               | Derivative time (ms)                                                                                                  |   | C     |
| DFilTmms                                                                                                                                    | ING               | Derivative time filter (ms)                                                                                           |   | C     |
| Bias                                                                                                                                        | ASG               | Bias added to process variable                                                                                        |   | O     |
| ILim                                                                                                                                        | ASG               | Anti-windup integral limit                                                                                            |   | O     |
| Droop                                                                                                                                       | ASG               | Percent change in effective setpoint at maximum action                                                                |   | O     |
| Condition: The conditional data objects shown in the first column of Table 5 shall be linked with the corresponding PID algorithm selected. |                   |                                                                                                                       |   |       |

**Table 5 – Conditional attributes in FPID**

|                   | PIDAlg<br>(M-Mandatory, O-Optional, Blank-Not Used) |   |   |    |    |    |     |
|-------------------|-----------------------------------------------------|---|---|----|----|----|-----|
| Data Objects Name | P                                                   | I | D | PI | PD | ID | PID |
| PAct              | O                                                   |   |   | O  | O  |    | O   |
| IAct              |                                                     | O |   | O  |    | O  | O   |
| DAct              |                                                     |   | O |    | O  | O  | O   |
| KP                | M                                                   |   |   | M  | M  |    | M   |
| KI                |                                                     | M |   | M  |    | M  | M   |
| ITmms             |                                                     | M |   | M  |    | M  | M   |
| KD                |                                                     |   | M |    | M  | M  | M   |
| DTmms             |                                                     |   | M |    | M  | M  | M   |
| DFILTmms          |                                                     |   | M |    | M  | M  | M   |

### 5.6.7 LN: Ramp function Name: FRMP

Logical node FRMP shall be used as a generic ramp. The LN is required due to the fact that the data object attributes of the ASG common data class do not contain all of the information required to achieve a full ramping function with divergent up and down trends.

| FRMP class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                            |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Status information</b>          |                   |                                                                                                                       |   |       |
| AdjSt                              | ENS               | State of adjustment process                                                                                           |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| Out                                | MV                | Ramp output                                                                                                           |   | M     |
| ErrTerm                            | MV                | Control loop termination error value                                                                                  |   | O     |
| <b>Settings</b>                    |                   |                                                                                                                       |   |       |
| RmpUp                              | ASG               | Ramping rate on a upward trend                                                                                        |   | O     |
| RmpDn                              | ASG               | Ramping rate on a downward trend                                                                                      |   | O     |
| StepPs                             | ASG               | Step size when turning from negative to positive direction                                                            |   | O     |
| StepNg                             | ASG               | Step size when turning from positive to negative direction                                                            |   | O     |

### 5.6.8 LN: Set-point control function Name: FSPT

Logical node FSPT shall be used to provide the common characteristics found in all controller or regulator type logical nodes. The LN can be standalone or cascaded with other logical nodes to form a complete controller.

| FSPT class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| SptDvAlm                  | SPS               | Deviation alarm                                                                                                       |   | O     |

| FSPT class             |                   |                                      |   |       |
|------------------------|-------------------|--------------------------------------|---|-------|
| Data object name       | Common data class | Explanation                          | T | M/O/C |
| SptUp                  | SPS               | Setpoint going up (raising)          |   | O     |
| SptDn                  | SPS               | Setpoint going up (lowering)         |   | O     |
| SptDir                 | SPS               | Setpoint direction                   |   | O     |
| SptEndSt               | ENS               | End status of set-point control      |   | O     |
| AdjSt                  | ENS               | Adjustment status                    |   | O     |
| <b>Measured Values</b> |                   |                                      |   |       |
| SptMem                 | MV                | Setpoint in memory                   |   | M     |
| ErrTerm                | MV                | Control loop termination error value |   | O     |
| Out                    | MV                | Output                               |   | O     |
| <b>Controls</b>        |                   |                                      |   |       |
| SptChg                 | BAC               | Setpoint change (raise, lower)       |   | O     |
| SptVal                 | APC               | Setpoint                             |   | M     |
| Auto                   | SPC               | Automatic operation                  |   | O     |
| <b>Settings</b>        |                   |                                      |   |       |
| MaxRst                 | ASG               | Maximum restriction                  |   | O     |
| MinRst                 | ASG               | Minimum restriction                  |   | O     |
| DvAlm                  | ASG               | Deviation alarm                      |   | O     |

### 5.6.9 LN: Action at over threshold Name: FXOT

Logical node FXOT shall be used to set a high-level threshold value to be used in control sequences. If a second level is necessary, a second instance can be modelled. FXOT can typically be used whenever a protection, control or alarm function is based on other physical measurements than primary electrical data.

| FXOT class                                                               |                   |                                                                                                                       |   |       |
|--------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                         | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                                                                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                                      |                   |                                                                                                                       |   |       |
| <b>Status information</b>                                                |                   |                                                                                                                       |   |       |
| Op                                                                       | ACT               | Level of action reached                                                                                               | T | M     |
| <b>Settings</b>                                                          |                   |                                                                                                                       |   |       |
| StrVal                                                                   | ASG               | Start level set-point                                                                                                 |   | C     |
| OpDITmms                                                                 | ING               | Operate delay time [ms]                                                                                               |   | O     |
| StrCrv                                                                   | CSG               | Start level curve                                                                                                     |   | C     |
| RsDITmms                                                                 | ING               | Reset operate delay time [ms]                                                                                         |   | O     |
| Condition: Start level shall be given as a singular point or as a curve. |                   |                                                                                                                       |   |       |

### 5.6.10 LN: Action at under threshold Name: FXUT

Logical node FXUT shall be used to set a low-level threshold value to be used in control sequences. If a second level is necessary, a second instance can be modelled. FXUT can typically be used whenever a protection, control or alarm function is based on other physical measurements than primary electric data.

| FXUT class                                                               |                   |                                                                                                                       |   |       |
|--------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                         | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                                                                  |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                                      |                   |                                                                                                                       |   |       |
| <b>Status information</b>                                                |                   |                                                                                                                       |   |       |
| Op                                                                       | ACT               | Level of action reached                                                                                               | T | M     |
| <b>Settings</b>                                                          |                   |                                                                                                                       |   |       |
| StrVal                                                                   | ASG               | Start level set-point                                                                                                 |   | C     |
| OpDITmms                                                                 | ING               | Operate delay time [ms]                                                                                               |   | O     |
| StrCrv                                                                   | CSG               | Start level curve                                                                                                     |   | C     |
| RsDITmms                                                                 | ING               | Reset operate delay time [ms]                                                                                         |   | O     |
| Condition: Start level shall be given as a singular point or as a curve. |                   |                                                                                                                       |   |       |

## 5.7 Logical nodes for generic references LN Group: G

### 5.7.1 Modelling remarks

The logical nodes of group G shall be used only for modelling functions without a dedicated logical node with appropriate semantics. Therefore, no description and requirements for the logical nodes of group G are given in IEC 61850-5.

### 5.7.2 LN: Generic automatic process control Name: GAPC

This node shall be used only to model in a generic way the processing/automation of functions that are not predefined by one of the groups A, C, M, P, or R. If needed, all data objects listed in Clause 6 of this standard can be used single or multiple for a dedicated application of LN GAPC. Data objects with proper semantic meaning should be preferred. The extension rules according to IEC 61850-7-1, Clause 14 shall be followed.

| GAPC class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| Auto                      | SPC               | Automatic operation                                                                                                   |   | O     |
| Str1                      | ACD               | Start                                                                                                                 |   | O     |
| Op1                       | ACT               | Operate                                                                                                               | T | O     |
| Alm1                      | SPS               | Generic single alarm                                                                                                  |   | O     |
| Wrn1                      | SPS               | Generic single warning                                                                                                |   | O     |
| Ind1                      | SPS               | Generic single indication                                                                                             |   | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| OpCntRs                   | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |
| SPCSO1                    | SPC               | Single point controllable status output                                                                               |   | O     |

| GAPC class       |                   |                                           |   |       |
|------------------|-------------------|-------------------------------------------|---|-------|
| Data object name | Common data class | Explanation                               | T | M/O/C |
| DPCSO1           | DPC               | Double point controllable status output   |   | O     |
| ISCSO1           | INC               | Integer status controllable status output |   | O     |
| <b>Settings</b>  |                   |                                           |   |       |
| StrVal1          | ASG               | Start value                               |   | O     |

### 5.7.3 LN: Generic process I/O Name: GGIO

This node shall be used only to model in a generic way process devices that are not predefined by the groups S, T, X, Y, or Z. If needed, all data objects listed in Clause 6 can be used single or multiple for a dedicated application of LN GGIO. Data objects with proper semantic meaning should be preferred. The extension rules according to IEC 61850-7-1, Clause 14 shall be followed.

| GGIO class                         |                   |                                                                                                                       |   |       |
|------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                   | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>                |                   |                                                                                                                       |   |       |
| EEName                             | DPL               | External equipment name plate                                                                                         |   | O     |
| <b>Status information</b>          |                   |                                                                                                                       |   |       |
| EEHealth                           | ENS               | External equipment health                                                                                             |   | O     |
| LocKey                             | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                                | SPS               | Local control behaviour                                                                                               |   | O     |
| IntIn1                             | INS               | Integer status input                                                                                                  |   | O     |
| Alm1                               | SPS               | General single alarm                                                                                                  |   | O     |
| Wrn1                               | SPS               | General single warning                                                                                                |   | O     |
| Ind1                               | SPS               | General indication (binary input)                                                                                     |   | O     |
| <b>Measured and metered values</b> |                   |                                                                                                                       |   |       |
| AnIn1                              | MV                | Analogue input                                                                                                        |   | O     |
| AnOut1                             | APC               | Controllable analogue output                                                                                          |   | O     |
| CntRs1                             | BCR               | Counter, resettable                                                                                                   |   | O     |
| <b>Controls</b>                    |                   |                                                                                                                       |   |       |
| OpCntRs                            | INC               | Resettable operation counter                                                                                          |   | O     |
| LocSta                             | SPC               | Switching authority at station level                                                                                  |   | O     |
| SPCSO1                             | SPC               | Single point controllable status output                                                                               |   | O     |
| DPCSO1                             | DPC               | Double point controllable status output                                                                               |   | O     |
| ISCSO1                             | INC               | Integer status controllable status output                                                                             |   | O     |

### 5.7.4 LN: Generic log Name: GLOG

The LN GLOG refers to a function which allows to log not only changed data itself but also any related data being defined in the settings of LN GLOG. The logging is started by the changed data object (TrgRef1) or by the operator (LogTrg). The logged data are identified by the references to the related source data objects in the data model.

| GLOG class                                                                        |                   |                                                                                                                                  |   |       |
|-----------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                  | Common data class | Explanation                                                                                                                      | T | M/O/C |
| LNName                                                                            |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.            |   |       |
| <b>Data objects</b>                                                               |                   |                                                                                                                                  |   |       |
| <b>Logged Status information, Measured and metered values, Controls, Settings</b> |                   |                                                                                                                                  |   |       |
| Access via LOG only                                                               |                   | Included value assigned to InRef1                                                                                                |   | O     |
| <b>Controls</b>                                                                   |                   |                                                                                                                                  |   |       |
| OpCntRs                                                                           | INC               | Counts the events logged (resettable)                                                                                            |   | O     |
| LogTrg                                                                            | SPC               | Trigger logging by operator                                                                                                      |   | O     |
| <b>Settings</b>                                                                   |                   |                                                                                                                                  |   |       |
| LogRef                                                                            | ORG               | Reference to Log                                                                                                                 |   | O     |
| TrgRef1                                                                           | ORG               | Trigger reference shows the receiving trigger signal                                                                             |   | O     |
| InRef1                                                                            | ORG               | Reference to data objects / data attributes to include in LOG according to IEC 61850-7-2, when the configured trigger was active |   | O     |

### 5.7.5 LN: Generic security application Name: GSAL

This node shall be used to monitor security violations regarding authorisation, access control, service privileges and inactive associations.

| GSAL class                                                                     |                   |                                                                                                                       |   |       |
|--------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                               | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                                                                         |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                                            |                   |                                                                                                                       |   |       |
| <b>Status information</b>                                                      |                   |                                                                                                                       |   |       |
| AuthFail                                                                       | SEC               | Authorisation failures                                                                                                |   | M     |
| AccCtlFail                                                                     | SEC               | Access control failures detected                                                                                      |   | M     |
| SvcViol                                                                        | SEC               | Service privilege violations                                                                                          |   | M     |
| Ina                                                                            | SEC               | Inactive associations                                                                                                 |   | M     |
| NumCntRs                                                                       | INS               | Number of counter resets                                                                                              |   | O     |
| <b>Controls</b>                                                                |                   |                                                                                                                       |   |       |
| OpCntRs                                                                        | INC               | Resettable operation counter                                                                                          |   | M     |
| NOTE An operation in the context of this logical node is a security violation. |                   |                                                                                                                       |   |       |

## 5.8 Logical nodes for interfacing and archiving LN Group: I

### 5.8.1 Modelling remarks

The Logical Nodes of group I shall be used at the border of the IEC 61850 modelled system with the exception of the process interface (e.g. to operator by IHMI, to external communication system by ITCI) or where the modelling level is changed (proxy).

### 5.8.2 LN: Archiving Name: IARC

For a description of this LN, see IEC 61850-5.

| IARC class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| MemOv                     | SPS               | Memory overflow                                                                                                       |   | M     |
| MemUsed                   | INS               | Memory used in %                                                                                                      |   | O     |
| NumRcd                    | INS               | Actual number of records                                                                                              |   | O     |
| <b>Settings</b>           |                   |                                                                                                                       |   |       |
| InTrg1                    | ORG               | Reference to trigger                                                                                                  |   | O     |
| InLog1                    | ORG               | Reference to data objects                                                                                             |   | O     |
| MaxNumRcd                 | ING               | Maximum number of records                                                                                             |   | O     |
| RcdMod                    | ENG               | Recorder operation mode (saturation, overwrite)                                                                       |   | O     |
| MemFull                   | ING               | Memory full level                                                                                                     |   | O     |

### 5.8.3 LN: Human machine interface Name: IHMI

For a description of this LN, see IEC 61850-5.

| IHMI class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>       |                   |                                                                                                                       |   |       |
| EENaame                   | DPL               | External equipment name plate                                                                                         |   | O     |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| EEHealth                  | ENS               | External equipment health                                                                                             |   | O     |
| LocKey                    | SPS               | Local or remote key                                                                                                   |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |

### 5.8.4 LN: Safety alarm function Name: ISAF

For a description of this LN, see IEC 61850-5. Logical node ISAF shall be used to represent an alarm push-button or any other device that is used to provide an alarm in case of danger to persons or property.

| ISAF class          |                   |                                                                                                                       |   |       |
|---------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name    | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName              |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b> |                   |                                                                                                                       |   |       |
| <b>Descriptions</b> |                   |                                                                                                                       |   |       |
| EENaame             | DPL               | External equipment name plate                                                                                         |   | O     |

| ISAF class                |                   |                                   |   |       |
|---------------------------|-------------------|-----------------------------------|---|-------|
| Data object name          | Common data class | Explanation                       | T | M/O/C |
| <b>Status information</b> |                   |                                   |   |       |
| EEHealth                  | ENS               | External equipment health         |   | O     |
| Alm                       | SPS               | Safety alarm (True=On, False=Off) |   | M     |
| <b>Controls</b>           |                   |                                   |   |       |
| OpCntRs                   | INC               | Resettable operation counter      |   | O     |
| AlmReset                  | SPC               | Alarm signal reset                |   | O     |

#### 5.8.5 LN: Telecontrol interface Name: ITCI

For a description of this LN, see IEC 61850-5.

| ITCI class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>       |                   |                                                                                                                       |   |       |
| EEName                    | DPL               | External equipment name plate                                                                                         |   | O     |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| EEHealth                  | ENS               | External equipment health                                                                                             |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |
| Alm1                      | SPS               | Alarm signal                                                                                                          |   | O     |
| <b>Controls</b>           |                   |                                                                                                                       |   |       |
| LocSta                    | SPC               | Switching authority at station level                                                                                  |   | O     |

#### 5.8.6 LN: Telemonitoring interface Name: ITMI

For a description of this LN, see IEC 61850-5.

| ITMI class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNName                    |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>       |                   |                                                                                                                       |   |       |
| EEName                    | DPL               | External equipment name plate                                                                                         |   | O     |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| EEHealth                  | ENS               | External equipment health                                                                                             |   | O     |

#### 5.8.7 LN: Teleprotection communication interfaces Name: ITPC

For a description of this LN, see IEC 61850-5. The LN ITPC comprises all information for communication channel setting and supervision. ITPC is not intended to generate direct process data objects. Thus, it does not contain the input and output data objects to be transmitted and it has no 'operate' data objects object.

| ITPC class                                                                                                                                                                                                                                                                                                                                                         |                   |                                                                                                                                                                                                                      |   |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                                                                                                                                                                                                                                                                                                                                   | Common data class | Explanation                                                                                                                                                                                                          | T | M/O/C |
| LNName                                                                                                                                                                                                                                                                                                                                                             |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22.                                                                                                |   |       |
| <b>Data objects</b>                                                                                                                                                                                                                                                                                                                                                |                   |                                                                                                                                                                                                                      |   |       |
| <b>Descriptions</b>                                                                                                                                                                                                                                                                                                                                                |                   |                                                                                                                                                                                                                      |   |       |
| EEName                                                                                                                                                                                                                                                                                                                                                             | DPL               | External equipment nameplate                                                                                                                                                                                         |   | O     |
| <b>Status information</b>                                                                                                                                                                                                                                                                                                                                          |                   |                                                                                                                                                                                                                      |   |       |
| EEHealth                                                                                                                                                                                                                                                                                                                                                           | ENS               | External equipment health                                                                                                                                                                                            |   | O     |
| GrdRxCmdRx                                                                                                                                                                                                                                                                                                                                                         | SPS               | Alarm situation: Guard received together with the command, may indicate interference on the channel. Used in case of an analogue communication channel.                                                              |   | O     |
| LosSig                                                                                                                                                                                                                                                                                                                                                             | SPS               | Alarm situation: No signal received, indicates a channel problem                                                                                                                                                     |   | O     |
| TxCmdCnt1                                                                                                                                                                                                                                                                                                                                                          | INS               | For diagnostics: Transmitted commands counters (for each command)                                                                                                                                                    |   | O     |
| RxCmdCnt1                                                                                                                                                                                                                                                                                                                                                          | INS               | For diagnostics: Received commands counters (for each command)                                                                                                                                                       |   | O     |
| LosSyn                                                                                                                                                                                                                                                                                                                                                             | SPS               | Alarm situation: Loss of synchronism. Indicates that there is no synchronization between the transmitter and the receiver, i.e., no communication is possible. Used in case of a digital communication channel.      |   | O     |
| <b>Measured and metered values</b>                                                                                                                                                                                                                                                                                                                                 |                   |                                                                                                                                                                                                                      |   |       |
| Ber                                                                                                                                                                                                                                                                                                                                                                | MV                | Bit error rate of the communication channel. Used in case of a digital communication channel                                                                                                                         |   | O     |
| Fer                                                                                                                                                                                                                                                                                                                                                                | MV                | Frame error rate of the communication channel. Used in case of a digital communication channel. May be vendor specific                                                                                               |   | O     |
| CarLev                                                                                                                                                                                                                                                                                                                                                             | MV                | Power of received signal in case of an analogue communication channel                                                                                                                                                |   | O     |
| Snr                                                                                                                                                                                                                                                                                                                                                                | MV                | Signal to noise ratio (in dB), used in case of analogue communication                                                                                                                                                |   | O     |
| LoopTestTm                                                                                                                                                                                                                                                                                                                                                         | MV                | Time measured at last loop test                                                                                                                                                                                      |   | O     |
| <b>Settings</b>                                                                                                                                                                                                                                                                                                                                                    |                   |                                                                                                                                                                                                                      |   |       |
| NumTxCmd                                                                                                                                                                                                                                                                                                                                                           | ING               | Number of used binary transmit commands                                                                                                                                                                              |   | O     |
| NumRxCmd                                                                                                                                                                                                                                                                                                                                                           | ING               | Number of used binary receive commands                                                                                                                                                                               |   | O     |
| TpcTxMod1                                                                                                                                                                                                                                                                                                                                                          | ENG               | Teleprotection application mode in transmit direction for each command (Unused, Blocking, Permissive, Direct, Unblocking, Status)                                                                                    |   | O     |
| TpcRxMod1                                                                                                                                                                                                                                                                                                                                                          | ENG               | Teleprotection application mode in receive direction for each command (Unused, Blocking, Permissive, Direct, Unblocking, Status)                                                                                     |   | O     |
| SecTmms                                                                                                                                                                                                                                                                                                                                                            | ING               | Pickup security timer on loss of carrier guard signal: if a command is received within SecTmms after the guard has disappeared, this command is considered valid, used in case of an analogue communication channel. |   | O     |
| BstRat                                                                                                                                                                                                                                                                                                                                                             | ASG               | Level of increased power during the transmission of a command in dB. Used in case of an analogue communication channel                                                                                               |   | O     |
| TxPwr                                                                                                                                                                                                                                                                                                                                                              | ASG               | Transmit power (peak envelope power) in dBm. Used in case of an analogue communication channel                                                                                                                       |   | O     |
| TxCtrHz                                                                                                                                                                                                                                                                                                                                                            | ASG               | Transmit center frequency. Used in case of an analogue communication channel                                                                                                                                         |   | O     |
| RxCtrHz                                                                                                                                                                                                                                                                                                                                                            | ASG               | Receive center frequency. Used in case of an analogue communication channel                                                                                                                                          |   | O     |
| TxBndWid                                                                                                                                                                                                                                                                                                                                                           | ASG               | Transmit bandwidth. Used in case of an analogue communication channel                                                                                                                                                |   | O     |
| RxBndWid                                                                                                                                                                                                                                                                                                                                                           | ASG               | Receive bandwidth. Used in case of an analogue communication channel                                                                                                                                                 |   | O     |
| NOTE EEHealth is used to indicate the state of the communication channel, whereas PhyHealth is used to indicate the state of the (physical) communication device. If ITPC receives a GOOSE message with quality attribute "invalid" or "questionable" or no GOOSE message at all within Tmax, it will set PhyHealth to "Warning". Other actions are a local issue. |                   |                                                                                                                                                                                                                      |   |       |

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

### 5.9.1 Modelling remarks

This group of logical nodes represents various devices that can be supervised, controlled or operated but that are not primarily of electrical nature. This group includes devices like tanks, valves, fans etc. Therefore, description and requirements are given in IEC 61850-5 with different level of detail.

### 5.9.2 LN: Fan Name: KFAN

Logical node KFAN shall be used to represent a fan. It can be seen as an extended nameplate that allows the temporary setting of data object.

| KFAN class                                            |                   |                                                                                                                       |   |       |
|-------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name                                      | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                                               |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>                                   |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>                                   |                   |                                                                                                                       |   |       |
| EENName                                               | DPL               | External equipment nameplate                                                                                          |   | O     |
| <b>Status information</b>                             |                   |                                                                                                                       |   |       |
| EEHealth                                              | ENS               | External equipment health                                                                                             |   | O     |
| Loc                                                   | SPS               | Local control behaviour                                                                                               |   | O     |
| LocKey                                                | SPS               | Local or remote key                                                                                                   |   | O     |
| OpTmh                                                 | INS               | Operation time                                                                                                        |   | O     |
| <b>Measured and metered values</b>                    |                   |                                                                                                                       |   |       |
| Spd                                                   | MV                | Rotational speed of the fan                                                                                           |   | O     |
| <b>Controls</b>                                       |                   |                                                                                                                       |   |       |
| OpCtl                                                 | SPC               | Operate fan                                                                                                           |   | C     |
| SpdSpt                                                | APC               | Speed set-point (in case of speed regulated motor)                                                                    |   | C     |
| LocSta                                                | SPC               | Switching authority at station level                                                                                  |   | O     |
| <b>Settings</b>                                       |                   |                                                                                                                       |   |       |
| MinOpTmm                                              | ING               | Minimum operation time in minutes                                                                                     |   | O     |
| MaxOpTmm                                              | ING               | Maximum operation time in minutes                                                                                     |   | O     |
| C: Condition: only one data object should be applied. |                   |                                                                                                                       |   |       |

### 5.9.3 LN: Filter Name: KFIL

Logical node KFIL shall be used to represent a (mechanical) filter. It can be seen as an extended nameplate that allows the temporary setting of data object.

| KFIL class                |                   |                                                                                                                       |   |       |
|---------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|---|-------|
| Data object name          | Common data class | Explanation                                                                                                           | T | M/O/C |
| LNNName                   |                   | The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2, Clause 22. |   |       |
| <b>Data objects</b>       |                   |                                                                                                                       |   |       |
| <b>Descriptions</b>       |                   |                                                                                                                       |   |       |
| EENName                   | DPL               | External equipment nameplate                                                                                          |   | O     |
| <b>Status information</b> |                   |                                                                                                                       |   |       |
| EEHealth                  | ENS               | External equipment health                                                                                             |   | O     |
| OpTmh                     | INS               | Operation time                                                                                                        |   | O     |
| Loc                       | SPS               | Local control behaviour                                                                                               |   | O     |