CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMUNICATION NETWORKS AND SYSTEMS FOR UTILITY AUTOMATION –

Part 7-400: Basic communication structure – Compatible logical node classes and data classes

FOREWORD

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International Standard IEC 61850-7-4 has been prepared by IEC technical committee 57: Power system control and associated communications.

This CD of Edition2 is based on the following documents:

IS	Report on voting
61850-7-4-2003	

CD	Report on votings
57/747/CD	
57/781/CD	

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

IEC 61850 consists of the following parts, under the general title *Communication networks and systems for utility automation:*

Part 1: Introduction and overview

Part 2: Glossary

Part 3: General requirements

Part 4: System and project management

Part 5: Communication requirements for functions and device models

Part 6: Configuration description language for communication in electrical substations related to IEDs

Part 7-1: Basic communication structure – Principles and models

Part 7-2: Basic communication structure – Abstract communication service interface (ACSI)

Part 7-3: Basic communication – Common data classes

Part 7-400: Basic communication structure for substation and feeder equipment – Compatible logical node classes and data classes

Part 7-410: Basic communication structure for hydro power equipment – Compatible logical node classes and data classes

Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO/IEC 9506-1 and ISO/IEC 9506-2) and to ISO/IEC 8802-3

Part 9-1: Specific communication service mapping (SCSM) – Sampled values over serial unidirectional multidrop point to point link

Part 9-2: Specific communication service mapping (SCSM) – Sampled values over ISO/IEC 8802-3

Part 10: Conformance testing

The content of this part of IEC 61850 is based on existing or emerging standards and applications. In particular the definitions are based upon:

- the specific data types defined in IEC 60870-5-101 and IEC 60870-5-103;
- the common class definitions from the Utility Communication Architecture 2.0: Generic Object Models for Substation and Feeder Equipment (GOMSFE) (IEEE TR 1550);
- CIGRE Report 34-03, Communication requirements in terms of data flow within substations, December 1996.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

INTRODUCTION

This part of IEC 61850 is part of set of standard definitions (IEC 61850). IEC 61850 defining Communication Networks and Systems for Utility Automation , and more specially the communication architecture for subsystems like 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 provides in part IEC 61850-7-x a both an utility specific data model and a substation domain specific data model with abstract definitions of data 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 61850-7-100 gives an overview of the basic communication architecture to be used for all applications in the power system domain. IEC 61850-7-300 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 61850-7-200. These common data classes are used in this part to define the compatible data classes.

To reach interoperability, all data in the data model need a strong definition with regard to syntax and semantics. The semantics of the data is mainly provided by names assigned to common logical nodes defined in this part and data they contain, as defined in this basic part, and dedicated logical nodes defined in domain specific parts like for hydro power control systems. Interoperability is easiest if as much as possible of the data are defined as mandatory. Because of different philosophies and technical features, some data especially settings were declared as optional in this edition of the standard. 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 with full semantics is only one of the elements required to achieve interoperability. The standardized access to the data is defined in compatible, utility and domain specific services (see IEC 61850-7-200). Since data and services are hosted by devices (IED), a proper device model is needed also. To describe both the device capabilities and the interaction of the devices in the related system, also a configuration language is needed as defined in part 61850-6 by the Substation Configuration description Language (SCL).

The compatible logical node name and data name definitions found in this part and the associated semantics are fixed. The syntax of the type definitions of all data classes are abstract definitions provided in IEC 61850-7-200 and IEC 61850-7-300. Not all features of logical nodes are listed in this part; for example data sets and logs are covered in IEC 61850-7-200.

COMMUNICATION NETWORKS AND SYSTEMS FOR UTILITY AUTOMATION –

Part 7-4: Basic communication structure – Compatible logical node classes and data 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 utility automation. It contains also the information model of devices and functions related applications in substations. In particular, it specifies the compatible logical node names and data names for communication between Intelligent Electronic Devices (IED). This includes the relationship between Logical Nodes and Data.

The Logical Node Names and Data 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 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 Names. Any definition shall be based on IEC 61850 or on referenced well identified public documents.

In Annex A, all rules are given (making use of examples) for:

- multiple instances of logical node classes by use of a LN instance identification (ID);
- multiple instances of data by use of a data instance ID;
- selecting data not included in LN out of the complete data name set;
- creating new logical node classes and data names.

In Annex B, examples are given for:

- the use of Logical Nodes in complex situations like line protection schemes;
- multiple instances of Logical Nodes with different levels of functionality.

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 part does not discuss implementation issues. The relationship between this standard and IEC 61850-5 is outlined in Annex C

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 document. The groups of Logical Nodes defined in this document are shown in Figure 1 ordered according to some semantic meaning like different control levels as plant level, unit level, etc. For convenience, the Logical Nodes are defined below in alphabetical order.

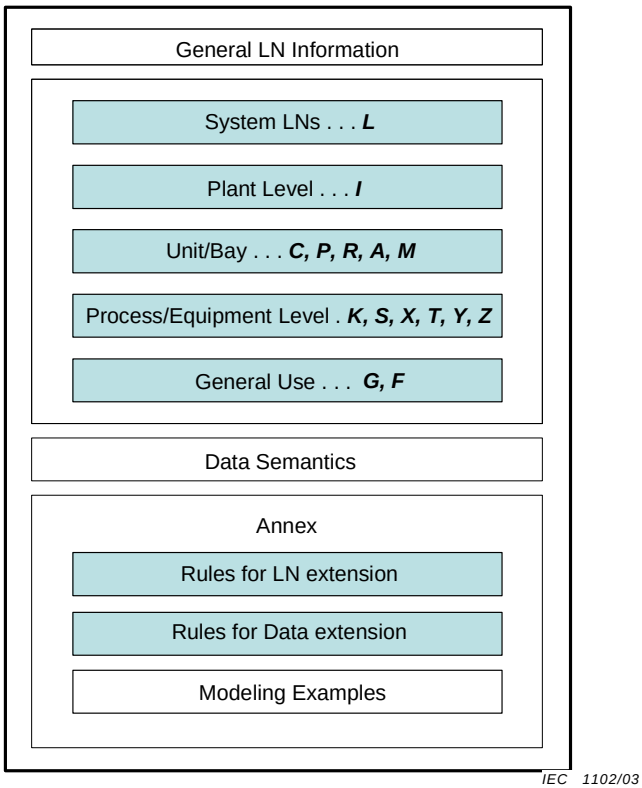

Figure 1 – Overview of this standard

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 60255-24, *Electrical relays – Part 24: Common format for transient data exchange (COMTRADE) for power systems*

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

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

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

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

IEC 61850-7-2, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)*

IEC 61850-7-3, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes*

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

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

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

3 Terms and definitions

For the purpose of this international standard 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 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	CB	Circuit Breaker
Acs	Access	CDC	Common Data Class
ACSI	Abstract Communication Service Interface	CE	Cooling Equipment
Acu	Acoustic	Cf	Crest factor
Age	Ageing	Cfg	Configuration
Alm	Alarm	CG	Core Ground
Amp	Current non phase related	Ch	Channel
An	Analogue	Cha	Charger
Ang	Angle	Chg	Change
Auth	Authorisation	Chk	Check
Auto	Automatic	Chr	Characteristic
Aux	Auxiliary	Cir	Circulating
Av	Average	Clc	Calculate, calculated
B	Bushing	Clk	Clock, clockwise
Bat	Battery	Cls	Close
Beh	Behaviour	Cnt	Counter
Bin	Binary	Col	Coil
Blk	Block, blocked	Cor	Correction
Bnd	Band	Crd	Coordination
Bo	Bottom	Crv	Curve
Cap	Capability	CT	Current Transducer
Capac	Capacitance	Ctl	Control
Car	Carrier	Ctr	Center

Term	Description
Cyc	Cycle
Dea	Dead
Den	Density
Det	Detected
DExt	De-excitation
Diag	Diagnostics
Dif	Differential, difference
Dir	Direction
Dis	Distance
Dl	Delay
Dlt	Delete
Dmd	Demand
Dn	Down
DPCSO	Double point controllable status output
DQ0	Direct, Quadrature, and zero axis quantities
Drag	Drag hand
Drv	Drive
DS	Device State
Dsch	Discharge
Dur	Duration
EC	Earth Coil
EE	External Equipment
EF	Earth Fault
Ena	Enabled
Eq	Equalization, Equal
Ev	Evaluation
Ex	External
Exc	Exceeded
Excl	Exclusion
Exp	Expired
Ext	Excitation
FA	Fault Arc
Fact	Factor
Fan	Fan
Flt	Fault
Flw	Flow
FPF	Forward Power Flow
Fu	Fuse
Fwd	Forward
Gen	General
Gn	Generator
Gnd	Ground
Gr	Group
Grd	Guard
Gri	Grid
H	Harmonics (phase related)
H_2	Hydrogen
H_2O	Water
Ha	Harmonics (non phase related)
Hi	High, highest
HP	Hot point
Hz	Frequency
IEEE	Institute of Electrical and Electronic Engineers
Imb	Imbalance
Imp	Impedance non phase related
In	Input
Ina	Inactivity
Incr	Increment
Ind	Indication
Inh	Inhibit
Ins	Insulation
Int	Integer
Intv	Interval
ISCSO	Integer status controllable status output
km	Kilometre
L	Lower
LD	Logical Device
LDC	Line Drop Compensation
LDCR	Line Drop Compensation Resistance
LDCX	Line Drop Compensation Reactance
LDCZ	Line Drop Compensation Impedance
LED	Light Emitting Diode
Len	Length
Lev	Level
Lg	Lag
Lim	Limit
Lin	Line
Liv	Live
LN	Logical Node
Lo	Low
LO	Lockout
Loc	Local
Lod	Load, loading
Lok	Locked
Los	Loss
Lst	List

Term	Description
LTC	Load Tap Changer
m	Minutes
M/O/C	Data Object is Mandatory or Optional or Conditional
Max	Maximum
Mem	Memory
Min	Minimum
Mod	Mode
Mot	Motor
ms	Milliseconds
Mst	Moisture
MT	Main Tank
Mth	Method
N	Neutral
Nam	Name
Net	Net sum
Ng	Negative
Nom	Nominal, Normalising
Num	Number
Ofs	Offset
Op	Operate, Operating
Opn	Open
Out	Output
Ov	Over, Override, Overflow
Pa	Partial
Par	Parallel
Pct	Percent
Per	Periodic, Period
PF	Power Factor
Ph	Phase
Phy	Physical
Pls	Pulse
Plt	Plate
Pmp	Pump
Po	Polar
Pol	Polarizing
Pos	Position
POW	Point on wave switching
PP	Phase to phase
PPV	Phase to phase voltage
Pres	Pressure
Prg	Progress, in progress
Pri	Primary
Pro	Protection
Ps	Positive
Pst	Post
Pwr	Power
Qty	Quantity
R	Raise
R0	Zero sequence resistance
R1	Positive sequence resistance
Rat	Winding ratio
Rcd	Record, recording
Rch	Reach
Rcl	Reclaim
Re	Retry
React	Reactance; Reactive
Rec	Reclose
Red	Reduction
Ref	Reference
Rel	Release
Rem	Remote
Res	Residual
Ris	Resistance
Rl	Relation, relative
Rms	Root mean square
Rot	Rotation, Rotor
Rs	Reset, Resetable
Rsl	Result
Rst	Restraint
Rsv	Reserve
Rte	Rate
Rtg	Rating
Rv	Reverse
Rx	Receive, received
S1	Step one
S2	Step two
Sch	Scheme
SCO	Supply change over
SCSM	Specific Communication Service Mapping
Sec	Security
Seq	Sequence
Set	Setting
Sh	Shunt
Spd	Speed
SPl	Single Pole
SPCSO	Single point controllable status output
Src	Source

Term	Description
St	Status
Sto	Storage e.g. activity of storing data
Stat	Statistics
Stop	Stop
Std	Standard
Str	Start
Sup	Supply
Svc	Service
Sw	Switch
Swg	Swing
Syn	Synchronisation
Tap	Tap
Td	Total distortion
Tdf	Transformer derating factor
Test	Test
Thd	Total Harmonic Distortion
Thm	Thermal
TiF	Telephone influence factor
Tm	Time Tmh = Time in h Tmm = Time in min Tms = Time in s Tmms = Time in ms
Tmp	Temperature (°C)
To	Top
Tot	Total
TP	Three pole
Tr	Trip
Trg	Trigger
Ts	Total signed
Tu	Total unsigned
Tx	Transmit, transmitted
Typ	Type
Un	Under
Use	Data actually in use
V	Voltage
VA	Volt Amperes
Vac	Vacuum
Val	Value
VAr	Volt Amperes Reactive
Vlv	Valve
Vol	Voltage non phase related
VT	Voltage Transducer
W	Active Power
Wac	Watchdog
Watt	Active Power non phase related
Wei	Weak End Infeed
Wh	Watt hours
Wid	Width
Win	Window
Wrm	Warm
X0	Zero sequence reactance
X1	Positive sequence reactance
Z	Impedance
Z0	Zero sequence impedance
Z1	Positive sequence impedance
Zer	Zero
Zn	Zone
Zro	Zero sequence method

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 (see A.2.3 for example), 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	DER
E	Reserved
F	Functional blocks
G	Generic Function References
H	Hydro power
I	Interfacing and Archiving
J	Reserved
K	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 [a)]	Supervision and Monitoring
T [a)]	Instrument Transformer and Sensors
U	Reserved
V	Reserved
W	Wind power
X [a)]	Switchgear
Y [a)]	Power Transformer and Related Functions
Z [a)]	Further (power system) Equipment

[a)] 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 – see Figure B.5 for example).

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 Name	Name of the Data
Common Data Class	Common Data Class that defines the structure of the data. See IEC 61850-7-3.
Explanation	Short explanation of the data and how it is used.
T	Transient Data – the status of data with this designation is momentary and 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 only applies to BOOLEAN process data attributes (FC=ST) of that DATA. Transient DATA is identical to normal DATA, except that for the process state change from TRUE to FALSE no event may be generated for reporting and for logging.
M/O/C	This column defines whether data, data sets, control blocks or services are mandatory (M) or optional (O) or conditional (C) for the instantiation of a specific Logical Node. NOTE The attributes for data that are instantiated may also be mandatory or optional based on the CDC (Attribute Type) definition in IEC 61850-7-3. The entry C is an indication that a condition exists for this data object. The condition decides what conditional data objects get mandatory. C may have an index to handle multiple conditions.

Kommentar [HD1]: #442

The LN type and the LNName attribute are 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 19.

All Data Names are listed alphabetically in Clause 6. Despite some overlapping, the data in the Logical Nodes Classes are grouped for the convenience of the reader into some of the following categories.

Common Logical Node Information
is information independent of the dedicated function represented by the LN class. Mandatory data (M) are common to all LN classes i.e. shall be used for all LN classes dedicated for functions.Optional data (O) may be used for all LN classes dedicated for functions.These dedicated LN classes show if optional data of the Common Logical Node class get mandatory

Kommentar [HD2]: see #441

Status Information
is data, which shows either the status of the process or of the function allocated to the LN class. This information is produced locally and cannot be changed remotely unless substitution is applicable. Data such as “start” or “trip” are listed in this category. Most of these data are mandatory.

Settings
are data which are needed for the function to operate. Since many settings are dependent on the implementation of the function, only a commonly agreed minimum is standardised. They may be changed remotely, but normally not very often.

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

Controls
are data which are changed by commands such as switchgear state (ON/OFF), tap changer position or resetable counters. They are typically changed remotely, and are changed during operation much more often than Settings.

Metered Values
are analogue data representing quantities measured over time, e.g. energy. This information is produced locally and cannot be changed remotely unless substitution is applicable.

5.3 System Logical Nodes LN Group: L

5.3.1 LN relationships

Kommentar [HD3]: #394

In this subclause, the system specific information is defined. This includes Common Logical Node Information (for example logical node behavior, 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 from the Common Logical Node..

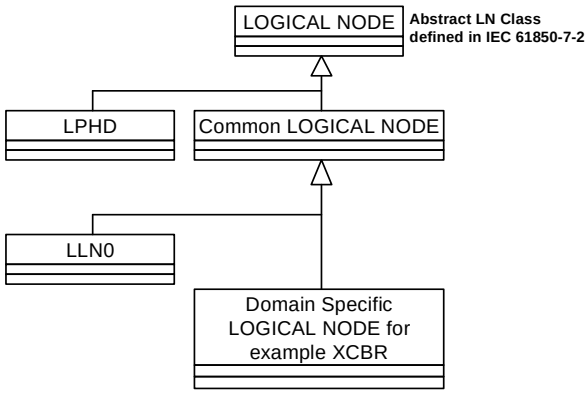

Figure 2 – LOGICAL NODE Relationships

Kommentar [HD4]: #401

IEC 1103/03

All logical node classes defined in this document inherit their structure from the abstract logical node class (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 of the common logical node (Common LN).

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 Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
PhyNam	DPL	Physical device name plate		M
PhyHealth	INS	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
RsStat	SPC	Reset device statistics	T	O
Data Sets (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				
Control Blocks (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				
Services (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				

Kommentar [HD5]: #442

Kommentar [HD6]: LNName is deleted because of #107

Kommentar [HD7]: Seoul: include a setting to set the daylight change – see MoM from Seoul

Kommentar [HD8]: #432

5.3.3 LN: Common Logical Node Name: Common LN

Kommentar [HD9]: #395

The Common Logical Node class provides Data which are mandatory or condtional to all dedicated LN classes. It contains also dat which may be used in all dedicated Logical Node classes like input references and data for the statistical calculation methods.

Common LN class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
Mandatory Logical Node Information (Shall be inherited by ALL LN but LPHD)				
Mod	INC	Mode		C
Beh	INS	Behaviour		M
Health	INS	Health		M
NamPlt	LPL	Name plate		M
Optional Logical Node Information				
InRef	ORG	General input		O
ClcExp	SPS	Calculation period expired	T	O
ClcStr	SPC	Start calculation at time operTm (if set) or immediately		O
ClcMth	ING	Calcualtion Method of statistical data. Allowed values PRES | MIN | MAX |TOTMIN | TOTMAX |AVG | SDV |TREND		O
ClcPerms	ING	Calculation Period of statistical data, shall be in milliseconds		O
ClcSrc	ORG	Object Reference to Source logical node		O
ClcTyp	INS	Calculation Typ (wether RMS values or other calculation methods is used)		

Kommentar [HD10]: #395

Kommentar [HD11]: tissue #216, 199
from San Diego: change the name to InRef

Kommentar [HD12]: #479

Kommentar [HD13]: Seoul and #504

GrRef	REF	Reference to a higher level Logical Device		O
Data Sets (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				
Control Blocks (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				
Services (see IEC 61850-7-2)				
Inherited and specialised from Logical Node class (see IEC 61850-7-2)				

Condition C: Mod shall be inherited by LLN0 as mandatory.

- All dedicated LN classes shall inherit all Data, Data Sets, Control Blocks and Services from this Common Lgical Node class..
- The data CalcMth shall be included in any logical node that represents analogue or counting information if the calculation method is unequal PRES i.e. that all analogue values (i. e. all common attributes i and f) are present values.
- The data ClcExp, ClcStr, ClcPerms and ClcSrc shall be included in any logical node that represents statistical data (MIN, MAX, ...).

.

5.3.4 LN: Logical node zero Name: LLN0

This LN shall be used to address common issues for Logical Devices. For example, LLN0 contains common information for the LD like Health, Mode and Beh and NamPlt.

LLNO class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
LocKey	SPS	Local operation for complete logical device		O
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpTmh	INS	Operation time		O
Controls				
Diag	SPC	Run Diagnostics		O
LEDRs	SPC	LED reset	T	O

Kommentar [HD14]: tissue #306
in annex give an example

Kommentar [HD15]: tissue #306

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
Automatic tap changer controller		ATCC	See Table 5
Synchronised switching	AsySw or CPBC	CPOW	See Table 5
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.

5.4.2 LN: Neutral current regulator Name: ANCR

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

ANCR class				
Data 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 19		
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
TapChg	BSC	Change Tap Position (stop, higher, lower)		M
RCol	SPC	Raise Plunge Core Position		O
LCol	SPC	Lower Plunge Core Position		O
Status Information				
Auto	SPS	Automatic operation		O

Kommentar [HD16]: tissue #306
in annex give an example

Kommentar [HD17]: tissue #306

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 beeing used.

ARCO class				
Data 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 19		
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
TapChg	BSC	Change reactive power (stop, higher, lower)		M
Status Information				
Auto	SPS	Automatic operation		O
VOvSt	SPS	Voltage override status		O
NeutAlm	SPS	Neutral alarm is present		O
DschBlk	SPS	Bank switch close blocked due to discharge	T	O

Kommentar [HD18]: tissue #306
in annex give an example

Kommentar [HD19]: tissue #306

5.4.4 LN: Automatic tap changer controller Name: ATCC

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

ATCC class				
Data 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 19		

ATCC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
TapChg	BSC	Change Tap Position (stop, higher, lower)		C
TapPos	ISC	Tap position		C
ParOp	DPC	Parallel/Independent operation		M
LTCBlk	SPC	Block (Inhibit) Automatic Control of LTC		O
LTCDragRs	SPC	Reset LTC Drag Hands	T	O
VRed1	SPC	Voltage reduction step 1		O
VRed2	SPC	Voltage reduction step 2		O
Measured Values				
CtlV	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 CtlV at 1.0 power factor, FPF		O
Metered Values				
HiCtlV	MV	Highest Control Voltage		O
LoCtlV	MV	Lowest Control Voltage		O
HiDmdA	MV	High current demand (Load Current Demand)		O
Status Information				
Auto	SPS	Automatic/Manual operation		O
HiTapPos	INS	High tap position		O
LoTapPos	INS	Low tap position		O
Settings				
BndCtr	ASG	Band center voltage (FPF presumed)		O
BndWid	ASG	Band width voltage (as voltage or percent of nominal voltage, FPF presumed)		O
CtlDlTmms	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
TmDlChr	SPG	Time delay linear or inverse characteristic		O
LDCZ	ASG	Line drop voltage due to line total impedance		O
VRedVal	ASG	Reduction of band centre (percent) when voltage step 1 is active		O
TapBlkR	ING	Tap position of Load Tap Changer where automatic Raise commands are		O

Kommentar [HD20]: tissue #306
in annex give an example

Kommentar [HD21]: tissue #306

ATCC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
		blocked		
TapBlkL	ING	Tap position of Load Tap Changer where automatic Lower commands are blocked		O

Condition C: depending on the tap-change method at least one of the two controls TapChg and TapPos shall be used.

5.4.5 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 beeing used.

AVCO class				
Data 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 19		
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
TapChg	BSC	Change Voltage (stop, higher, lower)		M
Status Information				
Auto	SPS	Automatic operation		O
BlkEF	SPS	Blocked by earth fault		O
BlkAOv	SPS	Blocked by current limit overflow		O
BlkVOv	SPS	Blocked by Voltage limit overflow		O
Settings				
LimAOv	ASG	Current limit for overflow blocking		O
LimVOv	ASG	Voltage limit for overflow blocking		O

Kommentar [HD22]: tissue #306
in annex give an example

Kommentar [HD23]: tissue #306

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 incl. cooling	YPTR	CCGR	Dedicated cooling group control split off from YPTR
Tap changer controller	CTCC	ATCC	Automatic tap changer controller

5.5.2 LN: Alarm handling Name: CALH

For a description of this LN, see IEC 61850-5. Individual alarms are generated in the corresponding logical nodes, for example metering alarms are found in MMXU or MMTR, etc. CALH allows the creation of group warnings and alarms. The individual alarms, which are used to calculate the group alarms/warnings, are subscribed from elsewhere. The calculation is a local issue.

CALH class				
Data 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 19		
Data				
Status Information				
GrAlm	SPS	Group alarm		M
GrWrn	SPS	Group warning		O
AlmLstOv	SPS	Alarm list overflow		O

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 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
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 secundary cooling medium in		O
CETmpOut	MV	Temperature of secundary cooling medium out		O
CEPres	MV	Pressure of secundary cooling medium		O
CEFlw	MV	Flow of secundary cooling medium		O
FanA	MV	Motor drive current fan		O
Controls				
CGRBlk	SPC	Control of automatic / manual operation		O
CECtl	SPC	Control of complete cooling group (pumps and fans)		O
PmpCtlGen	INC	Control of all pumps		O
PmpCtl	INC	Control of a single pump		O
FanCtlGen	INC	Control of all fans		O
FanCtl	INC	Control of a single fan		O
Status Information				
Auto	SPS	Automatic or manual		O
FanOvCur	SPS	Fan overcurrent trip		O
PmpOvCur	SPS	Pump overcurrent trip		O
PmpAlm	SPS	Loss of pump		O
Settings				
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 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 19		
Data				
Status Information				
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 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 Pos.

Kommentar [HD24]: check if the service is available; may be it’s necessary to include a figure in annex

CPOW class				
Data 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 19		
Data				
Controls				
Pos	DPC	Switch, general		O
Status Information				
TmExc	SPS	Maximum allowed time exceeded		M
StrPOW	SPS	CPOW started		O
OpOpn	ACT	Open switch	T	O
OpCls	ACT	Close switch	T	O
Settings				
MaxDlTmms	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 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 no Control Service is available between CSWI and XCBR (see GSE in IEC 61850-7-2).

CSWI class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**

CSWI class				
Data 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 19		
Data				
LocKey	SPS	Local operation		O
RemCtlBlk	SPC	Remote Control Blocked		O
Loc	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
Pos	DPC	Switch, general		M
PosA	DPC	Switch L1		O
PosB	DPC	Switch L2		O
PosC	DPC	Switch L3		O
Status Information				
OpOpn	ACT	Operation "Open Switch"	T	O
OpCls	ACT	Operation "Close Switch"	T	O

Kommentar [HD25]: tissue #306
in annex give an example

Kommentar [HD26]: tissue #306

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 LN's will normally be part of a logical device providing overall functionality within the system.

The LN classes of the F-group shall be used only if no other LN class from other groups doesn't 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.

FCNT class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/OC**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2 clause 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
Loc	SPS	Local operation		M
Status information				
Up	STS	Last count direction upward		O
Dn	STS	Last count direction downward		O
Measured values				
Out	BCR	Output value		M
Controls				
Blk	SPC	Block operation		O
CntRs	SPC	The counter is reset to 0		O

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

Logical Node FCSD shall comprise the data classes that represent the curve shaping output positions. The values can be dynamically modified online. The values entered in the table are based on statistical data 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-dimensional to adjust nonlinear transmitters to the correct physical values or, by instantiation, used for 3-dimensional surface mapping.

FCSD class				
Attribute Name	**Attr. Type**	**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 19		
Data				
Measured Values				
Out	MV	Output		M
Settings				
Crv	CSD	Curve shape		M
Controls				
Blk	SPC	Block operation		O

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 Appendix A.

FFIL class				
Attribute Name	**Attr. Type**	**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 19		
Data				
Settings				
FilTyp	ING	Filter type: | Low pass | High pass | Bandpass | Bandstop (notch) |		
Kp	ASG	Proportional Gain		M
Kld	ASG	K lead		O
Klg	ASG	K lag		O
T1	INT	Time 1 [ms]		O
T1ld	INT	Time 1 (lead) [ms]		O
T2	INT	Time 2 [ms]		O
T2ld	INT	Time 2 (lead) [ms]		O
T3	INT	Time 3 [ms]		O
Measured values				
Out	MV	Output		M
ErrTerm	MV	Error term		O
Control				

Blk	SPC	Block operation		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				
Attribute Name	**Attr. Type**	**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 19		
Data				
Status information				
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
Measured values				
Out	MV	Output signal		M
Settings				
HiLimSpt	ASG	High limit setpoint		M
LoLimSpt	ASG	Minimum limit setpoint		O
Controls				
Blk	SPC	Block operation		O

Kommentar [HD27]: check all abbriviations of F-LN if there are available and common

5.6.6 LN: PID regulator NAME: FPID

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

FPID class				
Attribute Name	**Attr. Type**	**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 19		
Data				
Measured Values				
Out	MV	PID output		M
PAct	MV	Proportional action		C
IAct	MV	Integral action		C
DAct	MV	Derivative action		C
P	MV	P output		O
I	MV	I output		O
D	MV	D output		O
ErrTerm	MV	Error term		O
Settings				

PidAlg	ING	P|I|D|PI|PD|ID|PID|		M
Kp	ASG	Proportional gain		C
Ki	ASG	Integral Gain		C
Ti	INT	Integral time (ms)		C
Kd	ASG	Derivative gain		C
Td	INT	Derivative time (ms)		C
Tf	INT	Derivative time filter (ms)		C
Bias	ASG	Bias added to Process variable		O
Controls				
Blk	SPC	Block operation		O

The conditional attributes shown in the first column of table 19 shall be linked with the corresponding PID algorithm selected.

	PidAlg (M-Mandatory, Blank-Not Used)						
Attribute Name	P	I	D	PI	PD	ID	PID
PAct	M			M	M		M
IAct		M		M		M	M
DAct			M		M	M	M
Kp	M			M	M		M
Ki		M		M		M	M
Ti		M		M		M	M
Kd			M		M	M	M
Td			M		M	M	M
Tf			M		M	M	M

Table 19 - Conditional attributes in FPID

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 the data attributes of the ASG common data class does not contain all of the information required to achieved a full ramping function with divergent up and down trends.

FRMP class				
Attribute Name	**Attr. Type**	**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 19		
Data				
Measured Values				
Out	MV	Ramp Output		M
ErrTerm	MV	Error term		O
Status information				
AdjMsg	INS	Adjustment Message		O
Settings				
RmpUp	ASG	Ramping rate on a upward trend		M
RmpDn	ASG	Ramping rate on a downward trend		M
StepPs	ASG	Step size when turning from negative to positive direction		O
StepNg	ASG	Step size when turning from positive to negative direction		O
Controls				

Blk	SPC	Block operation		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 forma a complete controller.

FSPT class				
Attribute Name	**Attr. Type**	**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 19		
Data				
Controls				
SptR	SPC	Setpoint raise		O
SptL	SPC	Setpoint lower		O
Measured Values				
SptMem	MV	Setpoint in memory		M
ErrTerm	MV	Error term		O
Output	MV	Output		O
Status Information				
Auto	SPS	Automatic operation		O
SptDvAlm	SPS	Deviation alarm		O
SptUp	SPS	Setpoint going up (raising)		O
SptDn	SPS	Setpoint going up (Lowering)		O
SptDir	SPS	Setpoint direction		O
SptMsg	INS	End Message		O
AdjMsg	INS	Adjustment Message		O
Settings				
MaxRst	RST	Maximum restriction		O
MinRst	RST	Minimum restriction		O
DvAlm	ASG	Deviation Alarm		O
SptVal	APC	Setpoint		O
DeadB	ASG	Deadband		O
Controls				
Blk	SPC	Block operation		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. It optionally provides a second level signal that can be used provide a two-step action. FXOT can typically be used whenever a protection, control or alarm function is based on other physical measurements than primary electric data.

FXOT class				
Attribute Name	**Attr. Type**	**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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
Status information				
Op	SPS	Level of action reached	T	M
OpB	SPS	Second level of action reached	T	O
Settings				
StrVal	ASG	Start level set-point		C
StrValB	ASG	Second level of action setpoint		C
OpDlTmms	ING	Operate delay time [ms]		O
StrCrv	CSD	Start level curve		C
RsDlTmms	ING	Reset operate delay time [ms]		O
Controls				
Blk	SPC	Block operation		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. It optionally provides a second level signal that can be used provide a two step action. FXUT can typically be used whenever a protection, control or alarm function is based on other physical measurements than primary electric data.

FXUT class				
Attribute Name	**Attr. Type**	**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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
Status information				
Op	SPS	Level of action reached	T	M
OpB	SPS	Second level of action reached	T	O
Settings				
StrVal	ASG	Start level set-point		C
StrValB	ASG	Second level of action setpoint		O
OpDlTmms	ING	Operate delay time [ms]		O
StrCrv	CRV	Start level curve		C
RsDlTmms	ING	Reset operate delay time [ms]		O
Controls				
Blk	SPC	Block operation		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 LN: Generic automatic process control Name: GAPC

Description of this LN see IEC 61850-5. 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 listed in clause 6 of this document can be used single or multiple for a dedicated application of LN GGIO. Data with proper semantic meaning should be preferred. The extensions rules according to Annex A shall be followed.

GAPC class				
Data 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 19		
Data				
LocKey	SPS	Local operation		O
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Controls				
SPCSO	SPC	Single point controllable status output		O
DPCSO	DPC	Double point controllable status output		O
ISCSO	INC	Integer status controllable status output		O
Status Information				
Auto	SPS	Automatic operation		O
Str	ACD	Start		O
Op	ACT	Operate	T	O
Settings				
StrVal	ASG	Start Value		O

Kommentar [HD28]: tissue #306 in annex give an example

Kommentar [HD29]: tissue #306

5.7.2 LN: Generic process I/O Name: GGIO

Description of this LN see IEC 61850-5. This node shall be used only to model in a generic way device processes that are not predefined by the groups S, T, X, Y, or Z. If needed, all data listed in clause 6 of this document can be used single or multiple for a dedicated application of LN GGIO. Data with proper semantic meaning should be preferred. The extensions rules according to Annex A shall be followed.

GGIO class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
LocKey	SPS	Local operation		O
RemCtlBlk	SPC	Remote Control Blocked		O
LocCtlBeh	SPS	Local Control Behavior		O
OpCntRs	INC	Resetable operation counter		O
Measured Values				
AnIn	MV	Analogue input		O
AnOut	APC	Controllable analogue output		O

Kommentar [HD30]: tissue #306 in annex give an example

Kommentar [HD31]: tissue #306

Kommentar [HD32]: #467

GGIO class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Controls				
SPCSO	SPC	Single point controllable status output		O
DPCSO	DPC	Double point controllable status output		O
ISCSO	INC	Integer status controllable status output		O
Status Information				
IntIn	INS	Integer status input		O
Alm	SPS	General single alarm		O
Ind	SPS	General indication (binary input)		O

5.7.3 LN: Generic security application Name: GSAL

For a description of this LN, see IEC 61850-7-2. This node shall be used to monitor security violations regarding authorisation, access control, service privileges and inactive associations.

GSAL class				
Data 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 19		
Data				
OpCntRs	INC	Resetable operation counter. NOTE – An operation in the context of this logical node is a security violation		M
Status Information				
AuthFail	SEC	Authorisation failures		M
AcsCtlFail	SEC	Access control failures detected		M
SvcViol	SEC	Service privilege violations		M
Ina	SEC	Inactive associations		M
NumCntRs	INS	Number of counter resets		O

Kommentar [HD33]: tissue #208

5.8 Logical Nodes for interfacing and archiving LN Group: I

5.8.1 LN: Archiving Name: IARC

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

IARC class				
Data 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 19		
Data				
Status Information				
MemOv	SPS	Memory Overflow		M
MemUsed	INS	Memory used in %		O
NumRcd	INS	Actual number of records		O
Settings				
MaxNumRcd	ING	Maximum number of records		O
OpMod	ING	Operation mode (Saturation, Overwrite)		O

IARC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
MemFull	ING	Memory full level		O

5.8.2 LN: Human machine interface Name: IHMI

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

IHMI class				
Data 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 19		
Data				

5.8.3 LN: Safety alarm function Name: ISAF

Kommentar [HD34]: #478 and from Hydro data model

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 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 19		
Data				
Status Information				
Alm	SPS	Safety alarm (1=On, 0=Off)	T	M
OpCntRs	INC	Resetable operation counter		O
Status Infomration				
AlmReset	SPC	Alarm signal reset		O

5.8.4 LN: Telecontrol interface Name: ITCI

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

ITCI class				
Data 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 19		
Data				

5.8.5 LN: Telemonitoring interface Name: ITMI

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

ITMI class				
Data 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 19		

ITMI class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/ C**
Data				

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

5.9.1 Modelling remarks

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

5.9.2 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.

KFAN class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
OpTmh	INS	Operation time		O
Status information				
ACAlm	SPS	AC supply failure (fuse or other problem)		O
MotPro	SPS	Motor protection tripped		O
Blocked	SPS	The fan is blocked from operation		O
Settings				
MinOpTmm	ING	Minimum operation time in minutes		O
MaxOpTmm	ING	Maximum operation time in minutes		O
Measured values				
Spd	MV	Rotational speed of the fan		O
Controls				
Operate	DPC	Operate fan		M
SpdSpt	APC	Speed set-point (in case of speed regulated motor)		O

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.

KFIL class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O

OpTmh	INS	Operation time		O
Status information				
ACAlm	SPS	AC supply failure (fuse or other problem)		O
MotPro	SPS	Motor protection tripped		O
Flush	SPS	Filter flushing		O
FlushCnt	INC	Filter flushing counter (reset-able)		O
FilAlm	SPS	Filter alarm		O
Settings				
DifPresHi	ASG	Alarm level set-point		O
Measured values				
DifPresHi	MV	Differential pressure over the filter		O
Controls				
Operate	DPC	Operate filter		O

5.9.4 LN: Pump **Name: KPMP**

Logical Node KPMP shall be used to represent a pump. It can be seen as an extended nameplate that allows the temporary setting of data.

KPMP class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
OpTmh	INS	Operation time		O
Status information				
ACAlm	SPS	AC supply failure (fuse or other problem)		O
MotPro	SPS	Motor protection tripped		O
BlkSt	SPS	The pump is blocked from operation		O
Settings				
MinOpTmm	ING	Minimum operation time in minutes		O
MaxOpTmm	ING	Maximum operation time in minutes		O
Measured values				
Spd	MV	Rotational speed of the pump		O
Controls				
Operate	DPC	Operate pump		M
SpdSpt	APC	Speed set-point (in case of speed regulated motor)		O

5.9.5 LN: Tank **Name: KTNK**

Logical Node KTNK shall be used to represent the physical device of a tank, such as a hydraulic oil tank. The tank can be pressurised or not. If used to represent a tank for pressurised gas, only the pressure MV will be used. If used for an oil sump, only the level MV will be used. For a simple level sensor, the SLVL logical node can be used instead.

KTNK class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
Loc	SPS	Local operation		O
Status information				
TnkTyp	INS	Type of tank (pressure only, level only, both pressure and level)		M
Settings				
VlmCap	AsG	Total volume capacity		O
Measured values				
Pres	MV	Pressure in the tank		O
LevPc	MV	Level in the tank (as percentage of full tank level)		O
Vlm	MV	Volume of media in tank		O
Tmp	MV	Temperature of the media in the tank		O

5.9.6 LN: Valve control — Name: KVLV

Logical Node KVLV shall be used torepresent a valve or gate where the position can be given as a percentage of full open position (optionally the angle 0-90° may be used). In case of dam gates where either open or closed position depends on the water level of the dam, the HGTE LN should be used.

KVLV class				
Attribute Name	**Attr. Type**	**Explanation**	**T**	**M/O**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2)		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment nameplate		O
OpCnt	INS	Operation counter		O
Loc	SPS	Local operation selected		M
Status information				
ClsPos	SPS	Closed end position reached (valve cannot move further)		C[1]
OpnPos	SPS	Open end position reached (valve cannot move further)		C[1]
Mvm	SPS	Valve is moving		O
Stuck	SPS	Valve is blocked (cannot move from present position)		O
Settings				
OpnLim	ASG	Opening limit of valve position (temporary restriction)		O
ClsLim	ASG	Closing limit of valve position (temporary restriction)		O
Incr	ASG	Increment of position change for open / close commands		O
Measured values				
PosPc	MV	Valve position given as 0 – 100 %		C[2]
PosDeg	MV	Valve position given as 0 – 90 °		C[2]
Flw	MV	Calculated liquid flow through the valve [m^3 / s]		O
Controls				
PosSpt	APC	Valve position set-point		O

Opn	DPC	Valve to full open position		O
Cls	DPC	Valve to full closed position		O
PosChg	INC	Change valve position (stop, raise, lower)		C^2
PosChgIncr	INC	Incremental change of position		C^2
BlkOpn	SPC	Block opening of the valve		O
BlkCls	SPC	Block closing of the valve		O

Note: For data attributes with conditions C^1, one or both may be used, however the use of at least one is mandatory. Data attributes with conditions C^2 are optional, but if used, only one can be selected.

5.10 Logical Nodes for metering and measurement LN Group: M

5.10.1 Modelling remarks

If the values for metering or measurement are provided by an external sensor connected via a 4 to 20 mA link, the live zero alarm is provided by the data external health (EEHealth).

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

Functionality	Defined in IEC 61850-5 by LN	Modelled in IEC 61850-7-4 by LN	Comments
Measurement	MMXU	MMXU	Three-phase version
		MMXN	Non-phase related version (single phase)
Metering (three-phase)	MMTR	MMTR	Metering (three-phase values)
		MMTN	Metering (single-phase values)
		MSTA	Metering (statistics)
Harmonics and interharmonics	MHAI	MHAI	Three-phase version
		MHAN	Non-phase related version (single phase)
Advanced		MADV	Advanced measurements for power quality
Flicker		MFLK	Flicker measurements for power quality
Differential measurements		MDIF	Calculated data for differential protection

5.10.2 LN: Advanced Measurement unit Name: MADV

This LN shall be used for calculation of currents, voltages, and powers using advanced summation techniques (arithmetic and vector) for three phase quantities, and for proper representation of these quantities in non-sinusoidal and unbalanced conditions according to IEEE standard 1459. The main use is for operative applications.

MADV class				
Data 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 19.		
Data				
EEHealth	ISI	External equipment health (external sensor)		
Measured Values				
TotVAa	MV	Arithmetic Total Apparent Power (va)		O
TotVAv	MV	Vector Total Apparent Power (va)		O
TotVAaFund	MV	Fundamental Arithmetic Total Apparent Power (va)		O
TotVAvFund	MV	Fundamental Vector Total Apparent Power (va)		O

MADV class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
TPF	WYE	True Power Factor (pu)		O
TPFworst	MV	Worst Phase True Power Factor (pu)		O
avgTPF	MV	Average True Power Factor (pu)		O
TotPFa	MV	Arithmetic Total Power Factor (pu)		O
TotPFv	MV	Vector Total Power Factor (pu)		O
DF	WYE	Displacement Power Factor (pu)		O
DFworst	MV	Worst Phase Displacement Power Factor (pu)		O
AvgDF	MV	Average Displacement Power Factor (pu)		O
TotDFa	MV	Arithmetic Total Displacement Power Factor (pu)		O
TotDFv	MV	Vector Total Displacement Power Factor (pu)		O
Ires	MV	Residual Current Ia + Ib + Ic (amps)		O
Inet	MV	Net Current Ia + Ib + Ic + In (amps)		O
nssN	WYE	non-active power (vars)		O
nssSn	WYE	Non-fundamental apparent power		O
nssSh	WYE	harmonic apparent power		O
nssDpi	WYE	current distortion power		O
nssDpv	WYE	voltage distortion power		O
nssDph	WYE	harmonic distortion power		O
nssSnS1	WYE	Sn / S1 ratio - harmonic pollution		O
nssIeh	MV	3 phase effective harmonic current		O
nssVeh	MV	3 phase effective harmonic voltage		O
nssSeh	MV	3 phase effective harmonic apparent power		O
nssDpei	MV	3 phase effective current distortion power		O
nssDpev	MV	3 phase effective voltage distortion power		O
nssDpeh	MV	3 phase effective harmonic distortion power		O
nssSen	MV	3 phase effective non-fundamental apparent power		O
nssSenSe1	MV	Sen / Se1 ratio - harmonic pollution		O
nssS1	WYE	fundamental apparent power (va)		O
nssP1	WYE	fundamental real power (watts)		O
nssSn	WYE	non-active apparent power (vars)		O
nssIe	MV	3 phase effective current (amps)		O
nssVe	MV	3 phase effective voltage (volts)		O
nssSe	MV	3 phase effective apparent power (va)		O
nssIe1	MV	3 phase effective fundamental current (amps)		O
nssVe1	MV	3 phase effective fundamental voltage (volts)		O
nssSe1	MV	3 phase effective fundamental apparent power (va)		O
nssTotN	MV	3 phase total non-active power (vars)		O
nssPFe	MV	3 phase effective power factor (pu)		O
nssS1p	MV	positive sequence fundamental apparent power (va)		O
nssS1u	MV	fundamental unbalanced apparent power (va)		O
nssP1p	MV	positive sequence fundamental apparent power (va)		O
nssQ1p	MV	positive sequence fundamental reactive power (var)		O

MADV class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
nssPF1p	MV	positive sequence fundamental power factor (pu)		O
nssS1uS1p	MV	ratio of fundamental unbalance to apparent power (pu)		O

5.10.3 LN: Differential measurements Name: MDIF

This LN shall be used to provide calculated process values representing the other side of the line (or of another object) as used for differential protection (PDIF). The LN MDIF is also used with function 87 according to IEEE device function number designation (IEEE 32R.2 1996)

Editorial remark: This LN will be changed later according to the result of the SS-SS-Task force.

MDIF class				
Data 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 19		
Data				
Measured Values				
OpARem	WYE	Operate Current (phasor) of the remote current measurement		C
Amp1	SAV	Current (Sampled value) phase A		C
Amp2	SAV	Current (Sampled value) phase B		C
Amp3	SAV	Current (Sampled value) phase C		C

Condition C: Either OpARem or Amp1/Amp2/Amp3 shall be used.

5.10.4 LN: Flicker Measurement unit Name Name: MFLK

This LN shall be used for calculation of flicker inducing voltage fluctuations according to IEC Standard 61000-4-15. The main use is for operative applications.

MFLK class				
Data 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 19.		
Data				
EEHealth	ISI	External equipment health (external sensor)		O
Measured Values				
Pst	DELTA	Pst of last complete interval		O
Plt	DELTA	Plt of last complete interval		O
PltSlide	DELTA	Sliding window Plt up to last complete Pst interval		O
PiMax	DELTA	Output 5 – Instantaneous peak P value		O
PiLPF	DELTA	Output 4 – 1 minute average of Output 5		O
PiRoot	DELTA	Output 3 – Square root of Output 5		O
PcbLsA	HST	Classifier bins of last complete short interval Phase A (or AB)		O
PcbLsB	HST	Classifier bins of last complete short interval Phase B (or BC)		O
PcbLsC	HST	Classifier bins of last complete short interval Phase C (or CA)		O

PcbLlA	HST	Classifier bins of last complete long interval Phase A (or AB)		O
PcbLlB	HST	Classifier bins of last complete long interval Phase B (or BC)		O
PcbLlC	HST	Classifier bins of last complete long interval Phase C (or CA)		O
PdmWaveA	FLKDMOD	Real time demodulated waveform Phase A (or AB)		O
PdmWaveB	FLKDMOD	Real time demodulated waveform Phase B (or BC)		O
PdmWaveC	FLKDMOD	Real time demodulated waveform Phase C (or CA)		O
PdmSpecA	FLKSPEC	Real time demodulated waveform spectra Phase A (or AB)		O
PdmSpecB	FLKSPEC	Real time demodulated waveform spectra Phase B (or BC)		O
PdmSpecC	FLKSPEC	Real time demodulated waveform spectra Phase C (or CA)		O

Note: DELTA class used for multi-phase measurements for WYE or DELTA connections since neutral is not measured for flicker.

FLKDMOD – Array of N measured values containing demodulated waveform where N is vendor dependent and discoverable

FLKSPEC – Array of N measured values containing demodulated spectra – M Hz resolution where N and M are discoverable

FLKPROB – Array of N counts representing classifier bins where N is discoverable

5.10.5 LN: Harmonics or interharmonics Name: MHAI

For a description of this LN, see IEC 61850-5. This LN shall be used for calculation of harmonics or interharmonics in a three-phase system. Instances either for harmonics (including subharmonics and multiples) or interharmonics are possible depending on the value of the basic settings, i.e.:

- frequency *f* (“Hz”);
- evaluation window Δt (“EvTmms”).

The frequency may either be given or calculated by means such as a phase-locked loop (only possible for a dominant frequency like the basic power frequency).

a) Settings for Harmonics, Subharmonics and multiples

EvTmms = 1/Hz (16 ms for 60 Hz, 20 ms for 50 Hz)
NumCyc = 1 results in Harmonics only, i.e in multiples of Hz in a)
NumCyc > 1 results in addition in Subharmonics and multiples
Lowest frequency = 1/EvTmms
Highest frequency = (SmpRte)/2 (see TVTR, TCTR and IEC 61850-7-3)

b) Settings for Interharmonics

EvTmms = 1/Hz (adopted to the lowest interharmonics frequency expected)
NumCyc = 1 results in Interharmonics, i.e. in multiples of Hz in b)
NumCyc > 1 normally not used since the lowest frequency is freely adjusted by choice of Hz
Lowest frequency = 1/EvTmms
Highest frequency = (SmpRte)/2 (see TVTR, TCTR and IEC 61850-7-3)

Both harmonics and interharmonics carry power and produce distortions. There are different methods to calculate disturbances. For more information and definitions see IEC 61000-4-7 (1991), IEEE Std 519-1992, and IEEE Std 1459-2000.

MHAI class				
Data 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 19		

MHAI class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Measured Values				
Hz	MV	Basic frequency		C
HA	HWYE	Sequence of Harmonics or Interharmonics current		O
HPhV	HWYE	Sequence of Harmonics or Interharominics phase to ground voltages		O
HPPV	HDEL	Sequence of Harmonics or Interharmonics phase to phase voltages		O
HW	HWYE	Sequence of Harmonics or Interharmonics active power		O
HVAr	HWYE	Sequence of Harmonics or Interharmonics reactive power		O
HVA	HWYE	Sequence of Harmonics or Interharmonics apparent power		O
HRmsA	WYE	Current RMS Harmonic or Interharmonics (un-normalized Total harmonic disortion, Thd)		O
HRmsPhV	WYE	Voltage RMS Harmonic or Interharmonics (un-normalized Thd) for phase to ground		O
HRmsPPV	DEL	Voltage RMS Harmonic or Interharmonics (un-normalized Thd) for phase to phase		O
HTuW	WYE	Total phase Harmonic or Interharmonics active power (no fundamental) unsigned sum		O
HTsW	WYE	Total phase Harmonic or Interharmonic active power (no fundamental) signed sum		O
HATm	WYE	Current Time product		O
HKf	WYE	K Factor		O
HTdf	WYE	Transformer derating factor		O
ThdA	WYE	Current Total Harmonic or Interharmonic Distortion (different methods)		O
ThdOddA	WYE	Current Total Harmonic or Interharmonic Distortion (different methods – odd components)		O
ThdEvnA	WYE	Current Total Harmonic or Interharmonic Distortion (different methods – even components)		O
TddA	WYE	Current Total Demand Distortion per IEEE 519		O
TddOddA	WYE	Current Total Demand Distortion per IEEE 519 (odd components)		O
TddEvnA	WYE	Current Total Demand Distortion per IEEE 519 (even components)		O
ThdPhV	WYE	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to ground		O
ThdOddPhV	WYE	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to ground (odd components)		O
ThdEvnPhV	WYE	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to ground (even components)		O
ThdPPV	DEL	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to phase		O
ThdOddPPV	DEL	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to phase (odd components)		O
ThdEvnPPV	DEL	Voltage Total Harmonic or Interharmonic Distortion (different methods) for phase to phase (even components)		O
HCfPhV	WYE	Voltage crest factors (peak waveform value/sqrt(2)/fundamental) for phase to ground		O
HCfPPV	DEL	Voltage crest factors (peak waveform value/sqrt(2)/fundamental) for phase to phase		O

MHAI class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
HCfA	WYE	Current crest factors (peak waveform value/sqrt(2)/fundamental)		O
HTif	WYE	Voltage Telephone Influence Factor		O
Settings				
HzSet	ASG	Basic frequency		C
EvTmms	ASG	Evaluation time (time window) determines the lowest frequency		O
NumCyc	ING	Number of cycles of the basic frequency		O
ThdAVal	ASG	ThdA alarm Setting – value entered in %		O
ThdVVal	ASG	ThdPhV / ThdPPV alarm Setting – value entered in %		O
ThdATmms	ING	ThdA alarm time delay in ms		O
ThdVTmms	ING	ThdPhV / ThdPPV alarm time delay in ms		O
NomA	ASG	Normalising demand current used in IEEE 519 TDD calculation		O

Condition C: Hz and HzSet are exclusive.

5.10.6 LN: Non phase related harmonics or interharmonics Name: MHAN

This LN shall be used for calculation of harmonics or interharmonics in a single-phase system, i.e. a single line with no phase relations. Instances either for harmonics (including subharmonics and multiples) or interharmonics are possible depending on the value of the basic settings, i.e.:

- frequency f (“Hz”);
- evaluation window Δt (“EvTmms”).

The frequency may either be given or calculated by means such as a phase-locked loop (only possible for a dominant frequency like the basic power frequency). The settings for Harmonics and Interharmonics instances, see MHAI.

MHAN class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Measured Values				
Hz	MV	Basic frequency		C
HaAmp	HMV	Sequence of Harmonics or Interharmonics for current		O
HaVol	HMV	Sequence of Harmonics or Interharmonics for voltages		O
HaWatt	HMV	Sequence of Harmonics or Interharmonics for active power		O
HaVolAmpr	HMV	Sequence of Harmonics or Interharmonics for reactive power		O
HaVolAmp	HMV	Sequence of Harmonics or Interharmonics for apparent power		O
HaRmsAmp	MV	Current RMS Harmonic or Interharmonic (un-normalized Thd)		O
HaRmsVol	MV	Voltage RMS Harmonic or Interharmonic (un-normalized Thd)		O
HaTuWatt	MV	Total Harmonic or Interharmonic active power (no fundamental) unsigned sum		O
HaTsWatt	MV	Total Harmonic or Interharmonic active power (no fundamental) signed sum		O
HaAmpTm	MV	Current Time product		O
HaKFact	MV	K Factor		O

MHAN class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
HaTdFact	MV	Transformer derating factor		O
ThdAmp	MV	Current Total Harmonic or Interharmonic Distortion (different methods)		O
ThdOddAmp	MV	Current Total Harmonic or Interharmonic Distortion (different methods – odd components)		O
ThdEvnAmp	MV	Current Total Harmonic or Interharmonic Distortion (different methods – even components)		O
TddAmp	MV	Current Total Demand Distortion per IEEE 519		O
TddOddAmp	MV	Current Total Demand Distortion per IEEE 519 (odd components)		O
TddEvnAmp	MV	Current Total Demand Distortion per IEEE 519 (even components)		O
ThdVol	MV	Voltage Total Harmonic or Interharmonic Distortion (different methods)		O
ThdOddVol	MV	Voltage Total Harmonic or Interharmonic Distortion (different methods - odd components)		O
ThdEvnVol	MV	Voltage Total Harmonic or Interharmonic Distortion (different methods- even components)		O
HaCfAmp	MV	Current crest factors (peak waveform value/sqrt(2)/fundamental)		O
HaCfVol	MV	Voltage crest factors (peak waveform value/sqrt(2)/fundamental)		O
HaTiFact	MV	Voltage Telephone Influence Factor		O
Settings				
HzSet	ASG	Basic frequency		C
EvTmms	ASG	Evaluation time (time window) determines the lowest frequency		O
NumCyc	ING	Number of cycles of the basic frequency		O
ThdAVal	ASG	ThdA alarm Setting – value entered in %		O
ThdVVal	ASG	ThdV alarm Setting – value entered in %		O
ThdATmms	ING	ThdA alarm time delay in ms		O
ThdVTmms	ING	ThdV alarm time delay in ms		O
NomA	ASG	Normalising demand current used in IEEE 519 TDD calculation		O

Condition C: Hz and HzSet are exclusive.

5.10.7 LN: Metering Name: MMTN

For a description of this LN, see IEC 61850-5. This LN shall be used for calculation of energy in a single-phase system. The main use is for billing purposes.

MMTN class				
Data 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 19		
Data				
Metered Values				
TotVAh	BCR	Net apparent energy since last reset		O
TotWh	BCR	Net Real energy since last reset		O
TotVArh	BCR	Net Reactive energy since last reset		O
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar)		O
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar)		O
DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away)		O

MMTN class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away)		O

5.10.8 LN: Metering Name: MMTR

For a description of this LN, see IEC 61850-5. This LN shall be used for calculation of energy in a three-phase system. The main use is for billing purposes.

MMTR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Metered Values				
TotVAh	BCR	Net apparent energy since last reset		O
TotWh	BCR	Net Real energy since last reset		O
TotVArh	BCR	Net Reactive energy since last reset		O
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar)		O
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar)		O
DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away)		O
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away)		O

5.10.9 LN: Non phase related Measurement Name: MMXN

This LN shall be used for calculation of currents, voltages, powers and impedances in a single-phase system, i.e. in a system where voltages and currents are not phase-related. The main use is for operative applications.

MMXN class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Measured Values				
Amp	MV	Current I (rms) not allocated to a phase		O
Vol	MV	Voltage V (rms) not allocated to a phase		O
Watt	MV	Power (P) not allocated to a phase		O
VolAmpr	MV	Reactive Power (Q) not allocated to a phase		O
VolAmp	MV	Apparent Power (S) not allocated to a phase		O
PwrFact	MV	Power Factor not allocated to a phase		O
Imp	CMV	Impedance		O
Hz	MV	Frequency		O

5.10.10 LN: Measurement Name: MMXU

For a description of this LN, see IEC 61850-5. This LN shall be used for calculation of currents, voltages, powers and impedances in a three-phase system. The main use is for operative applications.

MMXU class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
Measured Values				
TotW	MV	Total Active Power (Total P)		O
TotVAr	MV	Total Reactive Power (Total Q)		O
TotVA	MV	Total Apparent Power (Total S)		O
TotPF	MV	Average Power factor (Total PF)		O
Hz	MV	Frequency		O
PPV	DEL	Phase to phase voltages (VL1VL2, …)		O
PhV	WYE	Phase to ground voltages (VL1ER, …)		O
A	WYE	Phase currents (IL1, IL2, IL3)		O
W	WYE	Phase active power (P)		O
VAr	WYE	Phase reactive power (Q)		O
VA	WYE	Phase apparent power (S)		O
PF	WYE	Phase power factor		O
Z	WYE	Phase Impedance		O

5.10.11 LN: Sequence and imbalance Name: MSQI

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

MSQI class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Measured Values				
SeqA	SEQ	Positive, Negative and Zero Sequence Current		C
SeqV	SEQ	Positive, Negative and Zero Sequence Voltage		C
DQ0Seq	SEQ	DQ0 Sequence		O
ImbA	WYE	Imbalance current		O
ImbNgA	MV	Imbalance negative sequence current		O
ImbNgV	MV	Imbalance negative sequence voltage		O
ImbPPV	DEL	Imbalance phase-phase voltage		O
ImbV	WYE	Imbalance voltage		O
ImbZroA	MV	Imbalance zero sequence current		O
ImbZroV	MV	Imbalance zero sequence voltage		O

MSQI class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
MaxImbA	MV	Maximum imbalance current		O
MaxImbPPV	MV	Maximum imbalance phase-phase voltage		O
MaxImbV	MV	Maximum imbalance voltage		O

Condition C: At least one of either data shall be used.

5.10.12 LN: Metering Statistics Name: MSTA

The metered values are not always used directly, but as average values, minima and maxima over a given evaluation period. The reporting may be started after the end of this period.

MSTA class				
Data 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 19		
Data				
EEHealth	INS	External equipment health (external sensor)		O
EEName	DPL	External equipment name plate		O
Metered Values				
AvAmps	MV	Average current		O
MaxAmps	MV	Maximum current		O
MinAmps	MV	Minimum current		O
AvVolts	MV	Average voltage		O
MaxVolts	MV	Maximum voltage		O
MinVolts	MV	Minimum voltage		O
AvVA	MV	Average apparent power		O
MaxVA	MV	Maximum apparent power		O
MinVA	MV	Minimum apparent power		O
AvW	MV	Average real power		O
MaxW	MV	Maximum real power		O
MinW	MV	Minimum real power		O
AvVAr	MV	Average reactive power		O
MaxVAr	MV	Maximum reactive power		O
MinVAr	MV	Minimum reactive power		O
Controls				
EvStr	SPC	Start of evaluation interval		O
Settings				
EvTmms	ASG	Evaluation time (time window) for averages, etc.		O

5.11 Logical Nodes for protection functions LN Group: P

5.11.1 Modelling remarks

This section refers to modelling of protection and protection related Logical Nodes and shows the relation (see Table 3) between IEC 61850-5 and the Logical Node class definitions according to this document.

- If there are several stages to one function (i.e. for multi-zone relay), each stage shall be a separate instance of the LN. Examples are PDIS (n zones) or PTOV (2 stages).
- Multiple instances shall be used if LNs of the same LN class are operating with different setting groups in parallel.
- If different measuring principles such as phase or ground are required, each shall be represented by an instance of the same basic function. An example is PTOC (used for phase or ground in dedicated instances).
- The logical nodes are defined in IEC 61850-5 from protection requirements, however for modelling purposes, some logical nodes have been split (see table below).
- Logical Nodes from IEC 61850-5 are modelled using combinations of the LNs defined in this part (see table below).
- Other logical nodes have been added to model complex protection devices and schemes (see the following clauses). As an example, line protection uses LN PSCH to combine the outputs from multiple protection LNs.
- The protection functions provide (if applicable) the data Str (Start) with direction information. In the case of a protection function which provides no direction information, the direction “unknown” shall be transmitted. The data Str is summarised by LN PTRC.
- If the fault direction is provided in Str (Start), the directional protection may be modelled without the Directional Element LN RDIR. If any of the settings provided by LN RDIR are needed, the LN RDIR shall be used.
- The protection functions provide (if applicable) the data Op (Operate) without direction information. The data Op is conditioned by LN PTRC resulting in the data Tr (Real Trip), i.e. between every protection LN and the circuit breaker node XCBR shall be a LN PTRC.

Table 6 – Relation between IEC 61850-5 and IEC 61850-7-4 (this standard) for protection LNs

Functionality	IEEE C37.2 reference	Defined in IEC 61850-5	Modelled in IEC 61850-7-4	Comments
Transient earthfault		PTEF	PTEF	Use shown in Annex B.1
Directional earth fault wattmetric protection		PWDE	PSDE	Sensitive earth fault protection Use shown in Annex B.1
Zero speed and underspeed	14	PZSU	PZSU	
Distance	21	PDIS	PDIS PSCH	Use one instance per zone. To build line protection schemes
Volt per Hz	24	PVPH	PVPH	
(Time) Undervoltage	27	PTUV	PTUV	
Directional power /reverse power	32	PDPR	PDOP or PDUP	Directional over power Directional under power Reverse power modelled by PDOP plus directional mode “reverse”
Undercurrent/underpower	37	PUCP	PTUC PDUP	Undercurrent Underpower
Loss of field/Underexcitation	40	PUEX	PDUP	Directional under power
Reverse phase or phase balance current	46	PPBR	PTOC	Time overcurrent (PTOC) with three-phase information with sequence current as an input or even ratio of negative and positive sequence currents
Phase sequence voltage	47	PPBV	PTOV	Three-phase information and processing
Thermal overload	49	PTTR	PTTR	
Rotor thermal overload	49R	PROL	PTTR	Thermal overload

Functionality	IEEE C37.2 reference	Defined in IEC 61850-5	Modelled in IEC 61850-7-4	Comments
Stator thermal overload	49S	PSOL	PTTR	Thermal overload
Instantaneous overcurrent or rate of rise	50	PIOC	PIOC	
AC time overcurrent	51	PTOC	PTOC	
Voltage controlled/dependent time overcurrent	51V	PVOC	PVOC	
Power factor	55	PPFR	POPF PUPF	Over power factor Under power factor
(Time) Overvoltage	59	PTOV	PTOV	
DC-overvoltage	59DC	PDOV	PTOV	Both for DC and AC
Voltage or current balance	60	PVCB	PTOV PTOC	Overvoltage or overcurrent regarding the magnitude of the difference
Earth fault / Ground detection	64	PHIZ	PHIZ	
Rotor earth fault	64R	PREF	PTOC	Time overcurrent
Stator earth fault	64S	PSEF	PTOC	Time overcurrent
Interturn fault	64W	PITF	PTOC	Time overcurrent
AC directional overcurrent	67	PDOC	PTOC	Time overcurrent
Directional earth fault	67N	PDEF	PTOC	Time overcurrent
DC time overcurrent	76	PDCO	PTOC	Time overcurrent for AC and DC
Phase angle or out-of-step	78	PPAM	PPAM	
Frequency	81	PFRQ	PTOF PTUF PFRC	Over frequency Under frequency Rate of change of frequency
Carrier or pilot wire protection	85	RCPW	PSCH	PSCH is used for line protection schemes instead of RCPW
Differential	87	PDIF	PDIF	
Phase comparison	87P	PPDF	PDIF	
Differential line	87L	PLDF	PDIF	
Restricted earth fault	87N	PNDF	PDIF	
Differential transformer	87T	PTDF	PDIF PHAR	Differential transformer Harmonic restraint
Busbar	87B	PBDF	PDIF or PDIR	Busbar differential or Fault direction comparison
Motor differential	87M	PMDF	PDIF	
Generator differential	87G	PGDF	PDIF	
Motor Startup	49R, 66 48, 51LR	PMSU	PMRI PMSS	Motor Restart Inhibition Motor Starting Time Supervision

5.11.2 LN: Differential Name: PDIF

See IEC 61850-5 (LNs PLDF, PNDF, PTDF, PBDF, PMDF, and PPDF). This LN shall be used for all kind of current differential protection. Proper current samples for the dedicated application shall be subscribed.

PDIF class				
Data 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 19		

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PDIF class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
Status Information				
Str	ACD	Start		O
Op	ACT	Operate	T	M
TmASt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Measured Values				
DifAClc	WYE	Differential Current		O
RstA	WYE	Restraint Current		O
Settings				
LinCapac	ASG	Line capacitance (for load currents)		O
LoSet	ING	Low operate value, percentage of the nominal current		O
HiSet	ING	High operate value, percentage of the nominal current		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
RstMod	ING	Restraint Mode		O
RsDlTmms	ING	Reset Delay Time		O
TmACrv	CURVE	Operating Curve Type		O

5.11.3 LN: Direction comparison Name: PDIR

For a description of this LN, see IEC 61850-5. The operate decision is based on an agreement of the fault direction signals from all directional fault sensors (for example directional relays) surrounding the fault. The directional comparison for lines is made with PSCH.

PDIR class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start (appearance of the first related fault direction)		M
Op	ACT	Operate (decision from all sensors that the surrounded object is faulted)	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
RsDlTmms	ING	Reset Delay Time		O

5.11.4 LN: Distance Name: PDIS

For a description of this LN, see IEC 61850-5. The phase start value and ground start value are minimum thresholds to release the impedance measurements depending on the distance function characteristic given by the algorithm and defined by the settings. The settings replace the data curve as used for the characteristic on some other protection LNs.

PDIS class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**

PDIS class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
PoRch	ASG	Polar Reach is the diameter of the Mho diagram		O
PhStr	ASG	Phase Start Value		O
GndStr	ASG	Ground Start Value		O
DirMod	ING	Directional Mode		O
PctRch	ASG	Percent Reach		O
Ofs	ASG	Offset		O
PctOfs	ASG	Percent Offset		O
RisLod	ASG	Resistive reach for load area		O
AngLod	ASG	Angle for load area		O
TmDlMod	SPG	Operate Time Delay Mode		O
OpDlTmms	ING	Operate Time Delay		O
PhDlMod	SPG	Operate Time Delay Multiphase Mode		O
PhDlTmms	ING	Operate Time Delay for Multiphase Faults		O
GndDlMod	SPG	Operate Time Delay for Single Phase Ground Mode		O
GndDlTmms	ING	Operate Time Delay for single phase ground faults		O
X1	ASG	Positive sequence line (reach) reactance		O
LinAng	ASG	Line Angle		O
RisGndRch	ASG	Resistive Ground Reach		O
RisPhRch	ASG	Resistive Phase Reach		O
K0Fact	ASG	Residual Compensation Factor K_0		O
K0FactAng	ASG	Residual Compensation Factor Angle		O
RsDlTmms	ING	Reset Time Delay		O

5.11.5 LN: Directional overpower Name: PDOP

For a description of this LN, see IEC 61850-5 (LN PDPR). This LN shall be used for the overpower part of PDPR. Additionally, PDOP is used to model a reverse overpower function (IEEE device function number 32R, from IEEE 32R.2,1996) when the DirMod is set to reverse.

PDOP class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M

PDOP class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
DirMod	ING	Directional Mode		O
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.6 LN: Directional underpower Name: PDUP

For a description of this LN, see IEC 61850-5 (LN PDPR). This LN shall be used for the underpower part of PDPR.

PDUP class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O
DirMod	ING	Directional Mode		O

5.11.7 LN: Rate of change of frequency Name: PFRC

For a description of this LN, see IEC 61850-5 (LN PFRQ). This LN shall be used to model the rate of frequency change of PFRQ. One instance shall be used per stage.

PFRC class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
BlkV	SPS	Blocked because of voltage		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value df/dt		O
BlkVal	ASG	Voltage Block Value		O
OpDlTmms	ING	Operate Delay Time		O

PFRC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
RsDlTmms	ING	Reset Delay Time		O

5.11.8 LN: Harmonic restraint Name: PHAR

This LN shall be used to represent the harmonic restraint data of the transformer differential protection (see PDIF) in a dedicated node. There may be multiple instantiations of this LN with different settings, especially with different data HaRst.

PHAR class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start (active when restraint is needed)		M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
HaRst	ING	Number of harmonic restrained		O
PhStr	ASG	Start Value		O
PhStop	ASG	Stop Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.9 LN: Ground detector Name: PHIZ

For a description of this LN, see IEC 61850-5. This LN shall be used for high-impedance isolation faults only.

PHIZ class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
AStr	ASG	Current Start Value		O
VStr	ASG	Voltage Start Value		O
HVStr	ASG	Third Harmonic Voltage Start Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.10 LN: Instantaneous overcurrent Name: PIOC

For a description of this LN, see IEC 61850-5. This LN shall be used for instantaneous overcurrent protection only.

PIOC class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		O
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O

5.11.11 LN: Motor restart inhibition Name: PMRI

For a description of this LN, see IEC 61850-5 (LN PMSU). This LN shall be used to model from LN PMSU the part which protects a motor against thermal overload during start-up in a dedicated LN.

PMRI class				
Data 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 19		
Data				
Status Information				
Op	ACT	Operate	T	O
StrInh	SPS	Restart inhibited		O
StrInhTmm	INS	Restart Inhibition Time		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
SetA	ASG	Current setting for motor start-up		O
SetTms	ING	Time Setting for motor start-up		O
MaxNumStr	ING	Maximum number of starts (also for cold starts)		O
MaxWrmStr	ING	Maximum Warm Starts, permissible number of warm starts		O
MaxStrTmm	ING	Time period for the maximum number of starts		O
EqTmm	ING	Temperature Equalisation Time		O
InhTmm	ING	Restart Inhibit Time		O

5.11.12 LN: Motor starting time supervision Name: PMSS

For a description of this LN, see IEC 61850-5 (LN PMSU). This LN shall be used to model from LN PMSU the part which protects a motor against excessive starting time/locked rotor during start-up in a dedicated LN.

PMSS class

Data 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 19		
Data				
Status Information				
Str	ACD	Start		O
Op	ACT	Operate	T	O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
SetA	ASG	Current setting for motor start-up		O
SetTms	ING	Time Setting for motor start-up		O
MotStr	ASG	I Motor Startup, (current pickup value of motor starting)		O
LokRotTms	ING	Lock Rotor Time, permissible locked rotor time		O

5.11.13 LN: Over power factor Name: POPF

For a description of this LN, see IEC 61850-5 (LN PPFR). This LN shall be used for the over power factor part of PPFR.

POPF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
BlkA	SPS	Blocked below minimum operating current		O
BlkV	SPS	Blocked below minimum operating voltage		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O
BlkValA	ASG	Block Value (Minimum operating current)		O
BlkValV	ASG	Block Value (Minimum operating voltage)		O

5.11.14 LN: Phase angle measuring Name: PPAM

For a description of this LN, see IEC 61850-5. This function shall be used to model “out-of-step” protection of generators.

PPAM class				
Data 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 19		
Data				
Status Information				

PPAM class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Str	ACD	Start		M
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O

5.11.15 LN: Rotor protection Name: PRTR

For a description of this LN, see IEC 61850-5. Logical Node PRTR shall be used to represent a field short-circuit protection using the 6th harmomic (300Hz). The protection is normally included in the excitation system.

PRTR class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate (trips both field CB and generator CB)	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O

5.11.16 LN: Protection scheme Name: PSCH

This LN shall be used to model the logic scheme for line protection function co-ordination. The protection scheme allows the exchange of the “operate” outputs of different protection functions and conditions for line protection schemes. It includes data for teleprotection if applicable. In this case, all appropriate data shall be subscribed.

Editorial remark: This LN will be changed later according to the result of the SS-SS-Task force.

PSCH class				
Data 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 19		
Data				
Status Information				
ProTx	SPS	Teleprotection signal transmitted	T	M
ProRx	SPS	Teleprotection signal received	T	M
Str	ACD	Carrier Send		M
Op	ACT	Operate	T	M
CarRx	ACT	Carrier received after unblock logic		O
LosOfGrd	SPS	Loss of guard		O
Echo	ACT	Echo signal from weak end infeed function		O

PSCH class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
WeiOp	ACT	Operate signal from weak end infeed function		O
RvABlk	ACT	Block signal from current reversal function		O
GrdRx	SPS	Guard Received		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
SchTyp	ING	Scheme Type		O
OpDlTmms	ING	Operate Delay Time		O
CrdTmms	ING	Co-ordination timer for blocking scheme		O
DurTmms	ING	Minimum duration of carrier send signal		O
UnBlkMod	ING	Unblock function mode for scheme type		O
SecTmms	ING	Pickup security timer on loss of carrier guard signal		O
WeiMod	ING	Mode of weak end infeed function		O
WeiTmms	ING	Co-ordination time for weak end infeed function		O
PPVVal	ASG	Voltage level for weak end infeed function – phase-phase		O
PhGndVal	ASG	Voltage level for weak end infeed function – phase-ground		O
RvAMod	ING	Mode of current reversal function		O
RvATmms	ING	Pickup time for current reversal logic		O
RvRsTmms	ING	Delay time for reset of current reversal output		O

5.11.17 LN: Sensitive directional earthfault Name: PSDE

For a general description of directed earth fault protection, see IEC 61850-5. This LN is used for directional earthfault handling in compensated and isolated networks. The use of “operate” is optional and depends both on protection philosophy and on instrument transformer capabilities. For compensated networks, this function is often called wattmetric directional earthfault. The very high accuracy needed for fault current measurement in compensated networks may require phase angle compensation. This shall be realised by the related LN TCTR.

PSDE class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
Ang	ASG	Angle between voltage (U_0) and current (I_0)		O
GndStr	ASG	Ground Start Value (3 U_0)		O
GndOp	ASG	Ground Operate Value (3 I_0)		O
StrDlTmms	ING	Start Delay Time		O
OpDlTmms	ING	Operate Delay Time		O
DirMod	ING	Directional Mode		O

5.11.18 LN: Transient earth fault Name: PTEF

For a description of this LN, see IEC 61850-5. This LN shall be used to detect (“start”) transient earth fault in compensated networks.

PTEF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start (Transient earth fault)		C
Op	ACT	Operate (Transient earth fault)	T	C
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
GndStr	ASG	Ground Start Value		O
DirMod	ING	Directional Mode		O

Condition C: at least one of the two status information (Str, Op) shall be used.

5.11.19 LN: Tyristor protection Name: PTHF

Logical Node PTHF shall be used to represent a thyristor (thyristor valve) protection. In a power plant, this protection will typically be included in the excitation system.

PTHF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate (trips both field CB and generator CB)	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O

5.11.20 LN: Time overcurrent Name: PTOC

For a description of this LN, see IEC 61850-5 (LN PTOC). This LN shall also be used to model the Directional Time Overcurrent (PDOC/IEEE 67). The Definite Time overcurrent (also PTOC/IEEE 51) shall be modelled by use of PTOC and selecting the related curve.

PTOC class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M

PTOC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Op	ACT	Operate	T	M
TmASt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
TmACrv	CURVE	Operating Curve Type		O
StrVal	ASG	Start Value		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
OpDlTmms	ING	Operate Delay Time		O
TypRsCrv	ING	Type of Reset Curve		O
RsDlTmms	ING	Reset Delay Time		O
DirMod	ING	Directional Mode		O

5.11.21 LN: Overfrequency Name: PTOF

For a description of this LN, see IEC 61850-5 (LN PFRQ). This LN shall be used to model the overfrequency part of PFRQ. One instance shall be used per stage.

PTOF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
BlkV	SPS	Blocked because of voltage		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value (frequency)		O
BlkVal	ASG	Voltage Block Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.22 LN: Overvoltage Name: PTOV

For a description of this LN, see IEC 61850-5. For some applications such as transformer star-point or delta supervision, “operate” may not be used.

PTOV class				
Data 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 19		

PTOV class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	O
TmVSt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
TmVCrv	CURVE	Operating Curve Type		O
StrVal	ASG	Start Value		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.23 LN: Protection trip conditioning Name: PTRC

This LN shall be used to connect the “operate” outputs of one or more protection functions to a common “trip” to be transmitted to XCBR. In addition or alternatively, any combination of “operate” outputs of the protection functions may be combined to a new “operate” of PTRC.

PTRC class				
Data 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 19		
Data				
Status Information				
Tr	ACT	Trip		C
Op	ACT	Operate (combination of subscribed Op from protection functions)		C
Str	ACD	Sum of all starts of all connected Logical Nodes		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
TrMod	ING	Trip Mode		O
TrPlsTmms	ING	Trip Pulse Time		O

Condition C: At least one of the two status information (Tr, Op) shall be used.

5.11.24 LN: Thermal overload Name: PTTR

For a description of this LN, see IEC 61850-5 (LNs PROL, PSOL). PTTR shall be used for all thermal overload functions. Depending on the algorithm, the LN describes either a temperature or a current (thermal model). Temperature data are also provided by other LNs. Examples are the Hot spot temperature in LN YPTR or the Isolation gas temperature in LN SIMG.

PTTR class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**

PTTR class				
Data 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 19		
Data				
Measured Values				
Amp	MV	Current for thermal load model		O
Tmp	MV	Temperature for thermal load		O
TmpRl	MV	Relation between temperature and max. temperature		O
LodRsvAlm	MV	Load reserve to alarm		O
LodRsvTr	MV	Load reserve to trip		O
AgeRat	MV	Ageing rate		O
Status Information				
Str	ACD	Start		O
Op	ACT	Operate	T	M
AlmThm	SPS	Thermal Alarm		O
TmTmpSt	CSD	Active curve characteristic		O
TmASt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
TmTmpCrv	CURVE	Characteristic Curve for temperature measurement		O
TmACrv	CURVE	Characteristic Curve for current measurement /Thermal model		O
TmpMax	ASG	Maximum allowed temperature		O
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
RsDlTmms	ING	Reset Delay Time		O
ConsTms	ING	Time constant of the thermal model		O
AlmVal	ASG	Alarm Value		O

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5.11.25 LN: Undercurrent Name: PTUC

For a description of this LN, see IEC 61850-5 (LN PUCP). This LN shall be used for the undercurrent part of PUCP. The underpower part of LN PUCP is covered by PDUP already. Different instances shall be used for phase and ground.

PTUC class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
TmASt	CSD	Active curve characteristic		O
Controls				

PTUC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
OpCntRs	INC	Resetable operation counter		O
Settings				
TmACrv	CURVE	Operating Curve Type		O
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
TypRsCrv	ING	Type of Reset Curve		O
RsDlTmms	ING	Reset Delay Time		O
DirMod	ING	Directional Mode		O

5.11.26 LN: Undervoltage Name: PTUV

For a description of this LN, see IEC 61850-5. With an appropriate low operating curve, PTUV functions also as Zero voltage relay.

PTUV class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
TmVSt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
TmVCrv	CURVE	Operating Curve Type		O
StrVal	ASG	Start Value		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.27 LN: Underpower factor Name: PUPF

For a description of this LN, see IEC 61850-5 (LN PPFR). This LN shall be used for the underpower factor part of PPFR.

PUPF class				
Data 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 19		
Data				

PUPF class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
BlkA	SPS	Blocked below minimum operating current		O
BlkV	SPS	Blocked below minimum operating voltage		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O
BlkValA	ASG	Block Value (Minimum operating current)		O
BlkValV	ASG	Block Value (Minimum operating voltage)		O

5.11.28 LN: Underfrequency Name: PTUF

For a description of this LN, see IEC 61850-5 (LN PFRQ). This LN shall be used to model the underfrequency part of PFRQ. One instance shall be used per stage.

PTUF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
BlkV	SPS	Blocked because of voltage		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value (frequency)		O
BlkVal	ASG	Voltage Block Value		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.11.29 LN: Voltage controlled time overcurrent Name: PVOC

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

PVOC class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M

PVOC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
AVSt	CSD	Active curve characteristic		O
TmASt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
AVCrv	CURVE	Operating Curve Type (for voltage controlled current curve)		O
TmACrv	CURVE	Operating Curve Type (for current)		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O
OpDlTmms	ING	Operate Delay Time		O
TypRsCrv	ING	Type of Reset Curve		O
RsDlTmms	ING	Reset Delay Time		O

5.11.30 LN: Volts per Hz Name: PVPH

For a description of this LN, see IEC 61850-5. One instance of PVPH shall be used per protection stage.

PVPH class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
VHzSt	CSD	Active curve characteristic		O
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
VHzCrv	CURVE	Operating Curve Type		O
StrVal	ASG	Volts per hertz Start Value		O
OpDlTmms	ING	Operate Delay Time		O
TypRsCrv	ING	Type of Reset Curve		O
RsDlTmms	ING	Reset Delay Time		O
TmMult	ASG	Time Dial Multiplier		O
MinOpTmms	ING	Minimum Operate Time		O
MaxOpTmms	ING	Maximum Operate Time		O

5.11.31 LN: Zero speed or underspeed Name: PZSU

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

PZSU class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**

PZSU class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start		M
Op	ACT	Operate	T	M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
StrVal	ASG	Start Value (Speed)		O
OpDlTmms	ING	Operate Delay Time		O
RsDlTmms	ING	Reset Delay Time		O

5.12 Logical Nodes for power quality events LN Group: Q

5.12.1 Modelling Remarks

This group of logical nodes refers to the modelling of power quality events detection and analysis functions. The models are based on the principles used for modelling protection functions.

There is a one-to-one relationship between the power quality event logical nodes in IEC 61850-5 and the logical node class definitions in this document.

5.12.2 LN: Voltage Variation Name: QVVR

Description of this LN see IEC 61850-5.

QVVR class				
Data Name	**CommonData 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 19.		M
Data				
Controls				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	SPS	Start (Voltage Variation Event in progress)		M
DipStr	SPS	Start (Voltage Dip Event in progress)		O
SwlStr	SPS	Start (Voltage Swell Event in progress)		O
Op	SPS	Operate (Event finished but not Reset)	T	O
Measured Values				
Dur	MV	Voltage Variation Duration of the last completed event		O
Mag	MV	Voltage Variation Magnitude		O
TmLvl[k]	MV	Time at/or above/below Level [k]		
Area	MV	Voltage Variation Area		O
OpCnt[i]	INS	Operation counter		O

Settings				
Phs	ING	Monitored phase		O
PQStd	ING	Power Quality Standard (Enumerated -UNIPEDE, NRS048, CIGRE C4.07, EPRI, IEEE, Custom)		O
DipStrVal	ASG	Voltage Dip Set Point		M
SwlStrVal	ASG	Voltage Swell Set Point		M
IntStrVal	ASG	Voltage Interruption Set Point		O
IntDtMthd	ING	Interruption Detection Method		O
LvlStrVal[k]	ASG	Time at/or above/below Voltage Level Set Point		O
Mag1[i]	ASG	Voltage Variation Event Magnitude Range Point 1		O
Mag2[i]	ASG	Voltage Variation Event Magnitude Range Point 2		O
Dur1[i]	ASG	Voltage Variation Event Duration Range Point 1 [ms]		O
Dur2[i]	ASG	Voltage Variation Event Duration Range Point 2 [ms]		O

5.12.3 LN: LN: Frequency Variation Name: QFVR

Description of this LN see IEC 61850-5.

QFVR class				
Data 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 19.		M
Data				
Controls				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	SPS	Start (Frequency Variation Event in progress)		M
UnHzStr	SPS	Start (Underfrequency Variation Event in progress)		O
OvHzStr	SPS	Start (Overfrequency Variation Event in progress)		O
Op	SPS	Operate (Event finished but not Reset)	T	O
Measured Values				
Dur	MV	Frequency Variation Duration of the last completed event		O
Mag	MV	Frequency Variation Magnitude		O
RteChg	MV	Rate of change of Frequency Value		O
TmLv	MV	Time at/or above/below Level (can be instanciated)		O
Area	MV	Frequency Variation Area		O
CntEvent	BCPR	Operation counter		O
Settings				
Phs	ING	Monitored phase		O
UnHzStrVal	ASG	Underfrequency Set Point		M
OvHzStrVal	ASG	Overfrequency Set Point		M
LvlStrVal	CSD	Time at/or above/below Frequency Level Set Point		O
Mag1	CSD	Frequency Variation Event Magnitude Range Point 1		O
Mag2	CSD	Frequency Variation Event Magnitude Range Point 2		O

Dur1	CSD	Frequency Variation Event Duration Range Point 1 [ms]		O
Dur2	CSD	Frequency Variation Event Duration Range Point 2 [ms]		O

5.12.4 LN: LN: Voltage Unbalance Variation Name: QVUB

Description of this LN see IEC 61850-5.

QVUN class				
Data 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 19.		M
Data				
Controls				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	ACT	Start		M
Op	ACT	Operate	T	O
Measured Values				
Dur	MV	Voltage Unbalance Variation Duration		O
Mag	MV	Maxmum Unbalance Deviation Value		O
OpCnt[i,j]	INS	Operation counter		O
Settings				
UnbDtMthd	ING	Unbalance Detection Method		M
StrVal	ASG	Voltage Unbalance Start Value		M
LvlStrVal[k]	ASG	Time at/or above Unbalance Level Set Point		O
Mag1[i]	ASG	Unbalance Variation Event Magnitude Range Point 1		O
Mag2[i]	ASG	Unbalance Variation Event Magnitude Range Point 2		O
Dur1[i]	ASG	Unbalance Variation Event Duration Range Point 1 [ms]		O
Dur2[i]	ASG	Unbalance Variation Event Duration Range Point 2 [ms]		O

5.12.5 LN: LN: Current Unbalance Variation Name: QIUB

Description of this LN see IEC 61850-5.

QUNB class				
Data 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 19.		M
Data				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	ACT	Start		M
Op	ACT	Operate	T	O
Measured Values				

Dur	MV	Current Unbalance Variation Duration		O
Mag	MV	Maxmum Unbalance Deviation Value		O
OpCnt[i,j]	INS	Operation counter		O
Settings				
UnbDtMthd	ING	Unbalance Detection Method		
StrVal	ASG	Current Unbalance Start Value		M
LvlStrVal[k]	ASG	Time at/or above Unbalance Level Set Point		O
Mag1[i]	ASG	Unbalance Variation Event Magnitude Range Point 1		O
Mag2[i]	ASG	Unbalance Variation Event Magnitude Range Point 2		O
Dur1[i]	ASG	Unbalance Variation Event Duration Range Point 1 [ms]		O
Dur2[i]	ASG	Unbalance Variation Event Duration Range Point 2 [ms]		O

5.12.6 LN: LN: Voltage Transient Name: QVTR

Description of this LN see IEC 61850-5.

QVTR class				
Data 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 19.		M
Data				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	ACT	Start		M
Op	ACT	Operate	T	O
Measured Values				
Dur	MV	Transient Duration		O
Mag	MV	Maxmum Voltage Transient Value		O
RteChg	MV	Rate of change of Voltage Transient Value		O
OpCnt[i,j]	INS	Operation counter		O
Settings				
StrVal[i]	ASG	Voltage Transient Start Value		M
Mag1[i]	ASG	Transient Event Magnitude Range Point 1		O
Mag2[i]	ASG	Transient Event Magnitude Range Point 2		O
Dur1[i]	ASG	Transient Event Duration Range Point 1 [ms]		O
Dur2[i]	ASG	Transient Event Duration Range Point 2 [ms]		O

5.12.7 LN: LN: Current Transient Name: QITR

Description of this LN see IEC 61850-5.

QTRN class				
Data 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 19.		M
Data				
OpCntRs	INC	Resetable counter operation		O
Status Information				
Str	ACT	Start		M
Op	ACT	Operate	T	O
Measured Values				
Dur	MV	Transient Duration		O
Mag	MV	Maxmum Current Transient Value		O
RteChg	MV	Rate of change of Current Transient Value		O
OpCnt[i,j]	INS	Operation counter		O
Settings				
StrVal[i]	ASG	Current Transient Start Value		M
Mag1[i]	ASG	Transient Event Magnitude Range Point 1		O
Mag2[i]	ASG	Transient Event Magnitude Range Point 2		O
Dur1[i]	ASG	Transient Event Duration Range Point 1 [ms]		O
Dur2[i]	ASG	Transient Event Duration Range Point 1 [ms]		O

5.13 Logical Nodes for protection related functions LN Group: R

5.13.1 Modelling Remarks

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

Functionality	IEEE reference	Defined in IEC 61850-5 by LN	Modelled in IEC 61850-7-4 by LN	Comments
Carrier or pilot line wire protection	85	RCPW	PSCH	PSCH is used for line protection schemes instead of RCPW
Directional element			RDIR	Directional element for modelling directed protection with Pxyz nodes
Disturbance recording (acquisition)		RDRE	RDRE RADR RBDR	Basic functionality Analogue channel Binary channel
Others		R…	R…	1:1 Relationship

5.13.2 LN: Disturbance recorder function Name: RDRE

For consistent modelling, the disturbance recorder function described as a requirement in IEC 61850-5 is decomposed into one LN class for analogue channels (RADR) and another LN class for binary channels (RBDR). The output refers to the “IEEE Standard Format for Transient Data Exchange (COMTRADE) for Power Systems” (IEC 60255-24). Disturbance recorders are logical devices built up with one instance of LN RADR or LN RBDR per channel. Since the content of Logical Devices (LD) are not standardised, other LNs may be inside the LD “Disturbance recorder” if applicable. All enabled channels are included in the recording, independently of the trigger mode (TrgMod).

RDRE class

Data 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 19		
Data				
Controls				
RcdTrg	SPC	Trigger recorder		O
MemRs	SPC	Reset recorder memory	T	O
MemClr	SPC	Clear Memory	T	O
OpCntRs	INC	Resetable operation counter		O
Status Information				
RcdMade	SPS	Recording made		M
FltNum	INS	Fault Number		M
GriFltNum	INS	Grid Fault Number		O
RcdStr	SPS	Recording started		O
MemUsed	INS	Memory used in %		O
Settings				
TrgMod	ING	Trigger mode (internal trigger, external or both)		O
LevMod	ING	Level Trigger Mode		O
PreTmms	ING	Pre-trigger time		O
PstTmms	ING	Post-trigger time		O
MemFull	ING	Memory full level		O
MaxNumRcd	ING	Maximum number of records		O
ReTrgMod	ING	Retrigger Mode		O
PerTrgTms	ING	Periodic trigger time in s		O
ExclTmms	ING	Exclusion time		O
OpMod	ING	Operation mode (Saturation, Overwrite)		O
StoRte	ING	Storage rate, i.e. sampling rate of the disturbance recorder		O
TrgMod	ING	Trigger mode (internal trigger, external or both)		O

NOTE 1 The trigger modes (TrgMod) of RDRE, RADR and RBDR are not independent. If the trigger mode of RDRE is external, the trigger modes of RADR and RBDR may be external (no extension of trigger possibilities) or internal (extension of the external trigger mode). If the trigger mode of RDRE is internal, the trigger modes of RADR and RBDR should also be internal because otherwise, no trigger possibility is provided.

NOTE 2 The source of the external trigger is a local issue. It may be a contact or a signal from another logical node.

NOTE 3 The source of the internal trigger is an event detected by the supervision of the channel. It may, for analogue channels, be a limit violation or it may, for binary channels, be a status change. The trigger levels (High/Low) for analogue channels for internal triggering have to be set per channel.

NOTE 4 Since in case of sensors providing the analog data as samples, the sampling rate at the source (TVTR and TCTR)as defined in part 7-3 as Data attribute smpRate may be different from the sampling rate of the recording unit. Therefore, in line with table 4 in part 7-4, the sampling rate of the RDRE is a Data called StoRte meaning Storage rate.

5.13.3 LN: Disturbance recorder channel analogue Name: RADR

In addition to the channel number, all attributes needed for the COMTRADE file are provided either by data from the TVTR or TCTR or by attributes of the measured value (samples subscribed from TVTR or TCTR) itself or by data from pseudo channels (calculated values, derived values of power quality devices). The “circuit component” and “phase identification” is provided by the instance identification of the LN RADR. Channels “1” to “*n*” are created by “1” to “*n*” instances.

RADR class				
Data 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 19		
Data				
Measured Values				
Access via COMTRADE only		Analogue input channel		M
Status Information				
ChTrg	SPS	Channel triggered		M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
ChNum	ING	Channel number		O
TrgMod	ING	Trigger mode (internal trigger, external or both)		O
LevMod	ING	Level Trigger Mode		O
HiTrgLev	ASG	High (positive) trigger level		O
LoTrgLev	ASG	Low (negative) trigger level		O
PreTmms	ING	Pre-trigger time		O
PstTmms	ING	Post-trigger time		O

5.13.4 LN: Disturbance recorder channel binary Name: RBDR

In addition to the channel number, all attributes needed for the COMTRADE file are provided by attributes of the binary input (subscribed from another LN). The “circuit component” and “phase identification” is provided by the instance identification of the LN RBDR. Channels “1” to “*n*” are created by “1” to “*n*” instances.

RBDR class				
Data 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 19		
Data				
Status Information				
Access via COMTRADE only		Binary input channel		M
ChTrg	SPS	Channel triggered		M
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
ChNum	ING	Channel number		O
TrgMod	ING	Trigger mode (internal trigger, external or both)		O
LevMod	ING	Level Trigger Mode		O
PreTmms	ING	Pre-trigger time		O
PstTmms	ING	Post-trigger time		O

Kommentar [HD37]: #468 Add a reference to IEC 60255-24 (after the word COMTRADE) in the description of RADR and RBDR. This standard defines the "Comtrade" format for fault recorder data. Note: It is already included in section 2.

5.13.5 LN: Disturbance record handling Name: RDRS

Kommentar [HD38]: #468 need more explanation of "Analogue input channel" and "Binary Input channel". Also B.4 part should contain a relationship with RDRS in annex

For a description of this LN, see IEC 61850-5. This LN shall handle the disturbance records acquired by some local function. This LN is normally located at station level.

RDRS class

Data 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 19		
Data				
Controls				
AutoUpLod	SPC	Automatic upload		O
DltRcd	SPC	Delete record		O

5.13.6 LN: Breaker failure Name: RBRF

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

RBRF class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start, timer running		O
OpEx	ACT	Breaker failure trip ("external trip")	T	C
OpIn	ACT	Operate, retrip ("internal trip")	T	C
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				
FailMod	ING	Breaker Failure Detection Mode (current, breaker status, both, other)		O
FailTmms	ING	Breaker Failure Time Delay for bus bar trip		O
SPlTrTmms	ING	Single Pole Retrip Time Delay		O
TPTrTmms	ING	Three Pole Retrip Time Delay		O
DetValA	ASG	Current Detector Value		O
ReTrMod	ING	Retrip Mode		O

Condition C: At least one of either data shall be used depending on the applied tripping schema.

5.13.7 LN: Directional element Name: RDIR

This LN shall be used to represent all directional Data in a dedicated LN used for directional relay settings. The protection function itself is modelled by the dedicated protection LN. LN RDIR may be used with functions 21, 32 or 67 according to IEEE device function number designation.

RDIR class				
Data 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 19		
Data				
Status Information				
Dir	ACD	Direction		M
Settings				
ChrAng	ASG	Characteristic Angle		O
MinFwdAng	ASG	Minimum Phase Angle in Forward Direction		O
MinRvAng	ASG	Minimum Phase Angle in Reverse Direction		O

RDIR class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
MaxFwdAng	ASG	Maximum Phase Angle in Forward Direction		O
MaxRvAng	ASG	Maximum Phase Angle in Reverse Direction		O
BlkValA	ASG	Minimum operating current		O
BlkValV	ASG	Minimum operating voltage		O
PolQty	ING	Polarising Quantity		O
MinPPV	ASG	Min Phase-Phase Voltage		O

5.13.8 LN: Fault locator Name: RFLO

Kommentar [HD39]: 836-AT7 &8:

For a description of this LN, see IEC 61850. In case of a fault, the fault location is calculated in Ω. To convert it into km, the line parameters (settings) also have to be known.

RFLO class				
Data 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 19		
Data				
Measured Values				
FltZ	CMV	Fault Impedance		M
FltDiskm	MV	Fault Distance in km		M
Status Information				
FltLoop	INS	Fault Loop		O
Controls				
OpCntRs	INC	Resetable operation counter		O

5.13.9 LN: Power swing detection/blocking Name: RPSB

For a description of this LN, see IEC 61850-5. The power swing is characterised by slow periodic changing of measured impedance. Such a moderate impedance change is tolerated, but may result in tripping of the distance protection function. To avoid this unwanted behaviour, tripping of distance protection function shall be blocked in the correlated zone (power swing blocking). For convenience, the instances of RPSB should have the same instance numbers like the PDIS per zone (RPSB1 and PDIS1, etc.). If the generator is out of step (pole slipping), transient changes of impedance (one per slip) are measured. After a small number of slips, (MaxNumSlp) in a dedicated time window (EvTmms), the generator shall be tripped to avoid mechanical damage (out of step tripping). The actual number of slips shall be reset either by the trip or by the end of evaluation time.

RPSB class				
Data 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 19		
Data				
Status Information				
Str	ACD	Start (Power Swing Detected)		C1
Op	ACT	Operate (Out of step Tripping)	T	C2
BlkZn	SPS	Blocking of correlated PDIS zone		C1
Controls				
OpCntRs	INC	Resetable operation counter		O
Settings				

RPSB class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
ZeroEna	SPG	Zero Enable		O
NgEna	SPG	Negative Sequence Current Supervision Enabled		O
MaxEna	SPG	Max Current Supervision Enabled		O
SwgVal	ASG	Power Swing Delta		O
SwgRis	ASG	Power Swing Delta R		O
SwgReact	ASG	Power Swing Delta X		O
SwgTmms	ING	Power Swing Time		O
UnBlkTmms	ING	Unblocking Time		O
MaxNumSlp	ING	Maximum number of pole slips until tripping (Op, Out of step tripping)		O
EvTmms	ING	Evaluation time (time window, Out of step tripping)		O

Condition C1: Mandatory if RPSB is used for “Power swing blocking”

Condition C2: Mandatory if RPSB is used for “Out of step tripping”

5.13.10 LN: Autoreclosing Name: RREC

Description of this LN see IEC 61850-5. The number of Trigger Modes (TrMod *i*) and Reclose Times (RecTmms*i*) is equal to the maximum allowed number of reclose cycles (MaxCyc). The trigger for the activation of RREC can be the start signal of PTRC, or the report “breaker open” of the circuit breaker, or any other signals and combination of signals. If different types of protections are involved in the Autoreclosing process, all relevant data have to be published and subscribed by the allocated protection LNs. An example for the interaction of Protection (Pxyz) and Autoreclosing (RREC) is given in Annex B.

RREC class				
Data 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 19.		
Data				
Controls				
BlkRec	SPC	Block Reclose		O
ChkRec	SPC	Check Reclosing		O
OpCntRs	INC	Resetable operation counter		O
Status Information				
Auto	SPS	Automatic Operation (external switch status)		O
TrBeh	INS	Defines Single or Three Pole Tripping (mostly resulting from combination TrMod and RecCyc) for the next trip to be subscribed by the Protection		O
RecCyc	INS	Actual Reclose Cycle		O
OpCls	ACT	Operation”close switch” issued to close the XCBR		M
AutoRecSt	INS	Auto Reclosing Status		M
Settings				
TrMod1	ING	Indicates if Single Pole Tripping allowed or Three Pole Tripping always requested in the first cycle		O
TrMod2	ING	Indicates if Single Pole Tripping allowed or Three Pole Tripping always requested in the second cycle		O
TrMod3	ING	Indicates if Single Pole Tripping allowed or Three Pole Tripping always requested in the third cycle		O
MaxCyc	ING	Maximum number of Reclose cycles		O
UseCyc	ING	Used actual set maximum number of Reclose cycles		O

RREC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
MaxTmms	ING	Maximum time after fault detection during which autoreclosing is permitted		O
RecTmms1	ING	First Reclose Time		O
RecTmms2	ING	Second Reclose Time		O
RecTmms3	ING	Third Reclose Time		O
PlsTmms	ING	Close Pulse Time		O
RclTmms	ING	Reclaim Time		O

All settings with an index higher than 1 up to MaxCyc will appear if MaxCyc is higher than 1. UseCyc ≤ MaxCyc

5.13.11 LN: Synchronism-check or synchronising Name: RSYN

For a description of this LN, see IEC 61850-5. The voltage phasor difference from both sides of an open breaker is calculated and compared with predefined switching conditions (synchrocheck). Included is the case that one side is dead (example: energising a dead line) and the case that the phasor on one side can be actively controlled by “higher” or “lower” (means synchronising).

RSYN class				
Data 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 19		
Data				
Status Information				
RHz	SPS	Raise Frequency		C
LHz	SPS	Lower Frequency		C
RV	SPS	Raise Voltage		C
LV	SPS	Lower Voltage		C
Rel	SPS	Release		M
VInd	SPS	Voltage Difference Indicator		O
AngInd	SPS	Angle Difference Indicator		O
HzInd	SPS	Frequency Difference Indicator		O
SynPrg	SPS	Synchronising in progress		O
Measured Values				
DifVClc	MV	Calculated Difference in Voltage		O
DifHzClc	MV	Calculated Difference in Frequency		O
DifAngClc	MV	Calculated Difference of Phase Angle		O
Settings				
DifV	ASG	Difference Voltage		O
DifHz	ASG	Difference Frequency		O
DifAng	ASG	Difference Phase Angle		O
LivDeaMod	ING	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
PlsTmms	ING	Close Pulse Time		O
BkrTmms	ING	Closing time of breaker		O

Kommentar [HD40]: changed regarding WG18 comments (by e-mail) 03jan07

Note: Conditional attributes are mandatory in case of synchronising, optional in case of synchronism-check.

5.13.12 LN: For communication interfaces Name: RTPC

This LN will be changed as result of the SS-SS-Task force.

5.14 Logical Nodes for supervision and monitoring LN Group: S

5.14.1 Modelling remarks

Table 8 – Relation between IEC 61850-5 and IEC 61850-7-4 for supervision and monitoring LNs

Functionality	Defined in IEC 61850-5 by LN	Modelled in IEC 61850-7-4 by LN	Comments
Insulation medium supervision	SIMS	SIML	Insulation liquid like oil
		SIMG	Insulation gas like SF_6

5.14.2 LN: Monitoring and diagnostics for arcs Name: SARC

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

SARC class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCntRs	INC	Resetable Operation Counter (Switch and fault arcs)		O
Status Information				
FACntRs	INC	Fault arc counter		M
FADet	SPS	Fault arc detected		M
ArcCntRs	INC	Switch arc counter		O
SwArcDet	SPS	Switch arc detected		O

5.14.3 LN: Insulation medium supervision (gas) Name: SIMG

General description of this LN see IEC 61850-5. Insulation medium is gas, e.g. SF6 in gas isolated devices. If more measurement positions are needed and they are located to the same measuring object, these shall be added by numbered extensions of the data (e.g. Tmp1, Tmp2, .) in the existing LN SIMG. For other measuring objects related to the same IED, a new instance of SIMG may be used. If the new measuring point(s) is/are related to a new IED, in this new IED a new instance of SIMG shall be used.

SIMG class				
Data 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 19		
Data				

SIMG class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
Pres	MV	Isolation gas pressure		O
Den	MV	Isolation gas density		O
Tmp	MV	Isolation gas temperature		O
Status Information				
InsAlm	SPS	Insulation gas critical (refill isolation medium)		M
InsBlk	SPS	Insulation gas not safe (block device operation)		O
InsTr	SPS	Insulation gas dangerous (trip for device isolation)		O
InsLevMax	SPS	Insulation gas level maximum (relates to predefined filling value)		O
InsLevMin	SPS	Insulation gas level minimum (relates to predefined filling value)		O

5.14.4 LN: Insulation medium supervision (liquid) Name: SIML

For a description of this LN, see IEC 61850-5. The insulation medium is a liquid such as oil like that used for example for some transformers and tap changers. If more measurement positions are needed, these shall be added by numbered extensions of the data (for Tmp use Tmp1, Tmp2, …) in the existing LN SIML. For other measuring objects related to the same IED, a new instance of SIML may be used. If the new measuring point(s) is/are related to a new IED a new instance of SIML shall be used..

SIML class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
Tmp	MV	Insulation liquid temperature		O
Lev	MV	Insulation liquid level		O
Pres	MV	Insulation liquid pressure		O
H2O	MV	Relative saturation of moisture in insulating liquid (in %)		O
H2OPap	MV	Relative saturation of moisture in insulating paper (in %)		O
H2OAir	MV	Relative saturation of moisture in air in expansion volume (in %)		O
H2OTmp	MV	Temperature of insulating liquid at point of H2O measurement		O
H2ppm	MV	Measurement of Hydrogen (H_2 in ppm)		O
N2ppm	MV	Measurement of N2 in ppm		O
COppm	MV	Measurement of CO in ppm		O
CO2ppm	MV	Measurement of CO2 in ppm		O
CH4ppm	MV	Measurement of CH4 in ppm		O
C2H2ppm	MV	Measurement of C2H2 in ppm		O
C2H4ppm	MV	Measurement of C2H4 in ppm		O
C2H6ppm	MV	Measurement of C2H6 in ppm		O
O2ppm	MV	Measurement of O2 in ppm		O
TDCG	MV	Measurement of total dissolved combustable gases (TDCG)		O

SIML class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
FltGas	MV	Fault gas volume in Buchholz relay		O
Status Information				
InsAlm	SPS	Insulation liquid critical (refill insulation medium)		M
InsBlk	SPS	Insulation liquid not safe (block device operation)		O
InsTr	SPS	Insulation liquid dangerous (trip for device isolation)		O
TmpAlm	SPS	Insulation liquid temperature alarm		O
GasInsAlm	SPS	Gas in insulation liquid alarm (may be used for Buchholz alarm)		O
GasInsTr	SPS	Gas in insulation liquid trip (may be used for Buchholz trip)		O
GasFlwTr	SPS	Insulation liquid flow trip because of gas (may be used for Buchholz trip)		O
InsLevMax	SPS	Insulation liquid level maximum		O
InsLevMin	SPS	Insulation liquid level minimum		O
H2Alm	SPS	H2 alarm		O
MstAlm	SPS	Moisture sensor alarm		O

5.14.5 LN: Monitoring and diagnostics for partial discharges Name: SPDC

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

SPDC class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCnt	INS	Operation counter		M
Measured Values				
AcuPaDsch	MV	Acoustic level of partial discharge in db		C
AppPaDsch	MV	Apparent charge of partial discharge, peak level (PD)		C
NQS	MV	Average dischcarge current		C
UHFPaDsch	MV	UHF level of partial discharge in db		C
Status Information				
PaDschAlm	SPS	Partial discharge alarm		C

Condition C: depending on the functionality, at least one of the data AcuPaDsch, UHFPaDch, NQS, AppPaDsch or PaDschAlm shall be used.

5.14.6 LN: Temperature supervision Name: STMP

Logical Node STMP shall be used to represent various devices that supervise the temperatures of major plant objects. It provides alarm and trip / shutdown functions. If more than one sensor (LN TTMP) is connected the LN STMP shall be instantiated for each sensor.

STMP class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O

EEName	DPL	External equipment nameplate		O
Loc	SPS	Local operation		O
Measured values				
Tmp	MV	Temperature		O
Status information				
Alm	SPS	Temperature alarm level reached		M
Trip	SPS	Temperature trip level reached		O
Settings				
TmpAlmSpt	ASG	Temperature alarm level set-point		M
TmpTrSpt	ASG	Temperature trip level set-point		O

5.14.7 LN: Vibration supervision Name: SVBR

Logical Node SVBR shall be used to represent various devices that supervise the vibrations in rotating plant objects such as shafts, turbines, generators etc. It provides alarm and trip / shutdown functions. If more than one sensor (LN TVBR) is connected, the LN SVBR shall be instantiated for each sensor

SVBR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
Vbr	MV	Vibration level [mm/s]		O
AxDsp	MV	Total axial displacement [mm]		O
Status Information				
Alm	SPS	Vibration alarm level reached		M
Trip	SPS	Vibration trip level reached		O
Settings				
VbrAlmSpt	ASG	Vibration alarm level set-point		M
VbrTrSpt	ASG	ASG Vibration trip level set-point		O
AxDpAlmSpt	ASG	ASG Axial displacement alarm level set-point		O
AxDpTrpSpt	ASG	ASG Axial displacement trip level set-point		O

5.15 Logical Nodes for instrument transformers and sensors LN Group: T

This group of Logical Nodes represents the sensors for all the different values which have to be continuously sampled for monitoring their behavior over time. These samples are used either by dedicated processing Logical Node classes as for Protection (see LN Group P) or by the related Supervision Logical Node classes (see LN group S). The sampling rate defines the time resolution of the resulting figures of the process ing Logcial Node classes (group P, group S). The modelling of samples are conditional since they are not exposed to communication in any case since T and S nodes may be implemented in the same IED.

5.15.1 LN: Angle Name: TANG

Logical Node TANG shall be used to represent a measurement of an angle between two objects (one of which might be a theoretical vertical or horizontal line). The measurement can be returned optionally as degrees or radians (° or rad). Compare also with the specific gate position indicator (HGPI) of this document.

TANG class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
AngRadSv	SAV	Angle given as [Rad]		C
AngDrgrSv	SAV	Angle given as [°]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.2 LN: Axial displacement Name: TAXD

Logical Node TAXD shall be used to represent an axial displacement value. The axial displacement can, depending on the application, be either longitudinal or transverse to the shaft. This sensor is often used together with vibration sensors as input to a vibration monitoring system.

TTXD class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
AxDspSv	SAV	Total axial displacement [mm]		C
Settings				
SmpIntv	ING	Sampling interval		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.3 LN: Current transformer Name: TCTR

For a description of this LN, see IEC 61850-5. The current is delivered as sampled values. The sampled values are transmitted as engineering values, i.e. as “true” (corrected) primary current values. Therefore, the transformer ratio and the correction factors are of no interest for the transmitted samples, but for maintenance purposes of an external conventional (magnetic) transducer only. In addition, status information is provided and some other settings are accepted from the LN TCTR.

TCTR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
AmpSv	SAV	Current (Sampled value)		C
Settings				
ARtg	ASG	Rated Current		O

TCTR class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
HzRtg	ASG	Rated Frequency		O
Rat	ASG	Winding ratio of an external current transformer (transducer) if applicable		O
Cor	ASG	Current phasor magnitude correction of an external current transformer		O
AngCor	ASG	Current phasor angle correction of an external current transformer		O

Kommentar [HD41]: scale factor should be incl.

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.4 LN: Distance Name: TDST

Logical Node TDST shall be used to represens a measurement of the distance to an object that can move. It is intended to provide a measurement between a fixed location and a movable object.

TDST class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
DstSv	SAV	Distance [m]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.5 LN: Liquid flow Name: TFLW

Logical Node TFLW shall be used to represent a measurement of media flow rate through the device where it is located.

TFLW class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
FlwSv	SAV	Liquid flow rate [m^3/s]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.6 LN: Frequency Name: TFRQ

Logical Node TFRQ shall be used to represent a measurement of frequency. It is intended for any frequency that is not related to electrical ac measurements. It can be used for e.g. sound

measurements, vibrations and timing of repeated occurrences. If a pure vibration is to be measured, where the movement rather than the frequency is of interest, the TVBR logical node is recommended.

TFRQ class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
HzSv	SAV	Frequency [Hz] related to non-electrical values		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.7 LN: Humidity Name: THUM

Logical Node THUM shall be used to represent a measurement of humidity in the media that is monitored. The result is given in percent of maximum possible humidity.

THUM class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
HmdtSv	SAV	Humidity [%]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.8 LN: LMedia level Name: TLVL

Logical Node TLVL shall be used to represent a measurement of the media level in the container where it is located. The level is expressed as a percentage of full container. For a measurement given as a distance from a base level the HLVL logical node shall be used.

TLVL class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
LevPcSv	SAV	Level [%]		C
Settings				

SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.9 LN: Magnetic field Name: TMGF

Logical Node TMGF shall be used to represent a measurement of the magnetic field strength at the place where it is located.

TMGF class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
MagFldSv	SAV	Magnetic field strength / flux density [m/s]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.10 LN: Movement sensor Name: TMVM

Logical Node TPOS shall be used to represent the position of a movable device, actuator or similar. The position is given as a percentage of the full movement of the device being monitored. Compare with TDST that returns the distance in m.

TMVM class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
MvmRteSv	SAV	Movement rate [m/s]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.11 LN: Position indicator Name: TPOS

Logical Node TPOS shall be used to represent the position of a movable device, actuator or similar. The position is given as a percentage of the full movement of the device being monitored. Compare with TDST that returns the distance in m.

TPOS class				
Data 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 19		

Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
PosPcSv	SAV	Position given as percentage of full movement [%]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.12 LN: Pressure sensor Name: TPRS

Logical Node TPRS shall be used to represent the absolute pressure of a medium. The medium might be air, water, oil, steam or any other substance, the pressure of which needs to be supervised.

TPRS class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
PresSv	SAV	Pressure of media [Pa]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.13 LN: Rotation trnsmitter Name: TRTN

Logical Node TRTN shall be used to represent the rotational speed of a rotating device. Different measurement principles may be used, the presented result is however the same.

TRTN class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
SpdSv	SAV	Rotational speed [r/s]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.14 LN: Sound pressure sensor Name: TSND

Logical Node TSND shall be used to represent the sound pressure level at the location where the sensor is located.

TSND class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
SndSv	SAV	Sound pressure level [B]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.15 LN: Temperature sensor Name: TTMP

Logical Node TTMP shall be used to represent a single temperature measurement.

TTMP class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
TmpSv	SAV	Temperature [℃]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.16 LN: Mechanical tension / stress Name: TTNS

Logical Node TTNS shall be used to represent a measurement of the mechanical tension in an object.

TTNS class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
Tns	SAV	Mechanical stress [N]		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.17 LN: Vibration sensor Name: TVBR

Logical Node TVBR shall be used to represent a vibration level value. In case the vibration can be defined as a frequency, the TFRQ logical node could be used instead.

TVBR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
VbrSv	SAV	Vibration [mm/s]		C
Settings				
SmpInt	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.18 LN: Voltage transformer Name: TVTR

For a description of this LN, see IEC 61850-5. The voltage is delivered as sampled values. The sampled values are transmitted as engineering values, i.e. as “true” (corrected) primary voltage values. Therefore, the transformer ratio and the correction factors are of no interest for the transmitted samples but for maintenance purposes of an external conventional (magnetic) transducer only. In addition, status information is provided and some other settings are accepted from the LN TVTR.

TVTR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
VolSv	SAV	Voltage (sampled value)		C
Status Information				
FuFail	SPS	TVTR fuse failure		O
Settings				
VRtg	ASG	Rated Voltage		O
HzRtg	ASG	Rated frequency		O
Rat	ASG	Winding ratio of external voltage transformer (transducer) if applicable		O
Cor	ASG	Voltage phasor magnitude correction of external voltage transformer		O
AngCor	ASG	Voltage phasor angle correction of external voltage transformer		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.15.19 LN: Water acidity Name: TWPH

Logical Node TWPH shall be used to represent a water pH level value.

TWPH class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
Measured Values				
HydrPhSv	SAV	WaterpH level (0-14)		C
Settings				
SmpRte	ING	Sampling rate setting		O

Condition C: The data is mandatory if the data are transmitted over a communication link and therefore they are visible.

5.16 Logical Nodes for switchgear LN Group: X

5.16.1 LN: Circuit breaker Name: XCBR

This LN is used for modelling switches with short circuit breaking capability. Additional LNs for example SIMS, etc. may be required to complete the logical modelling for the breaker being represented. The closing and opening commands shall be subscribed from CSWI or CPOW if applicable. If no “Time Activated Control” service is available between CSWI or CPOW and XCBR, the opening and closing commands shall be performed with a GSE-message (see IEC 61850-7-2).

XCBR class				
Data 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 19		
Data				
LocKey	SPS	Local operation (local means without substation automation communication, hardwired direct control)		M
RemCtlBlk	SPC	Remote Control Blocked		O
Loc	SPS	Local Control Behavior		M
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCnt	INS	Operation counter		M
Controls				
Pos	DPC	Switch position		M
BlkOpn	SPC	Block opening		M
BlkCls	SPC	Block closing		M
ChaMotEna	SPC	Charger motor enabled		O
Metered Values				
SumSwARs	BCR	Sum of Switched Amperes, resetable		O
Status Information				
CBOpCap	INS	Circuit breaker operating capability		O
POWCap	INS	Point On Wave switching capability		O
MaxOpCap	INS	Circuit breaker operating capability when fully charged		O

Kommentar [HD42]: tissue #306
in annex give an example

Kommentar [HD43]: change comes from Amd2, attention important change; the same for XSWI

5.16.2 LN: Circuit switch Name: XSWI

This LN is used for modelling switches without short circuit breaking capability, for example disconnectors, air break switches, earthing switches, etc. Additional LNs, SIMS, etc. may be required to complete the logical model for the switch being represented. The closing and opening commands shall be subscribed from CSWI. If no “Time Activated Control” service is available between CSWI or CPOW and XSWI, the opening and closing commands shall be performed with a GSE-message (see IEC 61850-7-2).

XSWI class				
Data 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 19		
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
Loc	SPS	Local Control Behavior		M
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCnt	INS	Operation counter		M
Controls				
Pos	DPC	Switch position		M
BlkOpn	SPC	Block opening		M
BlkCls	SPC	Block closing		M
ChaMotEna	SPC	Charger motor enabled		O
Status Information				
SwTyp	INS	Switch type		M
SwOpCap	INS	Switch operating capability		O
MaxOpCap	INS	Circuit switch operating capability when fully charged		O

Kommentar [HD44]: tissue #306
in annex give an example

5.17 Logical Nodes for power transformers LN Group: Y

5.17.1 LN: Earth fault neutralizer (Petersen coil) Name: YEFN

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

YEFN class				
Data 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 19		
Data				
LocKey	SPS	Local operation		M
RemCtlBlk	SPC	Remote Control Blocked		O
Loc	SPS	Local Control Behavior		O
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
ECA	MV	Earth coil current		M
Controls				
ColTapPos	ISC	Coil Tap Position		M
ColPos	APC	Plunge Core Position		O

Kommentar [HD45]: tissue #306
in annex give an example

5.17.2 LN: Tap changer Name: YLTC

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

YLTC class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCnt	INS	Operation counter		O
Measured Values				
Torq	MV	Drive torque		O
MotDrvA	MV	Motor drive current		O
AbrPrt	MV	Abrasion (in %) of parts subject to wear		O
Controls				
TapPos	ISC	Change Tap Position to dedicated position		C
TapChg	BSC	Change Tap Position (stop, higher, lower)		C
Status Information				
EndPosR	SPS	End position raise reached		M
EndPosL	SPS	End position lower reached		M
OilFil	SPS	Oil filtration		O
MotDrvTr	SPS	Motor drive overcurrent trip		O
VacCelAlm	SPS	Circuit status of vacuum cell (ANSI)		O
OilFilTr	SPS	Oil filter unit trip		O
OoStep	SPS	Out of step alarm: supervision of diverter switch synchronism		O
LTCCycAlm	SPS	LTC switching cycle incomplete: tap change operation without diverter switch operation		O

Condition C: depending on the tap-change method, at least one of the two controls TapChg and TapPos shall be used.

5.17.3 LN: Power shunt Name: YPSH

For a description of this LN, see IEC 61850-5. The LN class power shunt also includes the switch for closing and opening the shunt.

YPSH class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Controls				
Pos	DPC	Switch position		M
BlkOpn	SPC	Block opening		M
BlkCls	SPC	Block closing		M
ShOpCap	INS	Operating capability		M
ChaMotEna	SPC	Charger motor enabled		O
MaxOpCap	INS	Power shunt operating capability when fully charged		O

5.17.4 LN: Power transformer Name: YPTR

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

YPTR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
HPTmp	MV	Winding hotspot temperature (in ℃)		O
Age	MV	Aging rate		O
LoadFact	MV	Load factor (apparent power / rated power)		O
MaxPwr	MV	Maximum permissible permanent power (overload) [W]		O
OvlTmm	MV	Maximum permissible overload time with cooling unit [min]		O
OvlTmmEmg	MV	Maximum permissible overload time without cooling unit (emergency case) [min]		O
EnvTmp	MV	Temperature of environment at the location of the power transformer (may be different to the location of the cooling equipment, see CCGR.EnvTmp).		O
EnvHum	MV	Humidity of environment		O
EnvPres	MV	Pressure of environment		O
CoreTmp	MV	Core temperature		O
Status Information				
HPTmpAlm	SPS	Winding hot point temperature alarm		O
HPTmpTr	SPS	Winding hot point temperature trip	T	O
OANL	SPS	Operation at no load		O
OpOvA	SPS	Operation at overcurrent		O
OpOvV	SPS	Operation at overvoltage		O
OpUnV	SPS	Operation at undervoltage		O
CGAlm	SPS	Core ground alarm		O
MbrAlm	SPS	Leakage supervision alarm of tank conservator membrane		O
Settings				
HiVRtg	ASG	Rated Voltage (High voltage level)		O
LoVRtg	ASG	Rated Voltage (Low voltage level)		O
PwrRtg	ASG	Rated power		O

5.18 Logical Nodes for further power system equipment LN Group: Z

5.18.1 LN: Auxiliary network Name: ZAXN

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

ZAXN class				
Data 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 19		
Data				

ZAXN class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
Vol	MV	Voltage of the auxiliary network		O
Amp	MV	Current of the auxiliary network		O

5.18.2 LN: Battery Name: ZBAT

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

ZBAT class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
Vol	MV	Battery voltage		M
VolChgRte	MV	Rate of battery voltage change		O
Amp	MV	Battery drain current		O
Controls				
BatTest	SPC	Start battery test		O
Status Information				
TestRsl	SPS	Battery Test Results		O
BatHi	SPS	Battery high (voltage or charge - Overcharge)		O
BatLo	SPS	Battery low (voltage or charge)		O
Settings				
LoBatVal	ASG	Low battery alarm value		O
HiBatVal	ASG	High battery alarm value		O

5.18.3 LN: Bushing Name: ZBSH

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

ZBSH class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
React	MV	Relative capacitance of bushing related to the data RefReact		M
AbsReact	MV	Online capacitance, absolute value		O
LosFact	MV	Loss Factor (tan delta)		O
Vol	MV	Voltage of bushing measuring tap		O
DisplA	MV	Displacement current: apparent current at measuring tap		O
LeakA	MV	Leakage current: active current at measuring tap		O
Settings				

ZBSH class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
RefReact	ASG	Reference capacitance for bushing at commissioning		O
RefPF	ASG	Reference power factor for bushing at commissioning		O
RefV	ASG	Reference voltage for bushing at commissioning		O

5.18.4 LN: Power cable Name: ZCAB

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

ZCAB class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.5 LN: Capacitor bank Name: ZCAP

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

ZCAP class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Controls				
CapDS	SPC	Capacitor bank device status		M
Status Information				
DschBlk	SPS	Blocked due to discharge		M

5.18.6 LN: Converter Name: ZCON

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

ZCON class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.7 LN: Generator Name: ZGEN

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

ZGEN class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Controls				
GnCtl	DPC	Generator control		M
DExt	SPC	De-excitation		M
AuxSCO	SPC	Aux. supply change over		O
StopVlv	SPC	Stop valve		O
ReactPwrR	SPC	Reactive power raise		O
ReactPwrL	SPC	Reactive power lower		O
Measured Values				
GnSpd	MV	Speed		O
Status Information				
GnSt	INS	Generator state (stopped, Starting, Started, Stopping, Disabled)		M
OANL	SPS	Operation at no load		M
ClkRot	SPS	Phase rotation clockwise		M
CntClkRot	SPS	Phase rotation counter clockwise		M
OpUnExt	SPS	Operation at under-excitation		M
OpOvExt	SPS	Operation at over-excitation		M
LosOil	SPS	Loss of oil		O
LosVac	SPS	Loss of vacuum		O
PresAlm	SPS	Low pressure alarm		O
Settings				
DmdPwr	ASG	Demanded power		O
PwrRtg	ASG	Rated power		O
VRtg	ASG	Rated Voltage		O

5.18.8 LN: Gas insulated line Name: ZGIL

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

ZGIL class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.9 LN: Power overhead line Name: ZLIN

For a description of this LN, see IEC 61850-5. ZLIN represents an overhead line with all physical characteristics.

ZLIN class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Settings				
LinLenkm	ASG	Line length in km		O
R1	ASG	Positive-sequence line resistance		O
X1	ASG	Positive-sequence line reactance		O
R0	ASG	Zero-sequence line resistance		O
X0	ASG	Zero-sequence line reactance		O
Z1Mod	ASG	Positive-sequence line impedance value		O
Z1Ang	ASG	Positive-sequence line impedance angle		O
Z0Mod	ASG	Zero-sequence line impedance value		O
Z0Ang	ASG	Zero-sequence line impedance angle		O
Rm0	ASG	Mutual resistance		O
Xm0	ASG	Mutual reactance		O
Zm0Mod	ASG	Mutual impedance value		O
Zm0Ang	ASG	Mutual impedance angle		O

5.18.10 LN: Motor Name: ZMOT

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

ZMOT class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Controls				
DExt	SPC	De-excitation		M
Status Information				
LosOil	SPS	Loss of oil		O
LosVac	SPS	Loss of vacuum		O
PresAlm	SPS	Low pressure alarm		O

5.18.11 LN: Reactor Name: ZREA

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

ZREA class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.12 LN: Neutral resistor Name: ZRES

Logical Node ZRES shall be used to represent a neutral resistor. The resistor is normally not controlled; this LN is a placeholder for rating plate data.

ZRES class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.13 LN: Rotating reactive component Name: ZRRC

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

ZRRC class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

5.18.14 LN: Surge arrestor Name: ZSAR

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

ZSAR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpCnt	INS	Operation counter		O
Status Information				
OPSA	SPS	Operation of surge arrestor	T	M

5.18.15 LN: Semi-conductor controlled rectifier Name: ZSCR

Logical Node ZSCR shall be used to represent a controllable rectifier. A typical use is to provide the controllable dc current within an excitation system.

ZSCR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Status Information				
Alm	SPS	Control function alarm		M
Settings				
SetA	ASG	Current setting (if operating to a fixed current)		C
SetV	ASG	Voltage setting (if operating to a fixed voltage)		C
Controls				
OpModRect	ING	Control mode setting (A, V, W)		C
AmpSpt	APC	Current target set-point		C
VolSpt	APC	Voltage target set-point		C

Condition C: The rectifier can be used to provide a fixed voltage and controllable current, to provide a fixed current and a controllable voltage or have both current and voltage controllable. If either voltage or current is fixed, the set-point shall be given as a setting.

5.18.16 LN: Synchronous machine Name: ZSMC

Logical Node ZSMC shall be used to represent any type of synchronous machine. The logical node only includes rating data, all controls and operational status information is found in other logical nodes in this document, compare e.g. the logical node HUNT.

Kommentar [HD46]: LN HUNT exists only in Hydro part therefore reference is not correct

ZSMC class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Measured Values				
PwrRtg	INS	Rated apparent power [VA]		M
VRtg	INS	Rated voltage [V]		M
ARtg	INS	Rated stator current [A]		M
SpdRtg	INS	Synchronous machine rated speed [s^{-1}]		M
SpdCrit	INS	Synchronous machine critical speed of the generator [s^{-1}]		O
FldRisTmp	INS	Reference temperature for field resistance [℃]		O
StatRisTmp	INS	Reference temperature for stator resistance [℃]		O
Status Information				
RotDir	SPS	Field rotation direction (TRUE = clockwise)		O
Settings				
StatRis	ASG	Stator resistance [Ohm]		O
PFRtg	ASG	Rated power factor		O
Inertia	ASG	Synchronous machine moment of inertia J [kgm^2]		O

ZSMC class				
Data Name	**Common Data Class**	**Explanation**	**T**	**M/O/C**
FldAmpRtg	ASG	Rated field current [A]		O
FldAmpRtgO	ASG	No-load field current for rated stator voltage [A]		O
FldRis	ASG	Field resistance [Ohm]		O
BaseImp	ASG	Base p.u. impedance [Ohm /phase]		O
StatLReact	ASG	Stator leakage reactance [p.u.]		O
ReactXd	ASG	D-axis synchronous reactance Xd [p.u.] (unsaturated)		O
ReactXdPr	ASG	D-axis transient synchronous reactance Xd' [p.u.] (unsaturated)		O
ReactXdSe	ASG	D-axis Reactance Xd'' [p.u.] (unsaturated)		O
ReactXq	ASG	Q-axis synchronous reactance Xq [p.u.] (unsaturated)		O
ReactXqPr	ASG	Q-axis transient reactance Xq' [p.u.] (unsaturated)		O
ReactXqSe	ASG	Q-axis sub-transient reactance Xq'' [p.u.] (unsaturated)		O
ReactX0	ASG	Zero sequence Reactance X0 [p.u.] (unsaturated)		O
ReactX2	ASG	Negative sequence Reactance X2 [p.u.] (unsaturated)		O
TmCstTdP	ASG	D-axis short circuit transient time constant Td' [s] (unsaturated)		O
TmCstTdS	ASG	D-axis short-circuit sub-transient time constant Td''[s] (unsaturated)		O
TmCstTd0P	ASG	D-axis open circuit transient time constant Td0' [s] (unsaturated)		O
TmCstTd0S	ASG	D-axis open circuit sub-transient time constant Td0''[s] (unsaturated)		O
TmCstTqP	ASG	Q-axis short circuit transient time constant Tq' [s] (unsaturated)		O
TmCstTqS	ASG	Q-axis short circuit sub-transient time constant Tq '' [s] (unsaturated)		O
TmCstTq0P	ASG	Q-axis open circuit transient time constant Tq0' [s] (unsaturated)		O
TmCstTq0S	ASG	Q-axis open circuit sub-transient time constant Tq0''[s] (unsaturated)		O
TmCstTa	ASG	Armature time constant Ta[s] (unsaturated)		O
SatCffS10	ASG	Saturation coefficient S1.0		O
SatCffS12	ASG	Saturation coefficient S1.2		O

5.18.17 LN: Thyristor controlled frequency converter Name: ZTCF

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

ZTCF class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O
Settings				
PwrHz	ASG	Target frequency		O

5.18.18 LN: Thyristor controlled reactive component Name: ZTCR

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

ZTCR class				
Data 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 19		
Data				
EEHealth	INS	External equipment health		O
EEName	DPL	External equipment name plate		O
OpTmh	INS	Operation time		O

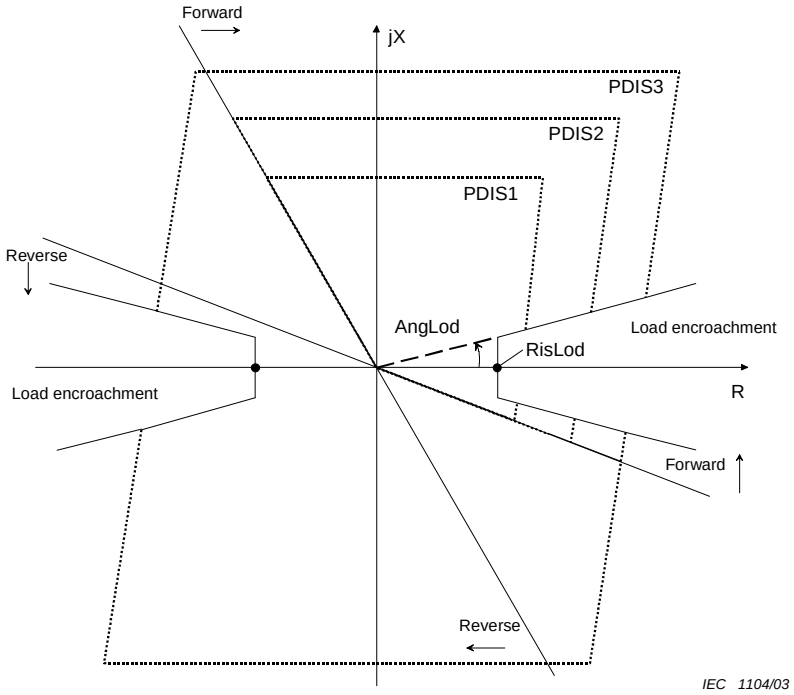
6 Data name semantics

In Table 9, the data used in Clause 5 are described. The meaning of Boolean values are FALSE = 0, TRUE = 1.

Table 9 – Description of Data

Data Name	Semantics
A	Phase currents (IL1, IL2, IL3)
AcsCtlFail	Number of access control failures detected: a data that the client wanted to access exists in the server, but based on the access view of the association with that client, an access to the data was refused.
AcuPaDsch	Acoustic level of partial discharge in db.
AdjMsg	Adjustment Message 0 Completed 1 Cancelled 2 New adjustments 3 Under way
AgeRat	Ageing rate, for example of transformer.
Alm	General single alarm.
AlmLstOv	TRUE = Indication that the Alarm List has overflowed.
AlmThm	Thermal Alarm.
AlmVal	Alarm Value is the pre-set value for a measurand that when reached will result in an alarm.
Amp	Current of a non-three-phase circuit.
Ang	Angle between phase voltage and current.
AngCor	Phase angle correction of a phasor (used for example for instrument transformers/transducers).
AngInd	This Data indicates the check result of the differences between the angles of the busbar and line voltages. FALSE indicates that the angle difference is below the required limit. The angle difference criteria for the synchronising are fulfilled. TRUE indicates the angle difference exceeds the limit. The synchronising process shall be aborted because the angle criteria are not fulfilled (synchrocheck) or shall be continued with turbine control activities (synchronising).

Kommentar [HD47]: #209

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>AngLod</td><td>Angle for load area. The following is an example of the definition of load encroachment used for the Data AngLod and RisLod with polygonal characteristic, applicable also with MHO. PDIS1, PDIS2, and PDIS3 are different instances of the LN PDIS, one for each zone. See also RisGndRch.
 
</td></tr>
<tr><td>AnIn</td><td>Analogue Input used for generic I/O.</td></tr>
<tr><td>ArcCntRs</td><td>Arc counter, resetable.</td></tr>
<tr><td>ARtg</td><td>Rated current, intrinsic property of the device, which cannot be set/changed from remote.</td></tr>
<tr><td>AStr</td><td>Current level: if this level is exceeded, the related functions start a dedicated action.</td></tr>
<tr><td>Area</td><td>The total calculated Area of a power quality event (ex. Voltage Sag in Fig. XXX)</td></tr>
<tr><td>AuthFail</td><td>Number of authorisation failures: an association to the client could not be established due to an authorisation failure.</td></tr>
<tr><td>Auto</td><td>This Data is responsible for the enabling or disabling of the output circuit of the automatic controller; automatic (TRUE) = output circuit is enabled, not automatic (FALSE) = output circuit is disabled.</td></tr>
<tr><td>AutoRecSt</td><td>This Data represents whether or not the auto reclosing is ready, in progress, or successful.
<table>
<tr><th>Auto Reclosing Status</th><th>Value</th></tr>
<tr><td>Ready</td><td>1</td></tr>
<tr><td>In Progress</td><td>2</td></tr>
<tr><td>Successful</td><td>3</td></tr>
</table></td></tr>
<tr><td>AutoUpLod</td><td>TRUE = automatic uploading of the disturbance recorder files.</td></tr>
<tr><td>AuxSCO</td><td>TRUE = Commands change over to operation from the auxiliary power supply.</td></tr>
<tr><td>AvAmps</td><td>Average current in a defined evaluation interval (period)</td></tr>
<tr><td>AVCrv</td><td>Characteristic Curve for protection operation of the form: y = f(x), where x = V (voltage) and y = A (current) The integers representing the different curves are given in the definition of CDC CURVE in IEC 61850-7-3.</td></tr>
<tr><td>AvgDF</td><td>Average Displacement Power Factor (pu)</td></tr>
<tr><td>avgTPF</td><td>Average True Power Factor (pu)</td></tr>
<tr><td>AVSt</td><td>Delivers the active curve characteristic.</td></tr>
<tr><td>AvVA</td><td>Average apparent power in a defined evaluation interval (period).</td></tr>
</table>

Kommentar [HD48]: #209

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>AvVAr</td><td>Average reactive power in a defined evaluation interval (period).</td></tr>
<tr><td>AvVolts</td><td>Average voltage in a defined evaluation interval (period).</td></tr>
<tr><td>AvW</td><td>Average real power in a defined evaluation interval (period).</td></tr>
<tr><td>BatHi</td><td>TRUE = Indicates that battery is in overcharge condition.</td></tr>
<tr><td>BatLo</td><td>TRUE = Indicates that battery voltage has dropped below a pre-set level.</td></tr>
<tr><td>BatTest</td><td>TRUE = Command to start the battery test.</td></tr>
<tr><td>Beh</td><td>Since the logical device controls all logical nodes that are part of the logical device, the mode of the logical device (“LDMode” = LLN0.Mod) and the mode of a specific logical node (“LNMode” = XXXX.Mod) are related. The behaviour of a logical node is therefore a combination of LLN0.Mod and XXXX.Mod and is described in the ”LNBeh” = XXXX.Beh. This Data is read-only and has the same possible values as Mod (Mode). The value is determined according the following table:
<table>
<tr><th>LNMode
XXXX.Mod</th><th>LDMode
LLN0.Mod</th><th>LNBeh (read only)
XXXX.Beh</th><th>LNBeh
Value</th></tr>
<tr><td>on</td><td>on</td><td>on</td><td>1</td></tr>
<tr><td>on</td><td>blocked</td><td>blocked</td><td>2</td></tr>
<tr><td>on</td><td>test</td><td>test</td><td>3</td></tr>
<tr><td>on</td><td>test-blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>on</td><td>off</td><td>off</td><td>5</td></tr>
<tr><td>blocked</td><td>on</td><td>blocked</td><td>2</td></tr>
<tr><td>blocked</td><td>blocked</td><td>blocked</td><td>2</td></tr>
<tr><td>blocked</td><td>test</td><td>test-blocked</td><td>4</td></tr>
<tr><td>blocked</td><td>test-blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>blocked</td><td>off</td><td>off</td><td>5</td></tr>
<tr><td>test</td><td>on</td><td>test</td><td>3</td></tr>
<tr><td>test</td><td>blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test</td><td>test</td><td>test</td><td>3</td></tr>
<tr><td>test</td><td>test-blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test</td><td>off</td><td>off</td><td>5</td></tr>
<tr><td>test-blocked</td><td>on</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test-blocked</td><td>blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test-blocked</td><td>test</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test-blocked</td><td>test-blocked</td><td>test-blocked</td><td>4</td></tr>
<tr><td>test-blocked</td><td>off</td><td>off</td><td>5</td></tr>
<tr><td>off</td><td>on</td><td>off</td><td>5</td></tr>
<tr><td>off</td><td>blocked</td><td>off</td><td>5</td></tr>
<tr><td>off</td><td>test</td><td>off</td><td>5</td></tr>
<tr><td>off</td><td>test-blocked</td><td>off</td><td>5</td></tr>
<tr><td>off</td><td>off</td><td>off</td><td>5</td></tr>
</table></td></tr>
<tr><td>BinIn</td><td>Binary input array used for generic I/O, and represents a set of binary inputs.</td></tr>
<tr><td>BkrTmms</td><td>Closing time of breaker including other delays until the operation of the breaker. This is a property of the breaker that is subject to ageing.</td></tr>
<tr><td>BlkA</td><td>TRUE = Operation is blocked by current reasons.</td></tr>
<tr><td>BlkAOv</td><td>TRUE = Switch operation is blocked by current limit overflow.</td></tr>
<tr><td>BlkCls</td><td>This Data is used to block 'close operation' (for example, for XCBR, XSWI, YPSH) from another logical node such as a protection node or from a local/remote switch. An example may be the low isolation gas density. Block closing is not reflected in operating capability. TRUE = block operation 'close circuit breaker’.</td></tr>
<tr><td>BlkEF</td><td>TRUE = Switch activity blocked due to earth fault.</td></tr>
<tr><td>BlkLV</td><td>Control voltage below which auto Lower commands blocked.</td></tr>
<tr><td>BlkOpn</td><td>This Data is used to block 'open operation' (for example to XCBR, XSWI, YPSH) from another logical node such as a protection node or from a local/remote switch. An example may be the blocking of the buscoupler also for trips during busbar transfer. Block opening is not reflected in operating capability. TRUE = block operation 'open circuit breaker'.</td></tr>
<tr><td>BlkRec</td><td>Block Reclosing.</td></tr>
<tr><td>BlkRV</td><td>Control voltage above which auto Raise commands blocked.</td></tr>
<tr><td>BlkV</td><td>TRUE = Operation is blocked for voltage reasons.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>BlkVal</td><td>When the measurements exceed (or drop below, in the case of a dropout function) this value, the function operation is blocked.</td></tr>
<tr><td>BlkValA</td><td>Block Value (Minimum operating current).</td></tr>
<tr><td>BlkValV</td><td>Block Value (Minimum operating voltage).</td></tr>
<tr><td>BlkVLo</td><td>Control voltage below which auto Raise commands are blocked. If the control voltage is under the limit of BlkVLo (e.g. because that part of the network is switched off) the ATCC issues no Raise commands until the control voltage exceeds the limit of BlkVLo.</td></tr>
<tr><td>BlkVHi</td><td>Control voltage above which auto Lower commands are blocked. If the control voltage is over the limit of BlkVHi the ATCC issues no Lower commands until the control voltage exceeds the limit of BlkVHi.</td></tr>
<tr><td>BlkVOv</td><td>TRUE = Switch operation is blocked by voltage limit overflow.</td></tr>
<tr><td>BlkZn</td><td>This Data is used by the power swing protection to block operation of protection for a specific protection zone i.e. the related instance of PDIS.

TRUE = blocked, FALSE = not blocked.</td></tr>
<tr><td>BndCtr</td><td>Centre of control bandwidth, forward power flow presumed.</td></tr>
<tr><td>BndWid</td><td>Band width, i.e. the defined range of control voltage given either as voltage value or percentage of the nominal voltage. Forward power flow is presumed if applicable.</td></tr>
<tr><td>CapDS</td><td>TRUE = Capacitor bank is on line, or close. FALSE = Capacitor bank off line or open.</td></tr>
<tr><td>CarRx</td><td>Carrier has been received after initiation of unblock logic.</td></tr>
<tr><td>CBOpCap</td><td>This is an enumeration representing the physical capabilities of the breaker to operate. It reflects the switching energy as well as additional blocking due to some local problems.

CBOpCap is always less or equal to MaxOpCap.

<table>
<tr><th>Breaker Operating Capability</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>Open</td><td>2</td></tr>
<tr><td>Close – Open</td><td>3</td></tr>
<tr><td>Open – Close – Open</td><td>4</td></tr>
<tr><td>Close – Open – Close – Open</td><td>5</td></tr>
</table>

More values (6...n) describe higher Operating Capabilities. A new value, i.e. a new line in the table must start alternating with "Close" and "Open" and must end always with “Open”.</td></tr>
<tr><td>CECtl</td><td>Control of complete cooling group (pumps and fans).</td></tr>
<tr><td>CETmpIn</td><td>Temperature of the secundary cooling medium in a cooling equipment (input). Typically used for the water temperature for water cooled power transformers (OFWF or ODWF).</td></tr>
<tr><td>CETmpOut</td><td>Temperature of the secundary cooling medium in a cooling equipment (output). Typically used for the water temperature for water cooled power transformers (OFWF or ODWF).</td></tr>
<tr><td>CEPres</td><td>Pressure of the secundary cooling medium in a cooling equipment. Typically used for the water pressure for water cooled power transformers (OFWF or ODWF).</td></tr>
<tr><td>CEFlw</td><td>Flow of the secundary cooling medium in a cooling equipment. Typically used for the water flow for water cooled power transformers (OFWF or ODWF).</td></tr>
<tr><td>CGAlm</td><td>TRUE = Core Ground Alarm indicates that the insulation has broken down.</td></tr>
<tr><td>CGRBlk</td><td>Control of automatic / manual operation. TRUE = Automatic control of cooling equipment blocked (inhibited)</td></tr>
<tr><td>ChaMotEna</td><td>This Data is used to enable the charger motor; used to prevent overload of the power supply after a busbar trip. TRUE = enable charger motor, FALSE = disable charger motor.</td></tr>
<tr><td>ChkRec</td><td>Determines if the reclosing is with (TRUE) or without (FALSE) synch-check.</td></tr>
<tr><td>ChNum</td><td>Channel number being monitored (for example for COMTRADE).</td></tr>
<tr><td>ChrAng</td><td>The angle by which the current is displaced from the polarising quantity in order to obtain maximum sensitivity.</td></tr>
<tr><td>ChTrg</td><td>Channel triggered. TRUE = channel started recording, FALSE = channnel not started recording.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>CircA</td><td>Measured circulating current, which circulates between transformers operated in parallel (one component of transformer secondary current in a paralleling installation).</td></tr>
<tr><td>ClcExp</td><td>Indicates that the calculation period of a statistical logical node has expired.

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

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

The possible values shall be :

<table>
<tr><th>value</th><th>Description</th></tr>
<tr><td>PRES</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are present values.</td></tr>
<tr><td>MIN</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are minimum values calculated during the corresponding calculation period ClcPer.</td></tr>
<tr><td>MAX</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are maximum values calculated during the corresponding calculation period CclPer.</td></tr>
<tr><td>TOTMIN</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are total minimum values calculated since the start of the system</td></tr>
<tr><td>TOTMAX</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are total maximum values calculated since the start of the system</td></tr>
<tr><td>AVG</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are average values calculated during the corresponding calculation period CclPer.</td></tr>
<tr><td>SDV</td><td>Indicates that all analogue values (i. e. all common attributes i and f) are standard deviation values calculated during the corresponding calculation period CclPer.</td></tr>
<tr><td>TREND</td><td>tbd</td></tr>
</table>

This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, e.g., CDC MV, CMV, WYE, etc.

NOTE 1 – If different calculation periods are required for the data of a logical node, then different logical nodes could be instantiated – with different calculation periods.

NOTE 2 – The calculation algorithm and number of samples used for the calculation is an implementation issue.</td></tr>
<tr><td>ClcPerms</td><td>The calculation period of a statistical logical node. The period shall always be in Milliseconds [ms].

This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, e.g., CDC MV, CMV, WYE, etc.

NOTE 3 – The calculation algorithm and number of samples used for the calculation is an implementation issue.</td></tr>
<tr><td>ClcSrc</td><td>The reference to the logical node whose analogue data attributes are used to calculate the value contained in this logical node instance.

This DATA shall be mandatory for all logical nodes that are intended to represent statistical data, indicated by the common data classes, e.g., CDC MV, CMV, WYE, etc.</td></tr>
<tr><td>ClkRot</td><td>TRUE = indication that phase rotation is clockwise (forward).</td></tr>
<tr><td>CntClkRot</td><td>TRUE = indication that phase rotation is counter clockwise (reverse).</td></tr>
<tr><td>ColPos</td><td>Represents the continuous adjustment of a coil (plunge core position) such as a Petersen Coil.</td></tr>
<tr><td>ColTapPos</td><td>Represents the discrete adjustment of a coil such as a Petersen Coil.</td></tr>
</table>

Kommentar [HD49]: is PRES the right term? ask native speakers in San Diego

Kommentar [HD50]: nedd more description #479

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>ConsTms</td><td>Time constant, for example for a thermal model.</td></tr>
<tr><td>Cor</td><td>Magnitude correction of a phasor (used for example for instrument transformers/transducers).</td></tr>
<tr><td>CrdTmms</td><td>Delay time in ms to wait on additional input if other actions are called for.</td></tr>
<tr><td>CtlDlTmms</td><td>Control delay time before operating after reaching control point forward power flow presumed.</td></tr>
<tr><td>CtlV</td><td>Voltage on secondary of transformer as used for voltage control.</td></tr>
<tr><td>DeaBusVal</td><td>Voltage setting used to detect a Dead Bus bar, for example for auto reclosing.</td></tr>
<tr><td>DeaLinVal</td><td>Voltage setting used to detect a Dead Line, for example for auto reclosing.</td></tr>
<tr><td>Den</td><td>Density of insulating medium.</td></tr>
<tr><td>DenAlm</td><td>Density alarm because of an abnormal condition (FALSE = Normal, TRUE = alert)</td></tr>
<tr><td>DetValA</td><td>Used to detect that the breaker has opened when the current is below that setting.</td></tr>
<tr><td>DExt</td><td>TRUE = Command to de-excite the machine.</td></tr>
<tr><td>DF</td><td>Displacement Power Factor (pu)
$P_{F1} = \frac{P_1}{S_1} = \cos\theta_1$</td></tr>
<tr><td>Diag</td><td>TRUE = Diagnostic is running, FALSE = Diagnostic is not running.</td></tr>
<tr><td>DipStrVal</td><td>When the voltage in at least one phase goes below the Voltage Dip Set Point it will start the voltage variation function and the timer that will measure the duration of the voltage variation power quality event. The event ends when all monitored phase voltages return above the threshold.</td></tr>
<tr><td>DFworst</td><td>Worst Phase Displacement Power Factor (pu)</td></tr>
<tr><td>DifAClc</td><td>Differential Current.</td></tr>
<tr><td>DifAng</td><td>Setting for the phase angle difference between two measured values by a synch-check LN.</td></tr>
<tr><td>DifAngClc</td><td>Calculated value for the phase angle difference between two measured values by a LN synch-check.</td></tr>
<tr><td>DifHz</td><td>Setting for the frequency difference between two measured values by a synch-check LN.</td></tr>
<tr><td>DifHzClc</td><td>Calculated value for the frequency difference between two measured values by a LN synch-check.</td></tr>
<tr><td>DifV</td><td>Setting for the voltage difference between two measured values by a synch-check LN.</td></tr>
<tr><td>DifVClc</td><td>Calculated value for the voltage difference between two measured values by a LN synch-check.</td></tr>
<tr><td>Dir</td><td>The direction of a fault or power flow.</td></tr>
<tr><td>DirMod</td><td>This Data is used to enable operation when the following directional conditions are met:
<table>
<tr><th>Direction Mode</th><th>Value</th></tr>
<tr><td>Non Directional</td><td>1</td></tr>
<tr><td>Forward</td><td>2</td></tr>
<tr><td>Reverse</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>DltRcd</td><td>TRUE = delete the selected record.</td></tr>
<tr><td>DmdPwr</td><td>Demanded Power.</td></tr>
<tr><td>DmdVArh</td><td>Reactive energy demand (default demand direction: energy flow from busbar away).</td></tr>
<tr><td>DmdWh</td><td>Real energy demand (default demand direction: energy flow from busbar away).</td></tr>
<tr><td>DPCSO</td><td>Generic double point control.</td></tr>
<tr><td>DQ0Seq</td><td>Direct, quadrature, and zero axis quantity.</td></tr>
<tr><td>DschBlk</td><td>TRUE = indicates that switch close action for capacitor bank is blocked due to the discharge state of the bank.</td></tr>
<tr><td>Dur</td><td>The total measured or calculated Duration of power quality event, i. e. the time from the start until the end of a voltage dip (sag), swell, interruption or other event</td></tr>
<tr><td>Dur1[1]</td><td>Defines the first Duration set point [ms] for the Event Range used to detect a power quality event</td></tr>
<tr><td>Dur2[1]</td><td>Defines the second Duration set point [ms] for the Event Range used to detect a power quality event</td></tr>
<tr><td>DurTmms</td><td>Minimum duration of carrier signal sent by a communication based scheme in ms.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>ECA</td><td>This is the measured current through a Petersen Coil in neutral compensated networks.</td></tr>
<tr><td>Echo</td><td>Echo signal from weak end infeed function.</td></tr>
<tr><td>EEHealth</td><td>This information reflects the state of external equipment, for example circuit breaker controlled by the logical node XCBR. The values are the same as for the Health.</td></tr>
<tr><td>EEName</td><td>This information reflects the name plate of external equipment, for example the circuit breaker XCBR controlled by the logical node CSWI.</td></tr>
<tr><td>EnaCls</td><td>The interlocking function itself determines the status of this data and thus permits the closing of the device when TRUE. The control service checks this value before he controls “Close/On” a switch.</td></tr>
<tr><td>EnaOpn</td><td>The interlocking function itself determines the status of this data and thus permits the opening of the device when TRUE. The control service checks this value before he controls “Open/Off” a switch.</td></tr>
<tr><td>EndPosL</td><td>TRUE = Load tap changer is in the maximum lower position.</td></tr>
<tr><td>EndPosR</td><td>TRUE = Load tap changer is in the maximum raise position.</td></tr>
<tr><td>EnvTmp</td><td>Temperature of environment.</td></tr>
<tr><td>EqTmm</td><td>Temperature Equalisation Time (min). For the duration of EqTmm, the thermal memory will be kept, i.e. the thermal memory is frozen. This time is active after the motor is switched off.</td></tr>
<tr><td>EvTmms</td><td>Evaluation time in ms (time window) determines the lowest frequency.</td></tr>
<tr><td>ExclTmms</td><td>Exclusion time in ms that consecutive triggers from the same source are ignored.</td></tr>
<tr><td>FACntRs</td><td>Fault arc counter, resetable.</td></tr>
<tr><td>FADet</td><td>TRUE = Alarm that fault arc has been detected.</td></tr>
<tr><td>Fail</td><td>TRUE = indicates a breaker has failed to operate and a breaker failure has occurred.</td></tr>
<tr><td>FailMod</td><td>Circuit Breaker failure detection mode.
<table>
<tr><th>Detection Mode</th><th>Value</th></tr>
<tr><td>Current</td><td>1</td></tr>
<tr><td>Breaker Status</td><td>2</td></tr>
<tr><td>Both Current and Breaker Status</td><td>3</td></tr>
<tr><td>Other</td><td>4</td></tr>
</table></td></tr>
<tr><td>FailTmms</td><td>The time delay in ms until the Breaker Failure function will issue the trip to an alternate device.</td></tr>
<tr><td>FanA</td><td>Motor drive current of a fan in A.</td></tr>
<tr><td>FanCtlGen
FanCtl</td><td>FanCtlGen – Control of all fans
FanCtl – Control of a single fan
<table>
<tr><th>Fan Control</th><th>Value</th></tr>
<tr><td>Inactive</td><td>1</td></tr>
<tr><td>Stage 1</td><td>2</td></tr>
<tr><td>Stage 2</td><td>3</td></tr>
<tr><td>Stage 3</td><td>4</td></tr>
</table>
More stages may be added with numbers greater than 4.</td></tr>
<tr><td>FanFlw</td><td>Air flow in fan.</td></tr>
<tr><td>FanOvCur</td><td>Fan overcurrent trip.</td></tr>
<tr><td>FltDiskm</td><td>The distance to a fault in km.</td></tr>
<tr><td>FltLoop</td><td>
<table>
<tr><th>Fault Loop</th><th>Value</th></tr>
<tr><td>Phase A to Ground</td><td>1</td></tr>
<tr><td>Phase B to Ground</td><td>2</td></tr>
<tr><td>Phase C to Ground</td><td>3</td></tr>
<tr><td>Phase A to Phase B</td><td>4</td></tr>
<tr><td>Phase B to Phase C</td><td>5</td></tr>
<tr><td>Phase C to Phase A</td><td>6</td></tr>
<tr><td>Others</td><td>7</td></tr>
</table></td></tr>
<tr><td>FltNum</td><td>Fault Number (number allocation is local issue).</td></tr>
</table>

Data Name	Semantics
FltZ	Fault impedance
FuFail	TRUE = indicates that the TVTR fuse has opened/failed.
GasFlwTr	Insulation liquid (for example oil) flow trip because of gas (maybe used for Buchholz trip).
GasInsAlm	Gas in insulation liquid (for example oil) alarm because of an abnormal condition (FALSE = Normal, TRUE = alert, maybe used for Buchholz trip).
GasInsTr	Gas in insulation liquid trip because of a dangerous condition (maybe used for Buchholz trip).
GnCtl	Generator Control.
GndDlMod	Operate Time Delay for Single Phase Ground Mode. TRUE = on, FALSE = off.
GndDlTmms	Operate Time Delay for single-phase ground faults in ms.
GndStr	When the ground measurements exceed (or drop below, in the case of a dropout function) this value, the operation of the related function is initiated.
GnSpd	Generator Speed.
GnSt	Generator State. ***Generator State*** / **Value** Stopped 1 Stopping 2 Started 3 Starting 4 Disabled 5
GrAlm	This Data summarises different alarms, assigned via configuration. TRUE = Indicates a Group Alarm.
GrRef	Reference to a higher-level object. The Mod of this Logical Device influences the Beh of the LN same as the same level LN Device (see Beh in Table 6). This Beh of the LN may be modified by the same level Logical Device. Same holds also for the data sets and the settings of control blocks.
GrdRx	If TRUE: receipt of a guard signal from the carrier set interface.
GriFltNum	Grid Fault Number is used for identification of disturbance records of a common fault (number allocation is local issue).
GrWrn	This Data summarises different warnings, assigned via configuration TRUE = Indicates a Group Warning.
H2	Measurement of Hydrogen (H_2 in ppm). Combustible gas measurement in oil indicating the amount of deterioration of the insulation system.
H2Alm	H2 alarm for gas composition (FALSE = Normal, TRUE = alert).
H2O	Relative saturation of moisture in oil (in %). Note that this a measurement used in conjunction with H2OTmp.
H2OTmp	Temperature of oil at point of measurement of relative saturation of moisture in oil (in °C). Note that this is a measurement used in conjunction with H2O.
HA	Phase related sequence of Harmonics or Interharmonics current for A, B C, N, Net, Res.
HaAmp	Non phase related sequence of Harmonics or Interharmonics current.
HaAmpTm	Non phase related Current Time product.
HaCfAmp	Non phase related current crest factors (peak waveform value/sqrt(2)/fundamental).
HaCfVol	Non phase related voltage crest factors (peak waveform value/sqrt(2)/fundamental).
HaKFact	Non phase related K Factor.
HaRmsAmp	Non phase related current RMS Harmonic or Interharmonic (un-normalized Thd).
HaRmsVol	Non phase related voltage RMS Harmonic or Interharmonic (un-normalized Thd).
HaRst	Number of the harmonic that is being monitored for restraint.
HaTdFact	Non phase related Transformer derating factor.
HaTiFact	Non phase related voltage Telephone Influence Factor, Method 1, 2, 3, …
HATm	Phase related Current Time product.
HaTsWatt	Non phase related total harmonic or interharmonic active power (no fundamental) signed sum.

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>HaTuWatt</td><td>Non phase related total harmonic or interharmonic active power (no fundamental) unsigned sum.</td></tr>
<tr><td>HaVol</td><td>Non phase related sequence of Harmonics or Interharmonics voltage.</td></tr>
<tr><td>HaVolAmp</td><td>Non phase related sequence of Harmonics or Interharmonics apparent power.</td></tr>
<tr><td>HaVolAmpr</td><td>Non phase related sequence of Harmonics or Interharmonics reactive power.</td></tr>
<tr><td>HaWatt</td><td>Non phase related sequence of Harmonics or Interharmonics active power.</td></tr>
<tr><td>HCfA</td><td>Phase related current crest factors (peak waveform value/sqrt(2)/fundamental).</td></tr>
<tr><td>HCfPhV</td><td>Phase to ground voltage crest factors (peak waveform value/sqrt(2)/fundamental).</td></tr>
<tr><td>HCfPPV</td><td>Phase to phase voltage crest factors (peak waveform value/sqrt(2)/fundamental).</td></tr>
<tr><td>Health</td><td>This information reflects the state of the logical node related HW and SW. More detailed information related to the source of the problem may be provided by specific Data. For LLN0, this Data reflects the worst value of “Health” of the logical nodes that are part of the logical device associated with LLN0.
<table>
<tr><th>Health State</th><th>Value</th></tr>
<tr><td>Ok (“green”) – no problems, normal operation</td><td>1</td></tr>
<tr><td>Warning (“yellow”) – minor problems, but in safe operation mode</td><td>2</td></tr>
<tr><td>Alarm (“red”) – severe problem, no operation possible</td><td>3</td></tr>
</table>
Health states 1 (“green”) and 3 (“red”) are unambiguous by definition. The detailed meaning of Health state 2 (“yellow”) is a local issue depending from the dedicated function/device.</td></tr>
<tr><td>HiBatVal</td><td>High battery alarm value.</td></tr>
<tr><td>HiCtlV</td><td>Highest control voltage since last reset.</td></tr>
<tr><td>HiDmdA</td><td>Highest current demand since last reset.</td></tr>
<tr><td>HiSet</td><td>High operate value, percentage of the nominal current.</td></tr>
<tr><td>HiTapPos</td><td>Highest tap position since last reset.</td></tr>
<tr><td>HiTrgLev</td><td>High (positive) trigger level.</td></tr>
<tr><td>HiVRtg</td><td>Rated Voltage (high voltage level).</td></tr>
<tr><td>HKf</td><td>Phase related K Factor for A, B, C.</td></tr>
<tr><td>HPhV</td><td>Sequence of Harmonics or Interharmonics for phase to ground voltages AN, BN, CN, NG.</td></tr>
<tr><td>HPPV</td><td>Sequence of Harmonics or Interharmonics for phase to phase voltage AB, BC, CA.</td></tr>
<tr><td>HPTmp</td><td>Winding hotspot temperature (in °C).</td></tr>
<tr><td>HPTmpAlm</td><td>Hot Point Temperature alarm (FALSE = Normal, TRUE = High).</td></tr>
<tr><td>HPTmpTr</td><td>TRUE = indicates that a trip has occurred due to winding hot point temperature.</td></tr>
<tr><td>HRmsA</td><td>Phase related Current RMS Harmonic or Interharmonics (un-normalized Total harmonic disortion, Thd) for A, B, C, N.</td></tr>
<tr><td>HRmsPhV</td><td>Phase to ground voltage RMS Harmonic or Interharmonic (un-normalized Thd) for AN, BN, CN, NG.</td></tr>
<tr><td>HRmsPPV</td><td>Phase to phase voltage RMS Harmonic or Interharmonic (un-normalized Thd) for AB, BC, CA.</td></tr>
<tr><td>HTdf</td><td>Phase related Transformer derating factor for A, B, C.</td></tr>
<tr><td>HTif</td><td>Phase related voltage Telephone Influence Factor, Method 1, 2, 3, …</td></tr>
<tr><td>HTsW</td><td>Phase related total phase harmonic or interharmonic active power (no fundamental) signed sum for A, B, C.</td></tr>
<tr><td>HTuW</td><td>Phase related total phase harmonic or interharmonic active power (no fundamental) unsigned sum for A, B, C.</td></tr>
<tr><td>HVA</td><td>Phase related sequence of Harmonics or Interharmonics apparent power for A, B, C.</td></tr>
<tr><td>HVAr</td><td>Phase related sequence of Harmonics or Interharmonics reactive power for A, B, C.</td></tr>
<tr><td>HVStr</td><td>When the third harmonic phase voltage measurement exceeds this value, the PHIZ protection control operation is initiated.</td></tr>
</table>

Data Name	Semantics
HW	Phase related sequence of Harmonics or Interharmonics active power for A, B, C.
Hz	The frequency of a power system in Hz.
HzInd	This Data indicates the check result of the differences between the frequencies of the busbar and line voltages. FALSE indicates that the frequency difference is below the required limit. The frequency difference criteria for the synchronising are fulfilled. TRUE indicates the frequency difference exceeds the limit. The synchronising process shall be aborted because the frequency criteria are not fulfilled (synchrocheck) or shall be continued with turbine control activities (synchronising).
HzRtg	Rated frequency, intrinsic property of the device, which cannot be set/changed from remote.
HzSet	Setting of a frequency.
IhA	Phase related sequence of Interharmonics Current for A, B C, N, Net, Res.
IhAmp	Non phase related sequence of Interharmonics Current.
IhPhV	Sequence of Interharmonics for phase to ground voltages AN, BN, CN, NG.
IhPPV	Sequence of Interharmonics for phase to phase voltage AB, BC, CA.
IhVA	Phase related sequence of Interharmonics apparent power for A, B, C.
IhVAr	Phase related sequence of Interharmonics reactive power for A, B, C.
IhVol	Non phase related sequence of Interharmonics voltage.
IhVolAmp	Non phase related sequence of Interharmonics apparent power.
IhVolAmpr	Non phase related sequence of Interharmonics reactive power.
IhW	Phase related sequence of Interharmonics active power for A, B, C.
IhWatt	Non phase related sequence of Interharmonics active power.
ImbA	Deviation from the average phase current. ImbA.phsX = $\lvert I_x - I_{ave} \rvert$ with $I_{ave} = (1/3) \times (I_A + I_B + I_C)$
ImbNgA	Current Imbalance Negative Sequence Method. ImbNgA = I2 / I1
ImbNgV	Voltage Imbalance Negative Sequence Method. ImbNgV = V2 / V1
ImbPPV	Deviation from the average phase-to-phase voltage. ImbPPV.phsXY = $\lvert V_{XY} - PPV_{ave} \rvert$ with $PPV_{ave} = (1/3) \times (V_{ab} + V_{bc} + V_{ca})$.
ImbV	Deviation from the average phase-to-neutral voltage. ImbV.phsX = $\lvert V_X - V_{ave} \rvert$ with $V_{ave} = (1/3) \times (V_{an} + V_{bn} + V_{cn})$.
ImbZroA	Current Imbalance Zero Sequence Method. ImbZroA = I0 / I1
ImbZroV	Voltage Imbalance Zero Sequence Method. ImbZroV = V0 / V1
Ina	Number of associations terminated due to inactivity.
Ind	General indication.
Inet	Net Current Ia + Ib + Ic + In (amps)
IntDtMthd	Voltage Interruption Detection Method is the method used to detect the interruption condition based on measured or calculated voltages, currents or the status of the breaker auxiliary contacts. Voltage Interruption Detection Method — Value Voltage — 1 Voltage and Current — 2 Voltage and Normally Open Breaker Contact — 3 Voltage and Normally Closed Breaker Contact — 4 Voltage and both Normally Open and Normally Closed Breaker Contacts — 5 Normally Open Breaker Contact — 6 Normally Closed Breaker Contacts — 7 Both Normally Open and Normally Closed Breaker Contacts — 8

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>InhTmm</td><td>Time Setting for Restart Inhibition (min). Once the StrInh is activated, the motor should not be allowed to start until this time has elapsed.</td></tr>
<tr><td>InOv</td><td>This Data indicates that a buffer overflow occurred for the input buffer and that all messages could not received properly. Important service requests may be lost (TRUE) in the communication. Appropriate actions shall be taken.</td></tr>
<tr><td>InRef</td><td>Reference to the object what is binded to this input</td></tr>
<tr><td>InsAlm</td><td>TRUE = provides an alarm after a pre-set limit is reached, for example low insulation level. Setting of the limits is a local issue and depends on the supervised media property. An appropriate action may be to refill the insulation medium.</td></tr>
<tr><td>InsBlk</td><td>TRUE = block the operation of the isolated device when the level is reached where operation is not safe anymore. Setting of the limits is a local issue and depends on the supervised media property.</td></tr>
<tr><td>InsLevMax</td><td>TRUE = Insulation medium level has reached predetermined maximum level, mainly used for the filling process.</td></tr>
<tr><td>InsLevMin</td><td>TRUE = Insulation medium level has dropped to a predetermined minimum level, mainly used for the filling process.</td></tr>
<tr><td>InsTr</td><td>TRUE = the isolation of the device is not guaranteed anymore. The device has to switch off from the power system, i.e. it has to be isolated by tripping the surrounding breakers. Setting of the limits is a local issue and depends on the supervised media property.</td></tr>
<tr><td>IntStrVal</td><td>The Voltage Interruption set point. When the measured voltage goes below this value</td></tr>
<tr><td>IntIn</td><td>Integer status input used for generic I/O.</td></tr>
<tr><td>Ires</td><td>Residual Current Ia + Ib + Ic (amps)</td></tr>
<tr><td>ISCSO</td><td>Generic integer control output.</td></tr>
<tr><td>K0Fact</td><td>K0 is Zero Sequence Compensation Factor = (Z0 – Z1)/3Z1 where Z0 is Zero Sequence Impedance, and Z1 is Positive Sequence Impedance.</td></tr>
<tr><td>K0FactAng</td><td>Residual Compensation Factor Angle for K0.</td></tr>
<tr><td>LCol</td><td>Lower Plunge Core Position.</td></tr>
<tr><td>LDC</td><td>Line Drop Compensation. LDC is R&X or Z model TRUE = R&X, FALSE = Z.</td></tr>
<tr><td>LDCR</td><td>Line drop voltage due to line resistance component (FPF presumed) at rated current.</td></tr>
<tr><td>LDCX</td><td>Line drop voltage due to line reactance component (FPF presumed) at rated current.</td></tr>
<tr><td>LDCZ</td><td>Line drop voltage due to line total impedance (FPF presumed) at rated current.</td></tr>
<tr><td>LEDRs</td><td>Resets all light emitting diodes, true causes reset to occur.</td></tr>
<tr><td>Lev</td><td>Level of insulating medium.</td></tr>
<tr><td>LevMod</td><td>Internal Trigger Mode for disturbance recording.
<table><tr><th>Internal Trigger Mode</th><th>Value</th></tr><tr><td>Positive or Rising</td><td>1</td></tr><tr><td>Negative or Falling</td><td>2</td></tr><tr><td>Both</td><td>3</td></tr><tr><td>Other</td><td>4</td></tr></table>
The disturbance recorder trigger mode is defined by TrgMod.
LevMod exists both for the disturbance recorder as a whole (RDRE) and for each of its individual channels (RADR, RBDR). The interaction of both is determined by the individual disturbance recorder.</td></tr>
<tr><td>LHz</td><td>TRUE = Lower frequency, FALSE = no action.</td></tr>
<tr><td>LimAOv</td><td>Current limit for overflow blocking.</td></tr>
<tr><td>LimLodA</td><td>The Data LodA current (percent) above which automatic commands suspended.</td></tr>
<tr><td>LimVOv</td><td>Voltage limit for overflow blocking.</td></tr>
<tr><td>LinAng</td><td>Line angle is the feeder/line impedance angle.</td></tr>
<tr><td>LinCapac</td><td>Capacitance of the line.</td></tr>
<tr><td>LinLenKm</td><td>The length of the line in km.</td></tr>
<tr><td>LivBusVal</td><td>Voltage setting used to detect Live Bus, for example for auto reclosing.</td></tr>
</table>

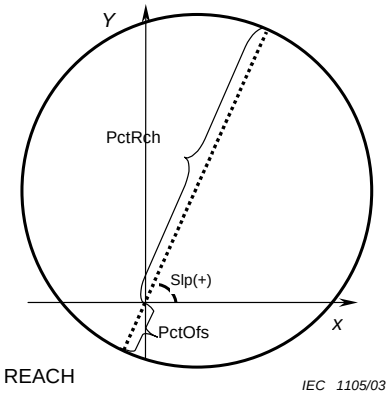
Kommentar [HD51]: #216

Kommentar [HD52]: example in annex necessary? like mod/beh?

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>LivDeaMod</td><td>Live Dead Mode of operation under which switching may be carried out.
<table>
<tr><th>Live Dead Mode</th><th>Value</th></tr>
<tr><td>Dead Line, Dead Bus</td><td>1</td></tr>
<tr><td>Live Line, Dead Bus</td><td>2</td></tr>
<tr><td>Dead Line, Live Bus</td><td>3</td></tr>
<tr><td>Dead Line, Dead Bus OR
Live Line, Dead Bus</td><td>4</td></tr>
<tr><td>Dead Line, Dead Bus OR
Dead Line, Live Bus</td><td>5</td></tr>
<tr><td>Live Line, Dead Bus OR
Dead Line, Live Bus</td><td>6</td></tr>
<tr><td>Dead Line, Dead Bus OR
Live Line, Dead Bus OR
Dead Line, Live Bus</td><td>7</td></tr>
</table></td></tr>
<tr><td>LivLinVal</td><td>Voltage setting used to detect Live Line, for example for auto reclosing.</td></tr>
<tr><td>LoBatVal</td><td>Low battery alarm value.</td></tr>
<tr><td>LocKey</td><td>This changeover is always done locally with a physical key or toggle switch. The physical key or toggle switch may have a set of contacts from which the position can be read. This Data indicates the switchover between local and remote operation; local = TRUE, remote = FALSE. At bay level ‘local’ means operation from the bay unit and ‘remote’ means opereation from a station unit. At process level, ‘local’ means operation direct on the process device, for example on a circuit breaker and ‘remote’ means operation from a bay unit. If in a Logical Device the Loc of LLN0 is in contradiction to the Loc of any contained LN, “local” is always dominant.</td></tr>
<tr><td>Loc</td><td>This data describes the control behavior of the related LN. It is a result of both the LocKey and the RemCtlBlk according to the following table:
<table>
<tr><td>LocKey</td><td>RemCtlBlk</td><td>Loc</td></tr>
<tr><td>True (local)</td><td>True (Blocked)</td><td>True (local)</td></tr>
<tr><td>True (local)</td><td>False (Not blocked)</td><td>True (local)</td></tr>
<tr><td>False (remote)</td><td>True (Blocked)</td><td>True (Local)</td></tr>
<tr><td>False (remote)</td><td>False (Not blocked)</td><td>False (Remote)</td></tr>
</table></td></tr>
<tr><td>LoCtlV</td><td>Lowest Control Voltage since last reset.</td></tr>
<tr><td>LodA</td><td>Load side current of transformer.</td></tr>
<tr><td>LodRsvAlm</td><td>Load reserve to alarm.</td></tr>
<tr><td>LodRsvTr</td><td>Load reserve to trip.</td></tr>
<tr><td>LokRotTms</td><td>Locked Rotor Time (s). This time is the permissible locked rotor time during start-up.</td></tr>
<tr><td>LoSet</td><td>Low operate value, percentage of the nominal current.</td></tr>
<tr><td>LosFact</td><td>Loss Factor (tan delta)</td></tr>
<tr><td>LosOfGrd</td><td>Loss of guard.</td></tr>
<tr><td>LosOil</td><td>TRUE = indicates that a loss of oil has been detected.</td></tr>
<tr><td>LosVac</td><td>TRUE = indicates when vacuum drops below a predetermined level.</td></tr>
<tr><td>LoTapPos</td><td>Lowest tap position since last reset.</td></tr>
<tr><td>LoTrgLev</td><td>Low (negative) trigger level.</td></tr>
<tr><td>LoVRtg</td><td>Rated Voltage (low voltage level).</td></tr>
<tr><td>LTCBlk</td><td>TRUE = Automatic control of LTC blocked (inhibited).</td></tr>
<tr><td>LTCDragRs</td><td>TRUE = Reset LTC Drag Hands (high and low positions to present position).</td></tr>
<tr><td>LV</td><td>TRUE = Lower voltage, FALSE = no action.</td></tr>
<tr><td>Mag</td><td>The measured global maximum or minimum value of the system parameter reached during the event. This is the parameter that defines the power quality event, for example the minimum voltage during a voltage dip or the maximum frequency during an overfrequency variation.
Figure in Am1</td></tr>
<tr><td>MaxAmps</td><td>Maximum current in a defined evaluation interval (period).</td></tr>
</table>

Data Name	Semantics
MaxCyc	Maximum number of allowed cycles for any cyclic process, e.g. used for the Autorecloser
MaxDlTmms	Operation instant difference (between intended and performed operation).
MaxEna	Monitoring of current exceeding a set value is enabled (TRUE) in order to detect a fault condition during power swing in the system.
MaxFwdAng	Maximum phase angle in forward direction.
MaxImbA	Maximum deviation from the average current. Max(Idev_a,Idev_b,Idev_c)
MaxImbPPV	Maximum deviation from the average phase-to-phase voltage. MaxImbPPV = Max(PPVdev_a,PPVdev_b,PPVdev_c)
MaxImbV	Maximum deviation from the average phase-to-neutral voltage. MaxImbV = Max(Vdev_a,Vdev_b,Vdev_c)
MaxNumRcd	Maximum number of records that can be recorded.
MaxNumStr	Setting for the maximum number of starts. This Data is also used for the permissible number of cold starts. For example, the motor manufacturer may state that three starts at the maximum are allowed within 1 h. These parameters are intended for this. So MaxNumStr is set to 3 and MaxStrTmm is set to 60 (min).
MaxOpCap	This Data shall provide the information of the operation capability available when the switch mechanism is fully charged. The Maximum Operating Capability gives the information about the maximum of CBOpCap.
MaxOpTmms	The Data maximum operating time in ms for the LN is used for co-ordinating action of the related function.
MaxRvAng	Maximum phase angle in reverse direction.
MaxStrTmm	The time period in which the maximum number of starts is allowed.
MaxTmms	Maximum allowed time in ms to be used for any application if needed
MaxVA	Maximum apparent power in a defined evaluation interval (period).
MaxVAr	Maximum reactive power in a defined evaluation interval (period).
MaxVolts	Maximum voltage in a defined evaluation interval (period).
MaxW	Maximum real power in a defined evaluation interval (period).
MaxWrmStr	Permissible number of warm starts, in most cases cold starts – 1.
MemClr	TRUE = Clear Memory.
MemFull	This Data is the percentage at which to indicate memory is full.
MemOv	TRUE = Memory overflow has occurred.
MemRs	TRUE = resetting the memory in the recorder.
MemUsed	Percentage of storage memory in use.
MinAmps	Minimum current in a defined evaluation interval (period).
MinFwdAng	Minimum phase angle in forward direction.
MinOpTmms	The Data minimum operating time in ms for the LN is used for co-ordinating with older electromechanical relays.
MinPPV	Minimum phase to phase Voltage.
MinRvAng	Minimum phase angle in reverse direction.
MinVA	Minimum apparent power in a defined evaluation interval (period).
MinVAr	Minimum reactive power in a defined evaluation interval (period).
MinVolts	Minimum voltage in a defined evaluation interval (period).
MinW	Minimum real power in a defined evaluation interval (period).

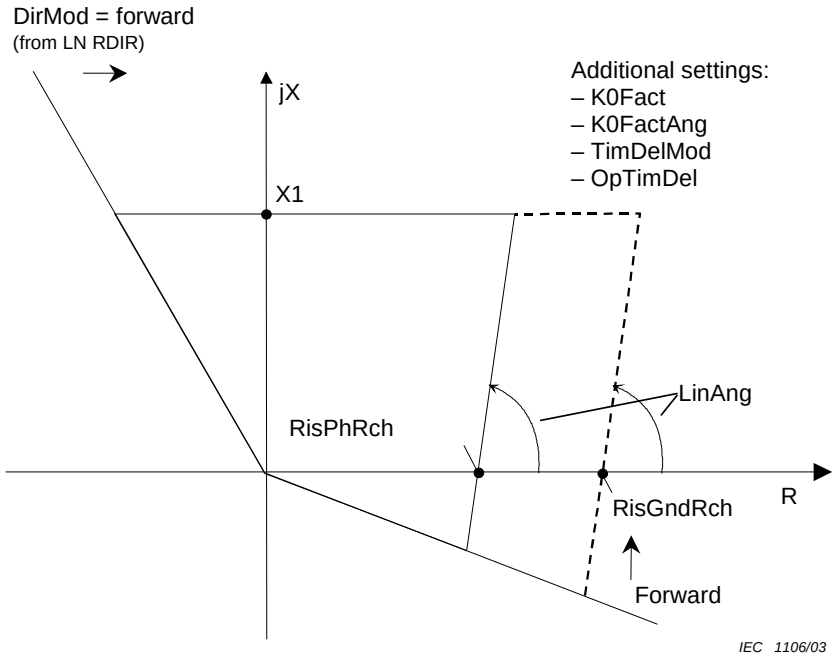
<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>Mod</td><td>
<table>
<tr><th>Mode</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>ON (enabled)</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>BLOCKED</td><td></td><td>2</td><td></td><td></td><td></td></tr>
<tr><td>TEST</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td>TEST/BLOCKED</td><td></td><td></td><td></td><td>4</td><td></td></tr>
<tr><td>OFF (disabled)</td><td></td><td></td><td></td><td></td><td>5</td></tr>
<tr><td>Function active</td><td>yes</td><td>yes</td><td>yes[3]</td><td>yes[3]</td><td>no</td></tr>
<tr><td>Outputs (to process) generated</td><td>yes</td><td>no</td><td>yes</td><td>no</td><td>no</td></tr>
<tr><td>GOOSE output</td><td>yes</td><td>yes</td><td>yes[4]</td><td>yes[4]</td><td>yes[7]</td></tr>
<tr><td>GOOSE input</td><td>yes</td><td>yes</td><td>yes[5]</td><td>yes[5]</td><td>n.a.</td></tr>
<tr><td>SV stream out</td><td>yes</td><td>yes</td><td>yes[8]</td><td>yes[8]</td><td>yes[7]</td></tr>
<tr><td>SV stream in</td><td>yes</td><td>yes</td><td>yes[5]</td><td>yes[5]</td><td>n.a.</td></tr>
<tr><td>Reporting (to clients)</td><td>yes</td><td>no[1]</td><td>yes[9]</td><td>yes[9]</td><td>no[1]</td></tr>
<tr><td>Controls (from clients) accepted</td><td>yes</td><td>no[2]</td><td>yes[6]</td><td>yes[6]</td><td>no[2]</td></tr>
<tr><td>Participating in GI / Integrity Scans</td><td>yes</td><td>yes</td><td>yes</td><td>yes</td><td>no</td></tr>
<tr><td>Functional (process related) data visible</td><td>yes</td><td>yes</td><td>yes</td><td>yes</td><td>yes[7]</td></tr>
<tr><td>Configuration (capability) data writable</td><td>yes</td><td>yes</td><td>yes</td><td>yes</td><td>yes</td></tr>
<tr><td>(Normal state)</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
1) with the exception of Mod/Beh change
2) with the exception of Mod/Beh change
3) in test mode provided by manufacturer
4) quality of DO flagged as test and test bit set in GOOSE header if the LLN0.Mod of GsCB is Test
5) interpretation of quality/Beh depending on LN implementation
6) only if the test bit is set in the control service
7) If required, the quality of the reported DO is set to invalid when its associated Beh is off
8) quality of DO flagged as test and test bit set in SV header if the LLN0.Mod of SVCB is Test
9) quality of DO flagged as test
</td></tr>
<tr><td>MotDrvA</td><td>Motor drive current.</td></tr>
<tr><td>MotStr</td><td>I-Motor Startup Threshold. This value identifies a motor starting condition.</td></tr>
<tr><td>MstAlm</td><td>Moisture sensor alarm (FALSE = Normal, TRUE = High Moisture).</td></tr>
<tr><td>NamPlt</td><td>This is the name plate of the logical node.</td></tr>
<tr><td>NeutAlm</td><td>TRUE = Neutral Alarm is present.</td></tr>
<tr><td>NgEna</td><td>Monitoring of Negative sequence current is enabled (TRUE) in order to detect an unbalanced fault condition during power swing in the system.</td></tr>
<tr><td>NomA</td><td>Normalising demand current used in IEEE 519 TDD calculation.</td></tr>
<tr><td>NumCntRs</td><td>Number of times a counter is reset.</td></tr>
<tr><td>NumCyc</td><td>Number of cycles of the basic frequency.</td></tr>
<tr><td>NumPwrUp</td><td>The number of power up operations of the physical device since the last reset.</td></tr>
<tr><td>NumRcd</td><td>Actual number of records.</td></tr>
<tr><td>OANL</td><td>TRUE = Provides indication that power system devices is operating with no load.</td></tr>
<tr><td>Ofs</td><td>Offset, for Analogue Values, the offset from zero of the Analogue Value.</td></tr>
<tr><td>OilFil</td><td>TRUE = Oil filtration is operational/running.</td></tr>
<tr><td>OilMotA</td><td>Oil circulation motor drive current.</td></tr>
<tr><td>OilTmpIn</td><td>Oil temperature cooler in.</td></tr>
<tr><td>OilTmpOut</td><td>Oil temperature cooler out.</td></tr>
<tr><td>OilTmpSet</td><td>Set point for oil temperature.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>Op</td><td>Operate (Common Data Classes ACT) indicates the trip decision of a protection function (LN). The trip itself is issued by PTRC.</td></tr>
<tr><td>OpARem</td><td>The remote operating current (phasor) used by the differential protection function.</td></tr>
<tr><td>OpCls</td><td>Operation Close Switch. OpCls shall be used if no control service is available between CSWI and XCBR and the GOOSE is used instead.</td></tr>
<tr><td>OpCnt</td><td>This Data represents a count of operations that is not resetable. In general, this type of counter is included in the following LNs: XCBR, XSWI, and YLTC. The counter shall not be reset from remote but maybe from local.</td></tr>
<tr><td>OpCntRs</td><td>This Data represents a resetable LN operations counter. The use of the INC Common Data Class, permits setting the counter to something other than “0”.</td></tr>
<tr><td>OpDlTmms</td><td>Time delay in ms before operating once operate conditions have been met.</td></tr>
<tr><td>OpEx</td><td>Trip of a breaker failure function to a circuit breaker other than the faulty one to switch off the grid fault ("external trip").</td></tr>
<tr><td>OpIn</td><td>Retrip of a breaker failure function after a trip of a protection function was not successful ("internal trip").</td></tr>
<tr><td>OpMod</td><td>This Data is used to defined the operation mode of mass storages
<table>
<tr><th>Direction Mode</th><th>Value</th></tr>
<tr><td>Saturation</td><td>1</td></tr>
<tr><td>Overwrite</td><td>2</td></tr>
</table>
</td></tr>
<tr><td>OpOpn</td><td>Operation open Switch. OpOpn shall be used if no control service is available between CSWI and XCBR and the GOOSE is used instead</td></tr>
<tr><td>OpOvA</td><td>TRUE = Device is operating under an overcurrent condition.</td></tr>
<tr><td>OpOvExt</td><td>TRUE = Device operating in an over excited condition.</td></tr>
<tr><td>OpOvV</td><td>TRUE = Device is operating under an overvoltage condition.</td></tr>
<tr><td>OPSA</td><td>TRUE = Surge arrestor operation detected.</td></tr>
<tr><td>OpTmh</td><td>This Data indicates the Operation time in h of a physical device since start of the operation. Details are LN specific.</td></tr>
<tr><td>OpUnExt</td><td>TRUE = Device operated in an under-excited condition.</td></tr>
<tr><td>OpUnV</td><td>TRUE = Device operating in an under voltage condition.</td></tr>
<tr><td>OutOv</td><td>This Data indicates that a buffer overflow occurred for the output buffer and important annunciation’s may be lost (TRUE) for the communication. A general interrogation is recommended or an integrity scan is started automatically.</td></tr>
<tr><td>PaDschAlm</td><td>TRUE = Partial Discharge has reached pre-set alarm level.</td></tr>
<tr><td>ParOp</td><td>Transformers are operating in parallel.</td></tr>
<tr><td>PctOfs</td><td>Distance characteristic offset in percent of the line length.


</td></tr>
<tr><td>PctRch</td><td>Distance characteristic reach in percent of the line length; see curve in PctOfs.</td></tr>
<tr><td>PerTrgTms</td><td>Periodic trigger time in s.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>PF</td><td>Phase to ground power factor for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhA</td><td>Phase current in amperes for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhAng</td><td>Phase angle of LodA relative to CtlV at 1.0 power factor, assuming forward power flow.</td></tr>
<tr><td>PhDlMod</td><td>Operate Time Delay Multiphase Mode. TRUE = on, FALSE = off</td></tr>
<tr><td>PhDlTmms</td><td>Operate Time Delay for Multiphase Faults in ms.</td></tr>
<tr><td>PhGndVal</td><td>Phase to ground is the Undervoltage level for WEI (weak end infeed) condition for a phase to ground measurement.</td></tr>
<tr><td>PhStop</td><td>Phase Stop Value.</td></tr>
<tr><td>PhStr</td><td>When the phase measurements exceed (or drop below, in the case of a dropout function) this value, the operation of the related function is initiated.</td></tr>
<tr><td>PhV</td><td>Phase to ground voltages for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhVA</td><td>Phase to ground apparent power for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhVAr</td><td>Phase to ground reactive for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhW</td><td>Phase to ground active power for Phases 1, 2, and 3, including Angle.</td></tr>
<tr><td>PhyHealth</td><td>See Health in Common Logical Node Information.</td></tr>
<tr><td>PhyNam</td><td>This is the name plate of the physical device.</td></tr>
<tr><td>PlsTmms</td><td>Defines the length of the breaker closing pulse from the reclosing LN.</td></tr>
<tr><td>PmpAlm</td><td>Loss of pump is indicated.</td></tr>
<tr><td>PmpCtlGen
PmpCtl</td><td>PmpCtlGen – Control of all pumps.
PmpCtl – Control of a single pump.
<table><tr><th>Pump Control</th><th>Value</th></tr><tr><td>Inactive</td><td>1</td></tr><tr><td>Stage 1</td><td>2</td></tr><tr><td>Stage 2</td><td>3</td></tr><tr><td>Stage 3</td><td>4</td></tr></table>
More stages may be added with numbers greater than 4</td></tr>
<tr><td>PmpOvCur</td><td>Pump overcurrent trip.</td></tr>
<tr><td>PolQty</td><td>This Data indicates the reference quantity used to determine fault direction.
<table><tr><th>Polarizing Quantity</th><th>Value</th></tr><tr><td>None</td><td>1</td></tr><tr><td>Zero sequence current</td><td>2</td></tr><tr><td>Zero sequence voltage</td><td>3</td></tr><tr><td>Negative sequence voltage</td><td>4</td></tr><tr><td>Phase to Phase Voltages (Cross Polarising)</td><td>5</td></tr><tr><td>Phase to Ground Voltages</td><td>6</td></tr></table></td></tr>
<tr><td>PoRch</td><td>Polar Reach is the diameter of the Mho diagram, see PctRch.</td></tr>
<tr><td>Pos</td><td>This Data is accessed when performing a switch command or to verify the switch status or position. When this Data is also used for a hand-operated switch, the (optional) CtlVal attribute in IEC 61850-7-3 does not exist.</td></tr>
<tr><td>PosA</td><td>This Data shall be used for switching, where single phase A may be operated separately.</td></tr>
<tr><td>PosB</td><td>This Data shall be used for switching, where single phase B may be operated separately.</td></tr>
<tr><td>PosC</td><td>This Data shall be used for switching, where single phase C may be operated separately.</td></tr>
<tr><td>POWCap</td><td>Point On Wave switching capability.
<table><tr><th>POW Switching Capability</th><th>Value</th></tr><tr><td>None</td><td>1</td></tr><tr><td>Close</td><td>2</td></tr><tr><td>Open</td><td>3</td></tr><tr><td>Close and Open</td><td>4</td></tr></table></td></tr>
</table>

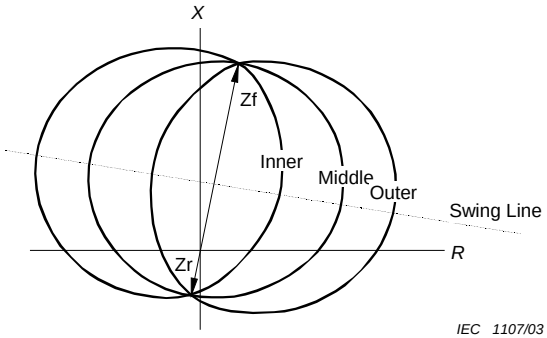
<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>PPV</td><td>Phase to phase voltages.</td></tr>
<tr><td>PPVVal</td><td>Undervoltage level for WEI conditions for a phase-phase measurement.</td></tr>
<tr><td>Pres</td><td>Pressure in a specific volume.</td></tr>
<tr><td>PresAlm</td><td>Pressure alarm because of an abnormal condition (FALSE = Normal, TRUE = alert)</td></tr>
<tr><td>PresTr</td><td>Pressure trip because of an abnormal condition (FALSE = Normal, TRUE = alert).</td></tr>
<tr><td>PreTmms</td><td>This is the time prior to trigger for which data is recorded when a trigger occurs.</td></tr>
<tr><td>ProRx</td><td>TRUE = indicates that the protection function has received the information about a fault in forward direction from the other end of the line.</td></tr>
<tr><td>ProTx</td><td>TRUE = indicates that the protection function has detected a fault in forward direction and has transmitted this information to the other end of the line.</td></tr>
<tr><td>Proxy</td><td>TRUE indicates that the LN (LPHD) is a proxy. This means that the LD embedding this LN is representing another physical device.</td></tr>
<tr><td>PstTmms</td><td>This is the time following the trigger that the data capture is recorded.</td></tr>
<tr><td>PwrDn</td><td>A device power down has been detected if PwrDn is TRUE.</td></tr>
<tr><td>PwrFact</td><td>Power factor not allocated to a phase.</td></tr>
<tr><td>PwrRtg</td><td>Rated Power.</td></tr>
<tr><td>PwrSupAlm</td><td>Alarm from power supply allocated to the Physical Device if PwrSupAlm is TRUE. May be an external contact. It refers always to the local power supply of the IED modelled by LPHD and not to the health (EEHealth) of the complete external supply system</td></tr>
<tr><td>PwrUp</td><td>A device power up has been detected if PwrUp is TRUE.</td></tr>
<tr><td>R0</td><td>Zero sequence line resistance.</td></tr>
<tr><td>R1</td><td>Positive sequence line resistance.</td></tr>
<tr><td>Rat</td><td>Winding ratio of an instrument transformer/transducer</td></tr>
<tr><td>RcdMade</td><td>TRUE = Disturbance recording complete.</td></tr>
<tr><td>RcdMod</td><td>This Data defines whether the recording will stop when the memory is full or saturated, or overwrite existing values.
<table>
<tr><th>Recording Mode</th><th>Value</th></tr>
<tr><td>Overwrite existing values</td><td>1</td></tr>
<tr><td>Stop when full or saturated</td><td>2</td></tr>
</table>
</td></tr>
<tr><td>RcdStr</td><td>TRUE = Disturbance recording processes started.</td></tr>
<tr><td>RcdTrg</td><td>External command to trigger recorder (TRUE).</td></tr>
<tr><td>RclTmms</td><td>Recloser reclaim time (after successful reclose) in ms.</td></tr>
<tr><td>RCol</td><td>Raise Plunge Core Position.</td></tr>
<tr><td>React</td><td>Relative capacitance of bushing related to reference capacitance for bushing at commissioning</td></tr>
<tr><td>ReactPwrL</td><td>TRUE = Lower reactive power, FALSE = no action.</td></tr>
<tr><td>ReactPwrR</td><td>TRUE = Raise reactive power, FALSE = no action.</td></tr>
<tr><td>RecTmms</td><td>Reclose delay time (shot) in milliseconds. Multiple instances allow to set the Reclose delay time per cycle or step.</td></tr>
<tr><td>RecCyc</td><td>Number of the actual recluse cycle (1 to n, typically n=3). Default value 0 if no Autoreclosing is going on.</td></tr>
<tr><td>RefPF</td><td>Reference power factor for bushing at commissioning.</td></tr>
<tr><td>RefReact</td><td>Reference capacitance for bushing at commissioning.</td></tr>
<tr><td>RefV</td><td>Reference voltage for bushing at commissioning.</td></tr>
<tr><td>Rel</td><td>This Data indicates that all criteria are fulfilled and the switching/operation action is released to proceed if value is TRUE, and blocked if FALSE.</td></tr>
<tr><td>RemCtlBlk</td><td>Remote Control Blocked (see Loc)</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>ReTrgMod</td><td>If the mode is true, the recorder will start a new recording if it is retriggered while still collecting samples on previous recording (during post fault time). If false, the recorder ignores the retrigger.</td></tr>
<tr><td>ReTrMod</td><td>Retrip Mode
<table>
<tr><th>Retrip Mode</th><th>Value</th></tr>
<tr><td>Off</td><td>1</td></tr>
<tr><td>Without Check</td><td>2</td></tr>
<tr><td>With Current Check</td><td>3</td></tr>
<tr><td>With Breaker Status Check</td><td>4</td></tr>
<tr><td>With Current and Breaker Status Check</td><td>5</td></tr>
<tr><td>Other Checks</td><td>6</td></tr>
</table></td></tr>
<tr><td>RHz</td><td>TRUE = Raise frequency, FALSE = no action</td></tr>
<tr><td>RisGndRch</td><td>Resistive reach of the quadrilateral ground distance element shown as the difference between the left and right resistive blinders in the diagram below. See also AngLod.

</td></tr>
<tr><td>RisLod</td><td>Resistive reach for load area…see AngLod for an example of the definition of load encroachment used for the Data AngLod and RisLod with polygonal characteristic, applicable also with MHO.</td></tr>
<tr><td>RisPhRch</td><td>Resistive reach of quadrilateral phase distance element; see RisGndRch.</td></tr>
<tr><td>Rm0</td><td>Mutual resistance coupling from parallel line.</td></tr>
<tr><td>RnbkRV</td><td>Runback Raise Voltage is the control voltage above which auto Lower command issued.</td></tr>
<tr><td>RsDlTmms</td><td>Time delay in ms before reset once reset conditions have been met.</td></tr>
<tr><td>RsStat</td><td>This Data resets device statistics of this LN.</td></tr>
<tr><td>RstA</td><td>Restraint Current</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>RstMod</td><td>Identifies the Restraint Mode for the Differential LN.
<table>
<tr><th>Restraint Mode</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>2nd Harmonic</td><td>2</td></tr>
<tr><td>5th Harmonic</td><td>3</td></tr>
<tr><td>2nd & 5th Harmonic</td><td>4</td></tr>
<tr><td>Waveform analysis</td><td>5</td></tr>
<tr><td>2nd Harmonic and waveform analysis</td><td>6</td></tr>
<tr><td>Other</td><td>7</td></tr>
</table></td></tr>
<tr><td>RV</td><td>TRUE = Raise voltage, FALSE = no action</td></tr>
<tr><td>RvABlk</td><td>Block signal from current reversal function.</td></tr>
<tr><td>RvAMod</td><td>This Data is the current reversal function mode.
<table>
<tr><th>Current Reversals Mode</th><th>Value</th></tr>
<tr><td>Off</td><td>1</td></tr>
<tr><td>On</td><td>2</td></tr>
</table></td></tr>
<tr><td>RvATmms</td><td>Pickup time in ms for current reversal logic.</td></tr>
<tr><td>RvRsTmms</td><td>After the reverse fault has disappeared, the current reversal output still will be active for this time.</td></tr>
<tr><td>SchTyp</td><td>This Data indicates the scheme type for line protection.
<table>
<tr><th>Scheme Type</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>Intertrip</td><td>2</td></tr>
<tr><td>Permissive Under Reach</td><td>3</td></tr>
<tr><td>Permissive Over Reach</td><td>4</td></tr>
<tr><td>Blocking</td><td>5</td></tr>
</table></td></tr>
<tr><td>SecTmms</td><td>Pickup security timer on loss of carrier guard signal in ms.</td></tr>
<tr><td>SeqA</td><td>The absolute measured values of positive, negative and zero sequence current.</td></tr>
<tr><td>SeqV</td><td>The absolute measured values of positive, negative and zero sequence voltage.</td></tr>
<tr><td>SetA</td><td>Current setting for a limit in motor start-up (for example counting operate condition or thermal stress). This setting is used in motor start-up protection.</td></tr>
<tr><td>SetTms</td><td>Time Setting for a limit in motor start-up (for example counting operate condition or thermal stress). This setting is used in motor start-up protection.</td></tr>
<tr><td>ShOpCap</td><td>This is an enumeration representing the operating capabilities of the power shunt.
<table>
<tr><th>Shunt Operating Capability</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>Open</td><td>2</td></tr>
<tr><td>Close</td><td>3</td></tr>
<tr><td>Open and Close</td><td>4</td></tr>
</table></td></tr>
<tr><td>SPCSO</td><td>Generic single point controllable status output.</td></tr>
<tr><td>SPlTrTmms</td><td>Single pole delay time in ms before the Breaker Failure tries to retrip the failed breaker.</td></tr>
</table>

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>SptMsg</td><td>End message
<table>
<tr><td>0</td><td>Ended normally</td></tr>
<tr><td>1</td><td>Ended with overshoot</td></tr>
<tr><td>2</td><td>Cancelled: measurement was deviating</td></tr>
<tr><td>3</td><td>Cancelled: loss of communication with dispatch centre</td></tr>
<tr><td>4</td><td>Cancelled: loss of communication with local area network</td></tr>
<tr><td>5</td><td>Cancelled: loss of communication with the local interface</td></tr>
<tr><td>6</td><td>Cancelled: timeout</td></tr>
<tr><td>7</td><td>Cancelled: voluntarily</td></tr>
<tr><td>8</td><td>Cancelled: noisy environments</td></tr>
<tr><td>9</td><td>Cancelled: material failure</td></tr>
<tr><td>A</td><td>Cancelled: new set-point request</td></tr>
<tr><td>B</td><td>Cancelled: improper environment (blockage)</td></tr>
<tr><td>C</td><td>Cancelled: stability time was reached</td></tr>
<tr><td>D</td><td>Cancelled: immobilisation time was reached</td></tr>
<tr><td>E</td><td>Cancelled: equipment was in the wrong mode</td></tr>
<tr><td>F</td><td>Unknown causes</td></tr>
</table></td></tr>
<tr><td>StopVlv</td><td>This Data is responsible for control and indication of the valve that stops the generator driving forces, for example fluid flow. TRUE = valve close(d)</td></tr>
<tr><td>StoRte</td><td>Storage rate (often called sampling rate) of the disturbance recorder in samples per Millisecond (ms)</td></tr>
<tr><td>Str</td><td>Start (Common Data Classes ACD) indicates the detection of a fault or an unacceptable condition. Str may contain phase and directional information.</td></tr>
<tr><td>StrInh</td><td>Status Information Restart inhibited. After a limit is reached (for example maximum number of starts or permissible temperature), restart inhibit is activated.</td></tr>
<tr><td>StrInhTmm</td><td>Time Setting for Restart Inhibition. Once the StrInh is activated, the motor should not be allowed to start until this time has elapsed.</td></tr>
<tr><td>StrPOW</td><td>TRUE = Start CPOW (for example by select) – Request by CSWI or RREC.</td></tr>
<tr><td>StrVal</td><td>Level of the supervised value, which starts a dedicated action of the related function.</td></tr>
<tr><td>SumSwARs</td><td>Sum of switched amperes, resetable. This Data indicates the sum or integration of all switched currents since the last reset of the counter for example after maintenance of the contacts, the nozzle and other aging parts.</td></tr>
<tr><td>SupVArh</td><td>Reactive energy supply (default supply direction: energy flow towards busbar).</td></tr>
<tr><td>SupWh</td><td>Real energy supply (default supply direction: energy flow towards busbar).</td></tr>
<tr><td>SvcViol</td><td>Service violation: the data that the client wanted to access exists in the access view for the association with that client, but the requested service is not allowed.</td></tr>
<tr><td>SwArcDet</td><td>TRUE = Alarm that switch arc has been detected.</td></tr>
<tr><td>SwgReact</td><td>Value of the power swing reactance band, see figure under SwgVal.</td></tr>
<tr><td>SwgRis</td><td>Value of the power swing resistance band, see figure under SwgVal.</td></tr>
<tr><td>SwgTmms</td><td>Power swing detection time in ms.</td></tr>
</table>

Kommentar [HD53]: #209

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>SwgVal</td><td>Value of the power swing band.
 
</td></tr>
<tr><td>SwOpCap</td><td>This is an enumeration representing the physical capabilities of the switch to operate. It includes additional blocking due to some local problems.

<table>
<tr><th>Switch Operating Capability</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>Open</td><td>2</td></tr>
<tr><td>Close</td><td>3</td></tr>
<tr><td>Open and Close</td><td>4</td></tr>
</table></td></tr>
<tr><td>SwTyp</td><td>
<table>
<tr><th>Switch Type</th><th>Value</th></tr>
<tr><td>Load Break</td><td>1</td></tr>
<tr><td>Disconnector</td><td>2</td></tr>
<tr><td>Earthing Switch</td><td>3</td></tr>
<tr><td>High Speed Earthing Switch</td><td>4</td></tr>
</table></td></tr>
<tr><td>SynPrg</td><td>Synchronizing in progress.</td></tr>
<tr><td>TapBlkL</td><td>Tap position of Load Tap Changer where automatic Lower commands blocked.</td></tr>
<tr><td>TapBlkR</td><td>Tap position of Load Tap Changer where automatic Raise commands blocked.</td></tr>
<tr><td>TapChg</td><td>This Data represents the control of a process to raise or lower a single step or tap.</td></tr>
<tr><td>TapPos</td><td>Represents the discrete adjustment of a transformer such as used in a load tap changer to a specified tap position.</td></tr>
<tr><td>TddA</td><td>Current Total Demand Distortion (according to IEEE 519, phase related).</td></tr>
<tr><td>TddAmp</td><td>Current Total Demand Distortion (according to IEEE 519,non-phase related).</td></tr>
<tr><td>TddEvnA</td><td>Current Total Demand Distortion (according to IEEE 519, even components, phase related).</td></tr>
<tr><td>TddEvnAmp</td><td>Current Total Demand Distortion (according to IEEE 519, even components, non-phase related).</td></tr>
<tr><td>TddOddA</td><td>Current Total Demand Distortion (according to IEEE 519, odd components, phase related).</td></tr>
<tr><td>TddOddAmp</td><td>Current Total Demand Distortion (according to IEEE 519, odd components, non-phase related).</td></tr>
<tr><td>TestRsl</td><td>Test Results value is TRUE if passed and FALSE if failed.</td></tr>
<tr><td>ThdA</td><td>Current otal Harmonic or Interharmonic Distortion (different methods, phase related).</td></tr>
<tr><td>ThdAmp</td><td>Current Total Harmonic or Interharmonic Distortion (different methods, non-phase related).</td></tr>
<tr><td>ThdATmms</td><td>Total harmonic or interharmonic distortion current alarm delay time in ms after the ThdAVal has been exceeded.</td></tr>
<tr><td>ThdAVal</td><td>Total harmonic or interharmonic distortion amperes alarm setting – value entered in %. Thd values above this threshold cause an alarm.</td></tr>
<tr><td>ThdEvnA</td><td>Current Total Harmonic or Interharmonic Distortion (even components, phase related).</td></tr>
<tr><td>ThdEvnAmp</td><td>Current Total Harmonic or Interharmonic Distortion (different methods, even components, non-phase related).</td></tr>
</table>

Data Name	Semantics
ThdEvnPhV	Phase to ground voltage Total Harmonic or Interharmonic Distortion (different methods, even components, phase related).
ThdEvnPPV	Phase to phase voltage Total Harmonic or Interharmonic Distortion (different methods, even components, phase related).
ThdEvnVol	Phase voltage Total Harmonic or Interharmonic Distortion (different methods, even components, non-phase related).
ThdOddA	Current Total Harmonic or Interharmonic Distortion (different methods, odd components, phase related).
ThdOddAmp	Current Total Harmonic or Interharmonic Distortion (different methods, odd components, non-phase related).
ThdOddPhV	Phase to ground voltage Total Harmonic or Interharmonic Distortion (different methods, odd components, phase related).
ThdOddPPV	Phase to phase voltage Total Harmonic or Interharmonic Distortion (different methods, odd components, phase related).
ThdOddVol	Phase to ground voltage Total Harmonic or Interharmonic Distortion (different methods, odd components, non-phase related).
ThdPhV	Phase to ground voltage Total Harmonic or Interharmonic Distortion (different methods, phase related).
ThdPPV	Phase to phase voltage Total Harmonic or Interharmonic Distortion (different methods, phase related).
ThdVol	Voltage Total Harmonic or Interharmonic Distortion (different methods, non-phase related).
ThdVTmms	Total harmonic or Interharmonic distortion voltage alarm time delay in ms after the ThdVVal has been exceeded.
ThdVVal	Total harmonic or Interharmonic distortion alarm setting – value entered in %. Thd values above this threshold cause an alarm.
TmACrv	Characteristic Curve for protection operation of the form: $y = f(x)$, where x = A (current) and y = Tm (time). The integers representing the different curves are given in the definition of CDC CURVE in IEC 61850-7-3.
TmASt	Delivers the active curve characteristic.
TmDlChr	Time delay linear or inverse characteristic. **Timer Delay** / **Value** Linear / TRUE Inverse characteristic / FALSE
TmDlMod	Operate Time Delay Mode. TRUE = on, FALSE = off
TmExc	TRUE = Maximum allowed time exceeded (LN CPOW).
TmMult	This Data is the time dial multiplier or Time Dial Setting mainly used for protection.
Tmp	The temperature of a specified component or in a specified volume.
TmpAlm	Temperature alarm because of an abnormal condition (FALSE = Normal, TRUE = alert).
TmpMax	Maximum temperature.
TmpRl	Relation between temperature and maximum temperature.
TmTmpCrv	Characteristic Curve for protection operation of the form: $y = f(x)$, where x = Tmp (Temperature) and y = Tm (time). The integers representing the different curves are given in the definition of CDC CURVE in IEC 61850-7-3.
TmTmpSt	Delivers the active curve characteristic.
TmVCrv	Characteristic Curve for protection operation of the form: $y = f(x)$, where x = V (voltage) and y = Tm (time). The integers representing the different curves are given in the definition of CDC CURVE in IEC 61850-7-3.
TmVSt	Delivers the active curve characteristic.
Torq	Drive torque.
TotPF	Average power factor for a three-phase circuit.

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>TotVA</td><td>Total apparent power in a three-phase circuit.</td></tr>
<tr><td>TotVAh</td><td>Net Apparent energy since last rest.</td></tr>
<tr><td>TotVAr</td><td>Total reactive power in a three-phase circuit.</td></tr>
<tr><td>TotVArh</td><td>Net Reactive energy since last reset.</td></tr>
<tr><td>TotW</td><td>Total real power in a three phase circuit.</td></tr>
<tr><td>TotWh</td><td>Net Real energy since last reset.</td></tr>
<tr><td>TPTrTmms</td><td>Three-pole delay time in ms before the Breaker Failure tries to retrip the failed breaker.</td></tr>
<tr><td>Tr</td><td>Trip is the command to open the breaker when issued in case of fault by PTRC.</td></tr>
<tr><td>TrBeh</td><td>Indicates for the next Trip if Single Pole Tripping is allowed or Three Pole Tripping requested.
<table>
<tr><th>Trigger Behavior</th><th>Value</th></tr>
<tr><td>Single Pole Tripping</td><td>1</td></tr>
<tr><td>Undefined</td><td>2</td></tr>
<tr><td>Three Pole Tripping</td><td>3</td></tr>
</table></td></tr>
<tr><td>TrgMod</td><td>Disturbance recorder trigger mode. The source of the External trigger is a local issue.
<table>
<tr><th>Trigger Mode</th><th>Value</th></tr>
<tr><td>Internal</td><td>1</td></tr>
<tr><td>External</td><td>2</td></tr>
<tr><td>Both</td><td>3</td></tr>
</table></td></tr>
<tr><td>TrMod</td><td>This data represents type of trip function; 3ph means only 3phase tripping possible, 1 or 3ph means PTRC with 1 and 3 phase tripping possibility and first trip depending on fault type. Specific means for example PTRC with 1 and 2ph and 3ph tripping possibility and first trip depending on fault type.
<table>
<tr><th>Trip Mode</th><th>Value</th></tr>
<tr><td>3 phase tripping</td><td>1</td></tr>
<tr><td>1 or 3 phase tripping</td><td>2</td></tr>
<tr><td>specific</td><td>3</td></tr>
</table></td></tr>
<tr><td>TrMod</td><td>Setting for single-pole or three-pole tripping to be used for protection if applicable. Multiple instances allow to set the Trip Mode per cycle or step.
<table>
<tr><th>Trip Mode</th><th>Value</th></tr>
<tr><td>Single Pole Tripping</td><td>1</td></tr>
<tr><td>Undefined</td><td>2</td></tr>
<tr><td>Three Pole Tripping</td><td>3</td></tr>
</table></td></tr>
<tr><td>TrPlsTmms</td><td>Trip pulse time is the minimum pulse time for breaker operation.</td></tr>
<tr><td>TypRsCrv</td><td>This is the type of the reset curve that is used to co-ordinate the reset with electromechanical relays that do not reset instantaneously.
<table>
<tr><th>Reset Curve</th><th>Value</th></tr>
<tr><td>None</td><td>1</td></tr>
<tr><td>Definite Time Delayed Reset</td><td>2</td></tr>
<tr><td>Inverse Reset</td><td>3</td></tr>
</table></td></tr>
<tr><td>UnBlkMod</td><td>This Data is the unblock function mode.
<table>
<tr><th>Unblock Function Mode</th><th>Value</th></tr>
<tr><td>Off</td><td>1</td></tr>
<tr><td>Permanent</td><td>2</td></tr>
<tr><td>Time Window</td><td>3</td></tr>
</table></td></tr>
<tr><td>UnBlkTmms</td><td>Unblocking Time.</td></tr>
<tr><td>UseCyc</td><td>Actual set maximum number of cycles for any cyclic process, e.g. used for the Autorecloser</td></tr>
<tr><td>VA</td><td>Phase apparent power</td></tr>
<tr><td>VAr</td><td>Phase reactive power (Q)</td></tr>
</table>

Kommentar [HD54]: to decide if the description for TrMod should be kept in addition to TrMod1…
01Feb: we deleted TrMod1, but didn't decide about TrMod
TrMod1 came from Ad2
TrMod came from 7-4 ed1

Kommentar [HD55]: sugge st to add max to name to UseMaxCyc

<table>
<tr><th>Data Name</th><th>Semantics</th></tr>
<tr><td>VHzCrv</td><td>Characteristic Curve for protection operation of the form: y = f(x), where x = Hz (frequency) and y = V (voltage) The integers representing the different curves are given in the definition of CDC CURVE in IEC 61850-7-3.</td></tr>
<tr><td>VHzSt</td><td>Delivers the active curve characteristic.</td></tr>
<tr><td>VInd</td><td>This Data indicates the check result of the differences between the absolute values of the busbar and line voltages. FALSE indicates that the voltage difference is below the required limit. The voltage difference criteria for the synchronising are fulfilled. TRUE indicates that the voltage difference exceeds the limit. The synchronising process shall be aborted because the voltage band criteria are not fulfilled (synchrocheck) or shall be continued with generator control activities (synchronising).</td></tr>
<tr><td>Vol</td><td>Voltage non phase related.</td></tr>
<tr><td>VolAmp</td><td>Apparent power measurement of a non-three-phase circuit.</td></tr>
<tr><td>VolAmpr</td><td>Volt-amperes reactive of a non-three-phase circuit.</td></tr>
<tr><td>VolChgRte</td><td>Rate of voltage change (change over time).</td></tr>
<tr><td>VOvSt</td><td>TRUE = Indicates voltage override control status.</td></tr>
<tr><td>VRed</td><td>TRUE = Voltage reduction is active to reduce load side voltage below the normal setting.</td></tr>
<tr><td>VRedVal</td><td>Reduction of band centre (percent) when voltage step x is active.</td></tr>
<tr><td>VRtg</td><td>Rated Voltage, intrinsic property of the device, which cannot be set/changed from remote.</td></tr>
<tr><td>VStr</td><td>Value of the voltage that must be reached that a dedicated action is started of the related function.</td></tr>
<tr><td>W</td><td>Phase active power (P)</td></tr>
<tr><td>WacTrg</td><td>The number of times the watchdog circuit has reset the device since the counter reset.</td></tr>
<tr><td>Watt</td><td>Real power in a non-three-phase circuit.</td></tr>
<tr><td>WeiMod</td><td>This Data is the weak end infeed function mode.
NOTE Normal are values 1, 3 and 4.
<table>
<tr><th>Weak End Infeed Mode</th><th>Value</th></tr>
<tr><td>Off</td><td>1</td></tr>
<tr><td>Operate</td><td>2</td></tr>
<tr><td>Echo</td><td>3</td></tr>
<tr><td>Echo & Operate</td><td>4</td></tr>
</table></td></tr>
<tr><td>WeiOp</td><td>Operate signal from week end infeed function.</td></tr>
<tr><td>WeiTmms</td><td>Co-ordination time for weak end feed function in ms.</td></tr>
<tr><td>WrmStr</td><td>The number of warm starts made by the physical/logical device since the last reset.</td></tr>
<tr><td>X0</td><td>Zero sequence line reactance.</td></tr>
<tr><td>X1</td><td>Positive sequence line (reach) reactance.</td></tr>
<tr><td>Xm0</td><td>Mutual reactance coupling from parallel line.</td></tr>
<tr><td>Z</td><td>Line impedance of all phases in a three-phase system</td></tr>
<tr><td>Z0Ang</td><td>Zero sequence source angle, near end (A).</td></tr>
<tr><td>Z0Mod</td><td>Zero sequence source module, remote end (B).</td></tr>
<tr><td>Z1Ang</td><td>Positive sequence line angle.</td></tr>
<tr><td>Z1Mod</td><td>Positive sequence line Mod.</td></tr>
<tr><td>ZeroEna</td><td>Zero Sequence Current Supervision Enabled (TRUE).</td></tr>
<tr><td>Zm0Ang</td><td>Mutual impedance coupling from parallel line Angle.</td></tr>
<tr><td>Zm0Mod</td><td>Mutual impedance coupling from parallel line Module.</td></tr>
</table>

Kommentar [HD56]: 836-US2: give Explanation:

Annex A
(normative)

Extension rules

A.1 The use of Logical Nodes and Data and its extensions

A.1.1 Basic rules

A.1.1.1 Logical Nodes (LN)

- If there is any Logical Nodes Class which fits the function to be modelled, an instance of this logical node shall be used with all its mandatory data (M). The rules of a unique instantiation can be found in IEC 61850-7-2.
- If there are dedicated versions of this function with the same basic data (for example ground, phase, zone A, zone B, etc.), different instances of this Logical Node Class shall be used.
- If there are no Logical Nodes Classes which fit to the function to be modelled, a new logical node shall be created according to the rules for new Logical Nodes, see A.4.
- Other extensions are not allowed in the domain of substation automation.

A.1.1.2 Data

- If, in addition to the mandatory data (M), there are also optional data (O), which fit the function to be modelled, these optional data shall be used.
- If there are same data (M or O) which are needed more times than defined in the Logical Node Class, additional data with number extensions shall be used.
- If, in the Logical Node Class, data are missing for the allocated function, the first choice shall be to use one of the data listed in Clause 6.
- If none of the data in Clause 6 covers the open requirement of the function, new data shall be created according to the rules for new data (see A.6).
- Other extensions are not allowed in the domain of substation automation.

A.2 Multiple instances of LN classes for dedicated and complex functions

A.2.1 Example for time overcurrent

Logical Node Class Name: PTOC (Time overcurrent)		
LN Instance Name	Meaning	Meaning of "Start value" StrVal
GFDPTOC	Ground Fault Detection	"Ground Start Value"
PFDPTOC	Phase Fault Detection	"Phase Start Value"

A.2.2 Example for Distance

Logical Node Class Name: PDIS (Distance)	
LN Instance Name (without LN-Prefix)	Meaning
PDIS1	Zone 1 of the distance protection
PDIS2	Zone 2 of the distance protection
PDIS3	Zone 3 of the distance protection
etc.	etc.

The semantics of the different instances may be given in the description attribute of data NamPlt (Name Plate). Instances of PSCH co-ordinate the “start” (Str) and “operate” (Op) according to the protection scheme. This co-ordination includes the PDIS functions on both sides of the line. The result of the co-ordination is a trip via PTRC to the local circuit breaker (see example in B.2).

A.2.3 Example for Power transformer

Logical Node Class Name: YPTR (Power transformer)	
LN Instance Name (without LN-Prefix)	Meaning
YPTR1	Transformer unit phase L1
YPTR2	Transformer unit phase L2
YPTR3	Transformer unit phase L3

The semantics of the different instances may be given in the description attribute of data NamPlt (Name Plate).

A.2.4 Example for Auxiliary network

Logical Node Class Name: ZAXN (Auxiliary network)	
LN Instance Name (without LN-Prefix)	Meaning
ZAXN1	220 V DC
ZAXN2	60 V DC
ZAXN3	380 V AC

The semantics of the different instances may be given in the description attribute of data NamPlt (Name Plate).

A.3 Specialisation of Data by use of the number extension

Standardised data names in Logical Nodes provide a unique identification. If the same data (i.e. data with the same semantics) are needed more times as defined, data with number extensions shall be used. The unnumbered original data shall be not used. Examples are given in the following. This number extensions is allowed for optional Data only. Mandatory data shall not be multiplied

Kommentar [HD57]: #320

Mandatory data should not be extented.

Logical Node Class Name: YPTR (Power transformer)	
Data name: HPTmp (Winding hotspot temperature in °C)	
HPTmp1	Winding hotspot 1 temperature (in °C)
HPTmp2	Winding hotspot 2 temperature (in °C)
HPTmp3	Winding hotspot 3 temperature (in °C)
HPTmp4	Winding hotspot 4 temperature (in °C)

The semantics of the different hot spots may be given in the description attribute of the data.

A.4 Rules for names of new Logical Nodes

If no standardised Logical Node class is applicable for the function to be modelled a new class with a new name may be created. To keep interoperability simple this option shall be used with care. A new Logical Node class name shall be created by use of the following naming conventions:

- The first character shall be chosen in accordance with the relevant prefix of the Logical Node group (see Table 1) if applicable.
- The other characters shall be defined in relation to the English name of the new LN class name.
- New Logical Node classes shall be marked by a “name space attribute” according to the concept and rules given in IEC 61850-7-1 and to the attributes given in IEC 61850-7-3.

The creator of the new Logical Node class shall ensure that each additional name is consistent with the mnemonic naming conventions of the standardised LN classes and unique in the substation automation system considered. The description of this new Logical Node Class shall be added to the IEC documentation of the provider specific system or customer specific project.

A.5 Examples for new LNs

A.5.1 New LN “Automatic door entrance control”

1. Character Logical Node Group Indication	2. Character	3. Character	4. Character	new LN
A for “Automatic Control”	**D**oor	**E**ntrance	**C**ontrol	**ADEC** “Automatic door entrance control”

A.5.2 New LN “Fire protection”

1. Character Logical Node Group Indication	2. Character	3. Character	4. Character	new LN
Z for “ Further equipment”	**F**ire	**P**rotection	**T**ransformer	**ZFPT** “Fire Protection of a power transformer”

A.6 Rules for names of new Data

When in a standardised LN, data are missing or for a new LN data are needed, the data names from Clause 6 shall be used if applicable. If no standardised data fulfils the needs for a special instance of a standardised LN class, a “new” data may be created. To keep interoperability simple, this option shall be used with care. In any case, the following rules shall be followed:

- For building the new Data name, the abbreviations of Clause 4 shall be used if applicable. Only in other cases are new abbreviations out of the English name for the data allowed.
- The Data shall be assigned to any of the Common Data Classes as defined in IEC 61850-7-3. If no standardised Common Data Class fulfills the needs of the new data, an extended or new data class may be used (see A.8).
- Any data name shall be allocated to one Common Data Class (CDC) only.
- New Data names shall be marked by a “name space attribute” according to the concept and rules given in IEC 61850-7-1 and to the attributes given in IEC 61850-7-3.

The creator of new data shall ensure that each additional name is consistent with the mnemonic naming conventions of the standardised data names and unique in the substation automation system considered. The description of the new data shall be published to the user of the dedicated substation automation system.

A.7 Example for new Data

New Data “Colour of Transformer Oil”

New Data name: **ColrTOil** Attribute Type (CDC): INS (Integer status)

A.8 Rules for new Common Data Classes (CDC)

When for new Data an appropriate CDC is missing the existing CDC can be extended or a new CDC may be created. To keep interoperability simple, this option shall be used with care. The rules for creating new CDC are defined in IEC 61850-7-3. New CDC shall be marked by a “name space attribute” according to the concept and rules given in IEC 61850-7-1 and to the attributes given in IEC 61850-7-3.

The creator of new CDC shall ensure that each additional CDC is consistent with the mnemonic naming conventions of the standardised CDC and unique in the substation automation system considered. The description of the new CDC shall be published to the user of the dedicated substation automation system.

Annex B
(informative)

Modelling examples

B.1 PTEF and PSDE

The functions PTEF “Protection function Transient Earth Fault” and PSDE “Sensitive directional earthfault” are shown for an earth fault in a compensated network. The PTEF detects the transient charging current related to the network capacitance. Therefore the PTEF can only detect the beginning of an earth fault. The PSDE detects the residual current ($3I_0$). Therefore, PSDE is able to detect the beginning and the end of an earth fault. If PSDE is used for tripping, the scheme would then depend on the protection philosophy and the instrument transformer capabilities.

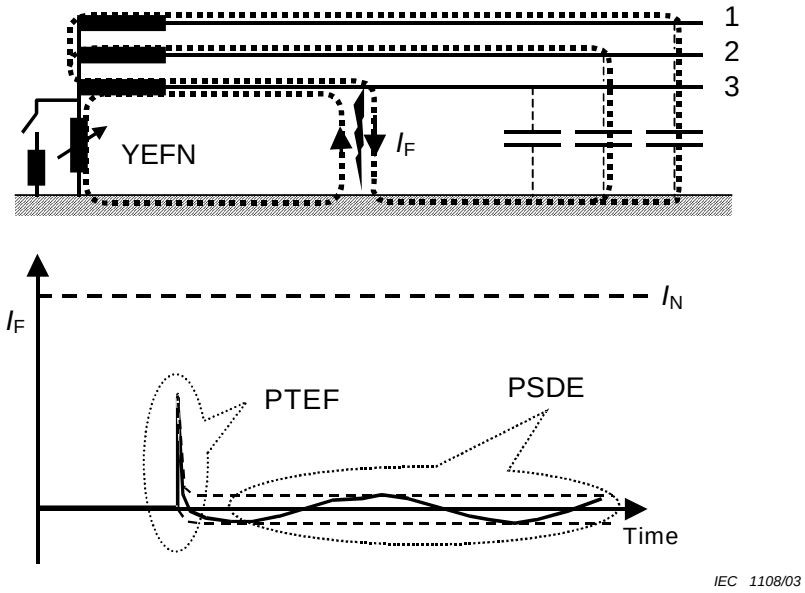


Figure B.1 – Fault current I_F in a compensated network with earth fault

Kommentar [HD58]: This chapter be changed as result of the SS-SS-Task force.

B.2 PSCH and PTRC

PSCH is used for modelling typical schemes in multifunctional IEDs for line protection. The data provided allow its use for modelling of different communications based accelerating schemes for transmission line protection.

PSCH may exchange data with many Logical Nodes (PDIS, PTOC,..., other PSCH). All these Logical Nodes may be located in different Logical Devices and Physical Devices (IEDs). PTRC is used to combine and condition various signals intended for tripping into a single trip condition.

The example in Figure B.2 illustrates a line protection scheme consisting of functions for distance protection (three instances for three zones) with teleprotection (PDIS + PSCH), for directional earth fault comparison protection (PTOC2) and for back up overcurrent protection (PTOC1) on both ends of the line.

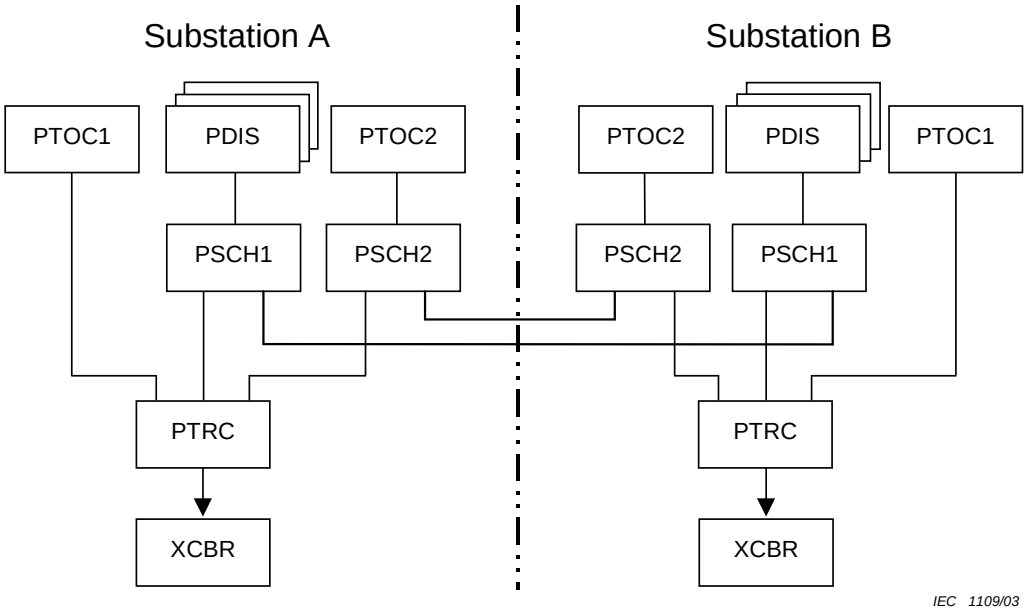


Figure B.2 – Use of PSCH and PTRC

The teleprotection functions (permissive overreach, permissive under reach, blocking, unblocking, etc.) of the distance protection and of the directional earth fault comparison scheme are concentrated in the logical nodes instances PSCH1 and PSCH2 of LN PSCH. These logical nodes control the communication between the two line ends.

All operate signals coming from the PSCH-nodes and from the protection nodes without an additional PSCH-node are combined to a trip-command in one PTRC. PTRC handles the trip signal conditioning (minimum trip command duration, single/three-pole decision, etc).

Editorial Note: This Figure will be updated later according to the results of the SS-SS task force

B.3 MDIF and PDIF

This is a Measuring Logical Node for IEDs with differential protection functions. In the case of a three terminal line differential protection, each IED at each terminal of the line will measure the local phase and sequence components and prepare the phasors (MDIF). Then this information is then sent to the IEDs at the other ends of the line (not part of this standard). Based on the local measurement and the received measurements, each IED (PDIF) will calculate the differential current (the sum of the three vectors for each phase current) and the restrained (bias) current (for example the sum of the three scalars divided by some constant). These are available as measurements from each IED through the MDIF.

The example in Figure B.3 illustrates a line protection scheme consisting of functions for differential protection PDIF (three instances for three zones) with remote provision of data by MDIF (differential measurements). MDIF comprises all three phases for a real time view including all phase relations of the other side.

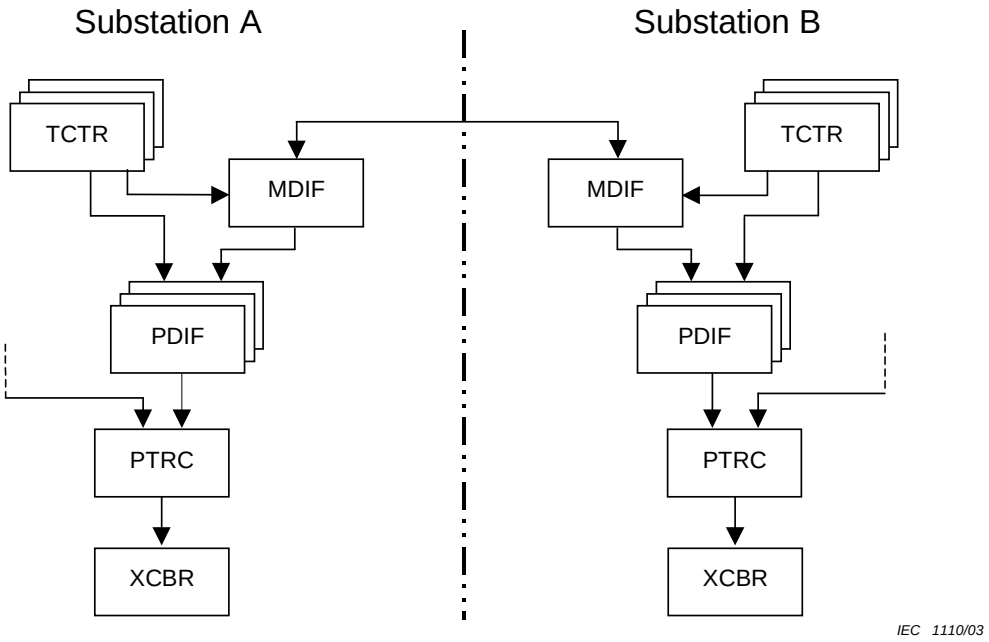


Figure B.3 – Use of MDIF and PDIF

Editorial Note: This Figure will be updated later according to the results of the SS-SS task force

B.4 RDRE and Disturbance Recorder

Figure B.4 represents the modeling of a disturbance recorder as a Logical Device containing the necessary LN. In the case of conventional wiring, TCTR, TVTR, XCBR, and GGIO represent the hardwired inputs. In the case of using a process bus, these LNs will be outside the Logical Device disturbance recorder. They will be in a Logical Device allocated either to a sensor/actor or to a remote I/O in the switchgear.

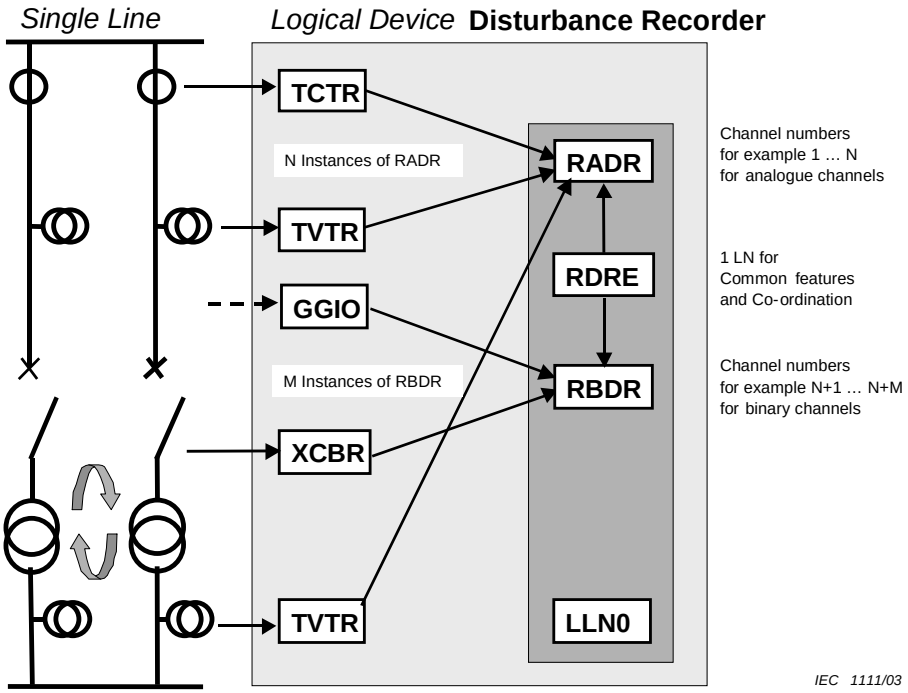


Figure B.4 – Modelling of Disturbance Recorder

B.5 PTRC

The example in Figure B.5 shows the different allocation of Logical Nodes (LN) to devices (IED). The Logical Nodes involved are PTOC (Time overcurrent protection), PDIS (Distance Protection), PTRC (Trip Conditioning) and XCBR (Circuit Breaker). Case (a) shows a protection device with two functions, which is hardwired connected with the circuit breaker. Case (b) shows a protection device with two functions where the Trip goes as a GSE-message over the process bus to the circuit breaker. Case (c) shows the two protection functions in dedicated devices, which may operate both in a fault and where the **trips** are transmitted as **GSE-messages** over the process bus independently to the circuit breaker IED (XCBR).

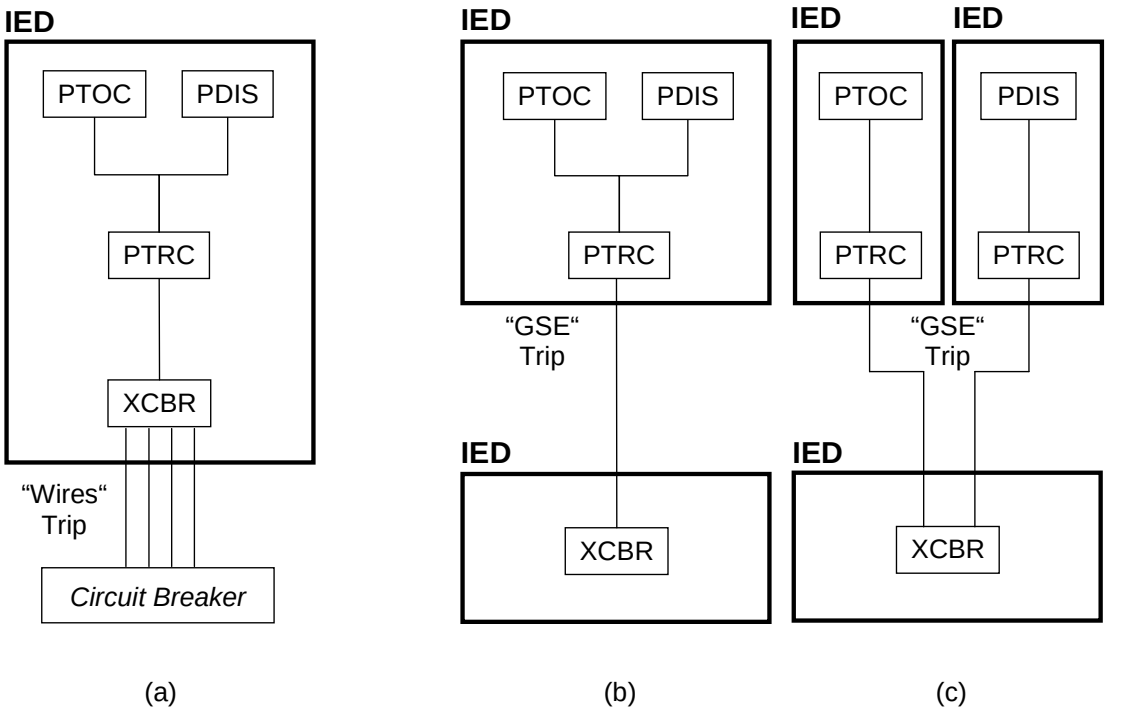


Figure B.5 – Examples for allocation of Logical Nodes to IEDs

B.6 PDIR

Figure B.6 illustrates the use of PDIR to combine the directional information for Busbar Protection where multiple Bays are connected to one busbar. Directional time overcurrent (PTOC) protects the bays. PDIR compares the direction signals of the bay protection functions and makes the trip decision for the circuit breakers of the bays based on the busbar image.

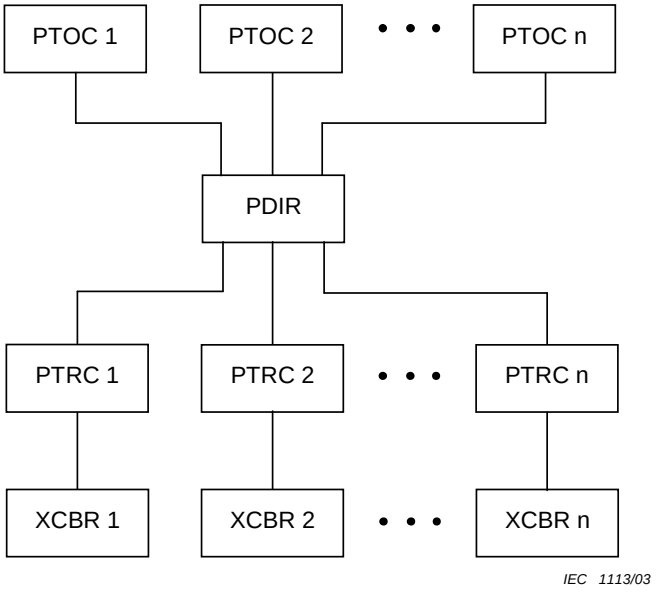


Figure B.6 – Use of PDIR

B.7 RREC

Figure B.7 illustrates the use of the autoreclosure LN RREC in co-operation with a protection LN (LN PTOC), the control LN CSWI and the circuit breaker LN XCBR. Case (a) shows the conventional scheme, where no process bus is used. The autoreclosure LN RREC is implemented in the protection IED and the controller CSWI in an independent bay level IED. The operator's place is indicated as LN IHMI. In case (b) the autoreclosure is located in a dedicated IED and the circuit breaker connected with a process bus. If no services with real-time capability are available between RREC and CSWI on one side and XCBR on the other side, the opening and (re-)closing commands are performed with a GSE-message (see IEC 61850-7-2).

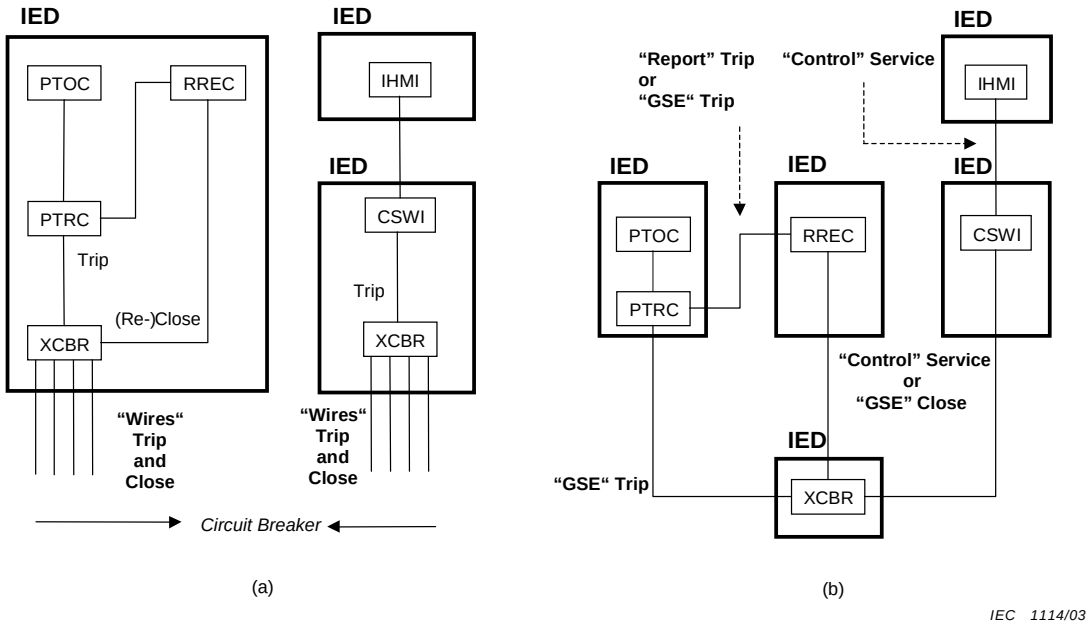


Figure B.7 – Use of RREC

B.8 PDIS

The following examples illustrate the varying complexity available when instantiating a PDIS LN.

Example instantiation of PDIS for a “Normal Zone”

PDIS class			
Data Name	**Common Data Class**	**Explanation**	**T**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2 clause 19	
Data			
Controls			
OpCntRs	INC	Resetable operation counter	
Status Information			
Str	ACD	Start	
Op	ACT	Operate	T
Settings			
RisLod	ASG	Resistive reach for load area	
AngLod	ASG	Angle for load area	
TmDlMod	SPG	Operate Time Delay Mode	
OpDlTmms	ING	Operate Time Delay	
X1	ASG	Reactive reach positive sequence	
RisGndRch	ASG	Resistive Ground Reach	
RisPhRch	ASG	Resistive Phase Reach	
K0Fact	ASG	Residual Compensation Factor K_0	
K0FactAng	ASG	Residual Compensation Factor Angle	

Example instantiation of “High end” zone with phase/ground with independent timers

PDIS class			
Data Name	**Common Data Class**	**Explanation**	**T**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2 clause 19	
Data			
Controls			
OpCntRs	INC	Resetable operation counter	
Status Information			
Str	ACD	Start	
Op	ACT	Operate	T
Settings			
RisLod	ASG	Resistive reach for load area	
AngLod	ASG	Angle for load area	
PhDlMod	SPG	Operate Time Delay Multiphase Mode	
PhDlTmms	ING	Operate Time Delay for Multiphase Faults	
GndDlMod	SPG	Operate Time Delay for Single Phase Ground Mode	

GndDlTmms	ING	Operate Time Delay for single phase ground faults	
X1	ASG	Reactive reach positive sequence	
LinAng	ASG	Line Angle	
RisGndRch	ASG	Resistive Ground Reach	
RisPhRch	ASG	Resistive Phase Reach	
K0Fact	ASG	Residual Compensation Factor K_0	
K0FactAng	ASG	Residual Compensation Factor Angle	

Example instantiation of “Simple Impedance Zone” phase protection

PDIS class			
Data Name	**Common Data Class**	**Explanation**	**T**
LNName		The name shall be composed of the class name, the LN-Prefix and LN-Instance-ID according to IEC 61850-7-2 clause 19	
Data			
Controls			
OpCntRs	INC	Resetable operation counter	
Status Information			
Str	ACD	Start	
Op	ACT	Operate	T
Settings			
OpDlTmms	ING	Operate Time Delay	
X1	ASG	Reactive reach positive sequence	
RisPhRch	ASG	Resistive Phase Reach	

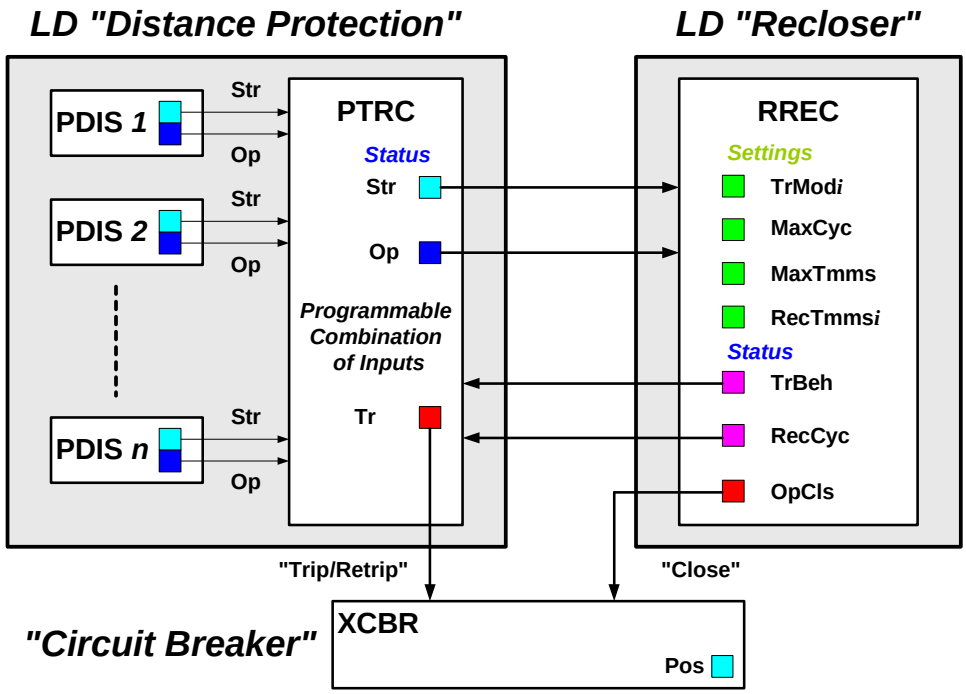
B.9 RREC

The LD “Distance Protection” (with the LN PDISi for the zone i) or any other protection function trips via the allocated PTRC (PTRC.Tr). The LD “Recloser” is informed about the trip commonly both by the PTRC.Str and the PTRC.Op.

The recloser represented by the LN RREC has information about the allowed behavior of the potential retrip after the first autorecloser cycle. The setting RREC.TrMod describes if the first retrip may be done single pole or three pole. For second and higher reclose cycles, only three pole tripping is allowed normally. Therefore, the autorecloser calculates out of the setting TrMod and the status RecCyc (actual reclose cycle number) the actually requested trip behavior TrBeh for the protection. This information has to be subscribed by the protection.

If the time of the actual cycle (ReciTmms) is elapsed, the close command to the breaker is issued by the recloser status OpCls. If no retrip happens the autoreclosing is over, otherwise the next cycle will start.

If different types of protections are involved in the Autoreclosing process, all relevant data have to be published and subscribed by the allocated protection LNs.


LD "Distance Protection"
LD "Recloser"
PDIS 1
PDIS 2
PDIS n
Str
Op
PTRC
Status
Str
Op
Programmable Combination of Inputs
Tr
RREC
Settings
TrMod*i*
MaxCyc
MaxTmms
RecTmms*i*
Status
TrBeh
RecCyc
OpCls
"Trip/Retrip"
"Close"
"Circuit Breaker"
XCBR
Pos

Annex C
(informative)

Relationship between this standard and IEC 61850-5

The Logical Nodes listed in IEC 61850-5 define requirements; the Logical Nodes listed in this part define the modelling. Some requirements of the LNs from IEC 61850-5 are modelled by LNs not explicitly in this standard. Its functionality is provided by the services or by the communication stack. Some system support functions are too dependent on implementation to be standardised in this part. In Table C.1 examples are listed.

Table C.1 – Relationship between IEC 61850-5 and this standard for some miscellaneous LNs

Functionality	Defined in IEC 61850-5 by LN	Modelled in IEC 61850-7-4 by LN	Comments
Time master	STIM	Not applicable	Dedicated function providing time from some external source to the system
System supervision	SSYS	Not applicable	Implementation dependent function provided by the system. Some minimum supervision is provided by the system logical nodes (group L)
Test generator	GTES	Not applicable	Dedicated function outside the system. For testing see IEC 61850-10

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