Feeder Terminal

REF 542plus

IEC61850 Conformance Statement for REF 542plus
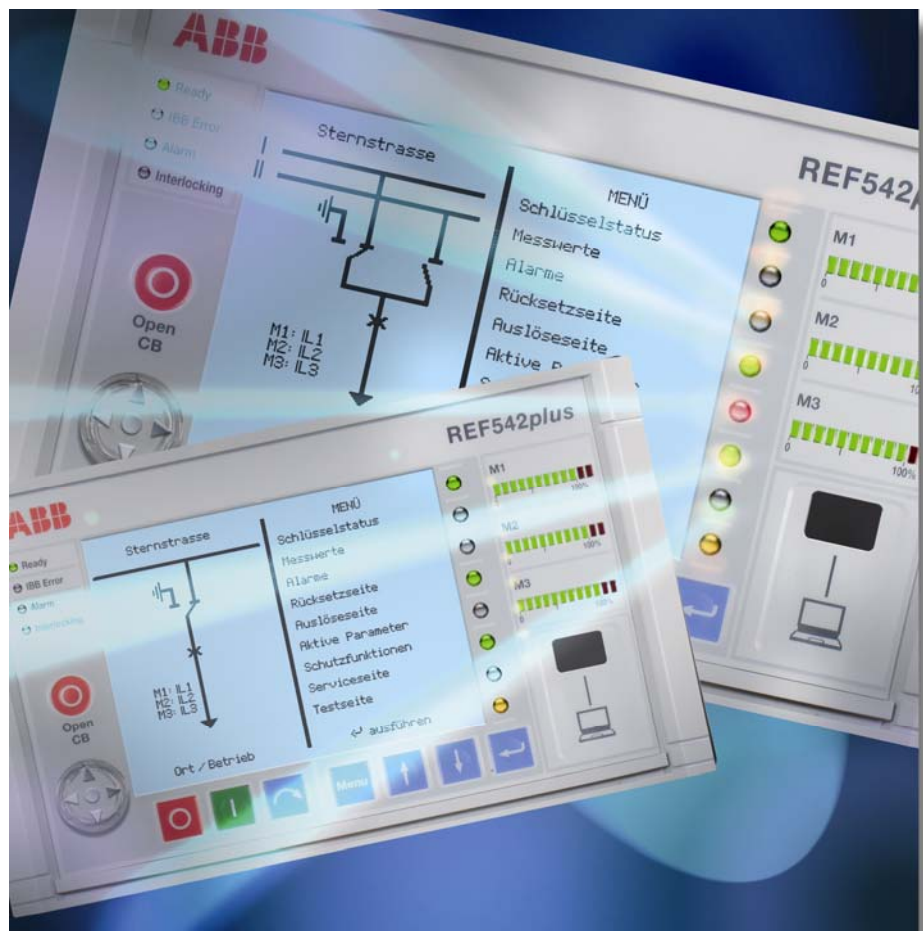

ABB

Table of Contents

1 About this document

1.1 Read it first!

Before attempting any operation with the REF 542plus *Ethernet Board*, read first the document.

This document is addressed to anyone who needs to interact with REF 542plus and IEC61850 interface.

1.2 Document information

Revision History

Revision	Date	Note
1VCD600508 C	20 Apr 2007	Corrections based on KEMA remarks
1MRS756361 A	11 May 2007	Changes in la yout. ID-numer changed from 1VCD600508 to 1MRS756361
1MRS756361 B	17 Nov 2008	Extension due to Release 2.6
1MRS756361 C	28 May 2009	Extension due to release 2.6SP1.
1MRS756361 D	10 Jan 2012	Extension due to release 3.0SP1.

Applicability

This manual is applicable to IEC 61850 interface version ETH V1F.09

2 Safety Information

There are safety warnings and notes in the following text. They are in a different format to distinguish them from normal text.

Safety warning

The safety warnings should always be observed. Non-observance can result in death, personal injury or substantial damages to property. Guarantee claims might not be accepted when safety warnings are not respected. They look like below:

Do not make any changes to the REF 542plus configuration unless you are familiar with the REF 542plus and its Oper ating Tool. This might result in disoperation and loss of warranty.

Note

A note contains additional information worth noting in the specific context, and looks like below:

> The selection of this control mode requires caution, because operations are allowed both from the HMI and remotely.

3 Abbreviations, Definitions and Conventions

3.1 Abbreviations

HMI	**H**uman **M**achine **I**nterface
RHMI	the same as HMI
LCD	**L**iquid **C**rystal **D**isplay
SLD	**S**ingle **L**ine **D**iagram
LED	**L**ight **E**mitting **D**iode
GPS	**G**lobal **P**ositioning **S**ystem
SCADA	**S**upervision, **C**ontrol and **D**ata **A**cquisition
CT	**C**urrent **T**ransformer
VT	**V**oltage **T**ransformer
SI	**S**ensor **I**nput
FUPLA	FUnctional Programming Language. The graphical language to program the REF 542plus.
Y	**Y**es
N	**N**o

3.2 Definitions

Operational State:	the unit is active and it is protecting and controlling the switchgear.
Stand-alone:	the unit is not connected to a Scada system.
M/m:	mandatory support. The item shall be implemented.
C/c:	conditional support. The item shall be implemented if the stated condition exists.
O/o:	optional support. The implementation may decide to implement the item.
x:	excluded: The implementation shall not implement this item.
i:	out-of-scope: The implementation of the item is not within the scope of this product.
F/S:	Functional Standard. Should be applied.
Base:	Shall be applied in any application claiming conformance to this standard.

3.3 Conventions

Actual situation with comments, e.g. "*Supported*", "*Partly supported (foobar is unavailable)*", "*1ms*" are filled on either Comments column, in "Value/range" column, or device column in *italics*. Possible existing text from standard can be preserved in parenthesis.

4 Reference Documents

Ref	Document id	Rev	Document title
[1]	61850-8-1 First edition 2004-05		Communication networks and systems in substations Part 8-1: Specific communication service mapping (SCSM) – Map-pings to MMS (ISO/IEC 9506 Part 1 and Part 2) and to ISO/IEC 8802-3
[2]	61850-10 First edition 2005-05		Communication networks and systems in substations – Part 10: Conformance testing
[3]	IEC61850-7-2 First edition 2003-05		Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI)
[4]	IEC61850-6 First edition 2004-03		Communication networks and systems in substations - Part 6: Configuration description language for communication in electrical substations related to IEDs
[5]	IEC61850-7-3 First edition 2003-05		Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes
[6]	IEC61850-7-4 First Edition 2003-05		Communication networks and systems in substations – Part 7-4:

5 Introduction

This document defines the compliance to IEC61850 in terms of service, modeling and engineering interfaces. Also, exceptions and local adaptations are described.

The conformance statements and documents are referred as PICS (Protocol Implementation Conformance Statement), MICS (Model Implementation Conformace Statement) and local adaptations to be published are described in PIXIT (Protocol Implementation eXtra Information for Testing). ACSI conformance statement describes the abstract services interfaces, which are normally mapped to certain SCSM and therefore indirectly stated in PICS.

The purpose of the information in this document is to give a user, to a system integrator a detailed explanation of IEC61850 capabilities of a product.

5.1 Scope of this statement

The scope of this document is one product/software module. This is identified as follows:

Product family / name:

Product designation: REF 542plus Ethernet Board

Product version: see document revision history1.00

Role(s) in two-party association (TP, c/s): server

Role(s) in multicast association (MC, GOOSE, GSSE): none

Notes, exceptions: MMS conformance statement is not filled

6 ACSI conformance statement

6.1 General

These tables are according to 7-2. [3]

6.2 ASCI basic conformance statement

Table 6-1– Basic conformance statement

		Client/ Subscriber	Server/ Publisher	Value/Comments
Client-Server roles				
B11	**Server** side (of TWO-PARTY-APPLICATION-ASSOCIATION)	—	c1	*Supported*
B12	**Client** side of (TWO-PARTY-APPLICATION-ASSOCIATION)	c1	—	*Not Supported*
SCSMs supported				
B21	**SCSM**: IEC 61850-8-1 used			*Supported*
B22	**SCSM**: IEC 61850-9-1 used			*Not Supported*
B23	**SCSM**: IEC 61850-9-2 used			*Not Supported*
B24	**SCSM**: other			
Generic substation event model (GSE)				
B31	**Publisher** side	—	O	*Not Supported*
B32	**Subscriber** side	O	—	*Not Supported*
Transmission of sampled value model (SVC)				
B41	**Publisher** side	—	O	*Not Supported*
B42	**Subscriber** side	O	—	*Not Supported*
C1 – shall be 'M' if support for **LOGICAL-DEVICE** model has been declared.				

6.3 ACSI models conformance statement

Table 6-2– ACSI models conformance statement

		Client/ Subscriber	Server/ Publisher	Value/Comments
If **Server** side (B1) supported				
M1	**Logical device**	c2	c2	*Supported*
M2	**Logical node**	c3	c3	*Supported*
M3	**Data**	c4	c4	*Supported*
M4	**Data set**	c5	c5	*Supported*
M5	**Substitution**	O	O	*Not Supported*
M6	**Setting group control**	O	O	*Not Supported*
	Reporting			
M7	**Buffered report control**	O	O	*Supported*
M7-1	Sequence-number			
M7-2	report-time-stamp			
M7-3	reason-for-inclusion			
M7-4	data-set-name			
M7-5	data-reference			
M7-6	buffer-overflow			
M7-7	EntryID			
M7-8	BufTim			
M7-9	IntgPd			
M7-10	GI			
M8	**Unbuffered report control**	M	M	*Supported*
M8-1	sequence-number			
M8-2	report-time-stamp			
M8-3	reason-for-inclusion			
M8-4	data-set-name			
M8-5	data-reference			
M8-6	BufTim			
M8-7	IntgPd			
M8-8	GI			
	Logging	O	O	*Not Supported*
M9	**Log control**	O	O	*Not Supported*
M9-1	IntgPd			
M10	**Log**	O	O	*Not Supported*
M11	**Control**	M	M	*Supported*
If **GSE** (B31/32) is supported				
	GOOSE	O	O	*Not Supported*
M12-1	EntryID			
M12-2	DataRefInc			
M13	**GSSE**	O	O	*Not Supported*

		Client/ Subscriber	Server/ Publisher	Value/Comments
If **SVC** (41/42) is supported				
M14	Multicast SVC	O	O	*Not Supported*
M15	Unicast SVC	O	O	*Not Supported*
M16	**Time**	M	M	*Supported* (Time source with required accuracy shall be available)
M17	**File Transfer**	O	O	*Supported*
c1 – shall be 'M' if support for **LOGICAL-DEVICE** model has been declared. c2 – shall be 'M' if support for **LOGICAL-NODE** model has been declared c3 – shall be 'M' if support for **DATA** model has been declared c4 – shall be 'M' if support for **DATA-SET**, Substitution, Report, Log Control, or Time model has been declared c5 – shall be 'M' if support for Report, GSE, or SMV models has been declared				

6.4 ACSI service conformance statement

The ACSI service conformance statement shall be as defined in Table 2-3 (depending on the statements in Table 2-2).

Table 6-3 – ACSI service Conformance statement

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Server					
S1	ServerDirectory	TP		M	*Supported*
Application association					
S2	Associate		M	M	*Supported*
S3	Abort		M	M	*Supported*
S4	Release		M	M	*Supported*
Logical device					
S5	GetLogicalDeviceDirectory	TP	M	M	*Supported*
Logical node					
S6	LogicalNodeDirectory	TP	M	M	*Supported*
S7	GetAllDataValues	TP	O	M	*Supported*
Data					
S8	GetDataValues	TP	M	M	*Supported*
S9	SetDataValues	TP	O	O	*Supported*
S10	GetDataDirectory	TP	O	M	*Supported*
S11	GetDataDefinition	TP	O	M	*Supported*

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Data set					
S12	GetDataSetValues	TP	O	M	*Supported*
S13	SetDataSetValues	TP	O	O	*Not Supported*
S14	CreateDataSet	TP	O	O	*Not Supported*
S15	DeleteDataSet	TP	O	O	*Not Supported*
S16	GetDataSetDirectory	TP	O	O	*Supported*

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Substitution					
S17	SetDataValues	TP	M	M	*Not Supported*

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Setting group control					
S18	SelectActiveSG	TP	O	O	*Not Supported*
S19	SelectEditSG	TP	O	O	*Not Supported*
S20	SetSGValues	TP	O	O	*Not Supported*
S21	ConfirmEditSGValues	TP	O	O	*Not Supported*
S22	GetSGValues	TP	O	O	*Not Supported*
S23	GetSGCBValues	TP	O	O	*Not Supported*

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Reporting					
Buffered report control block (BRCB)					
S24	Report	TP	c6	c6	
S24-1	data-change (dchg)				*Supported*
S24-2	qchg-change (qchg)				*Supported*
S24-3	data-update (dupd)				*Not Supported*
S25	GetBRCBValues	TP	c6	c6	*Supported*
S26	SetBRCBValues	TP	c6	c6	*Supported*
Unbuffered report control block (URCB)					
S27	Report	TP	c6	c6	
S27-1	data-change (dchg)				*Supported*
S27-2	qchg-change (qchg)				*Supported*
S27-3	data-update (dup				*Not Supported*
S28	GetURCBValues	TP	c6	c6	*Supported*
S29	SetURCBValues	TP	c6	c6	*Supported*
c6 – shall declare support for at least one (BRCB or URCB)					

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Logging					
Log control block					
S30	GetLCBValues	TP	M	M	*Not Supported*
S31	SetLCBValues	TP	O	M	*Not Supported*
Log					
S32	QueryLogByTime	TP	c7	M	*Not Supported*
S33	QueryLogByEntry	TP	c7	M	*Not Supported*
S34	GetLogStatusValues	TP	M	M	*Not Supported*
c7 – shall declare support for at least one (QueryLogByTime or QueryLogByEntry)					

Generic substation event model (GSE)

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Generic substation event model (GSE)					
GOOSE-CONTROL-BLOCK					
S35	SendGOOSEMessage	MC	c8	c8	*Not Supported*
S36	GetReference	TP	O	c9	*Not Supported*
S37	GetGOOSEElementNumber	TP	O	c9	*Not Supported*
S38	GetGoCBValues	TP	O	O	*Not Supported*
S39	SetGoCBValues	TP	O	O	*Not Supported*
GSSE-CONTROL-BLOCK					
S40	SendGSSEMessage	MC	c8	c8	*Not Supported*
S41	GetReference	TP	O	c9	*Not Supported*
S42	GetGSSEElementNumber	TP	O	c9	*Not Supported*
S43	GetGsCBValues	TP	O	O	*Not Supported*
S44	SetGsCBValues	TP	O	O	*Not Supported*
c8 – shall declare support for at least one (SendGOOSEMessage or SendGSSEMessage) c9 – shall declare support if TP association is available					

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Transmission of sampled value model (SVC)					
Multicast SVC					
S45	SendMSVMessage	MC	c10	c10	*Not Supported*
S46	GetMSVCBValues	TP	O	O	*Not Supported*
S47	SetMSVCBValues	TP	O	O	*Not Supported*
Unicast SVC					
S48	SendUSVMessage	TP	c10	c10	*Not Supported*
S49	GetUSVCBValues	TP	O	O	*Not Supported*
S50	SetUSVCBValues	TP	O	O	*Not Supported*
c10 – shall declare support for at least one (SendMSVMessage or SendUSVMessage)					

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
Control					
S51	Select		M	O	*Not Supported*
S52	SelectWithValue	TP	M	O	*Supported*
S53	Cancel	TP	O	O	*Supported*
S54	Operate	TP	M	M	*Supported*
S55	Command-Termination	TP	M	O	*Supported*
S56	TimeActivated-Operate	TP	O	O	*Not Supported*

	Services	AA: TP/MC	Client (C)	Server (S)	Comments
File transfer					
S57	GetFile	TP	O	M	*Supported*
S58	SetFile	TP	O	O	*Supported*
S59	DeleteFile	TP	O	O	*Supported*
S60	GetFileAttributeValues	TP	O	M	*Supported*

		Services	AA: TP/MC	Client (C)	Server (S)	Comments
Time						
	T1	Time resolution of internal clock			2^{-10} *(1ms)*	(nearest negative power of 2 in seconds)
	T2	Time accuracy of internal clock				T0
						T1, *Supported*
						T2
						T3
						T4
						T5
	T3	supported TimeStamp resolution	-		2^{-10} *(1ms)*	(nearest negative power of 2 in seconds according to IEC61850-7-2, paragraph 5.5.3.7.3.3)

7 MICS - Model conformance statement

7.1 General

A Model Implementation Conformance Statement or MICS shall be provided detailing the standard data object model elements supported by the system or device. The MICS is implemented in the file ICD (IED capability description) according to IEC 61850-6.

However, since the nature of configurable devices and systems, the ICD file might not reveal all the details the supported or used Common Data Attribute Classes and Common Data Classes with the attributes are listed here. See [5]

7.2 Common Data Attribute Classes

7.2.1 Quality

Table 7-1– Quality

Quality Type Definition					
Attribute Name		Attribute Type	Value / Value Range	M/O/C	REF-Eth61850 comments
		PACKED LIST			
Validity		CODED ENUM	good | invalid | reserved | questionable	M	*Supported*
detailQual		PACKED LIST		M	*Supported*
	Overflow	BOOLEAN		M	*Defaulted*
	outOfRange	BOOLEAN		M	*Supported*
	badReference	BOOLEAN		M	*Defaulted*
	Oscillatory	BOOLEAN		M	*Defaulted*
	Failure	BOOLEAN		M	*Defaulted*
	oldData	BOOLEAN		M	*Supported*
	Inconsistent	BOOLEAN		M	*Defaulted*
	Inaccurate	BOOLEAN		M	*Defaulted*
Source		CODED ENUM	process | substituted DEFAULT process	M	*Supported*
Test		BOOLEAN	DEFAULT FALSE	M	*Defaulted*
operatorBlocked		BOOLEAN	DEFAULT FALSE	M	*Defaulted*

NOTE – The DEFAULT value shall be applied, if the functionality of the related attribute is not supported. The mapping may specify to exclude the attribute from the message, if it is not supported or if the DEFAULT value applies.

7.2.2 Analogue value

Table 7-2– Analogue value

AnalogueValue Type Definition				
Attribute Name	Attribute Type	Value / Value Range	M/O/C	REF-Eth61850 comments
I	INT32	integer value	GC_1	*Not supported*
F	FLOAT32	floating point value	GC_1	*Supported*

7.2.3 Range configuration

Table 7-3– Range Configuration

RangeConfig Type Definition				
Attribute Name	**Attribute Type**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
hhLim	AnalogueValue		M	*Not supported*
hLim	AnalogueValue		M	*Not supported*
lLim	AnalogueValue		M	*Not supported*
llLim	AnalogueValue		M	*Not supported*
Min	AnalogueValue		M	*Not supported*
Max	AnalogueValue		M	*Not supported*

7.2.4 Step position with transient indication

Table 7-4– Step position with transient indication

ValWithTrans Type Definition				
Attribute Name	**Attribute Type**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
posVal	INT8	-64 ... 63	M	*Not supported*
transInd	BOOLEAN		O	*Not supported*

7.2.5 Originator

Table 7-5– Originator

Originator Type Definition				
Attribute Name	**Attribute Type**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
orCat	ENUMERATED	not-supported | bay-control | station-control | remote-control | automatic-bay | automatic-station | automatic-remote | maintenance | process	M	*Supported*
orIdent	OCTET STRING64		M	*Supported*

Table 7-6– Values for orCat

Value	Explanation
bay-control	Control operation issued from an operator using a client located at bay level
station-control	Control operation issued from an operator using a client located at station level
remote-control	Control operation from a remote operater outside the substation (e.g. network control center)
automatic-bay	Control operation issued from an automatic function at bay level
automatic-station	Control operation issued from an automatic function at station level
automatic-remote	Control operation issued from a automatic function outside of the substation
maintenance	Control operation issued from a maintenance / service tool
Process	Status change occurred without control action (e.g. external trip of a circuit breaker or failure inside the breaker)

7.2.6 Unit definition

Table 7-7– Unit

Unit Type Definition				
Attribute Name	**Attribute Type**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
SIUnit	ENUMERATED	According to table in Annex A	M	*Not supported*
Multiplier	ENUMERATED	According to table in Annex A	O	*Not supported*

7.2.7 Vector definition

Table 7-8– Vector

Vector Type Definition				
Attribute Name	**Attribute Type**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
Mag	AnalogueValue		M	*Supported*
Ang	AnalogueValue		O	*Not supported*

7.2.8 CtxInt

Context specific Integer. The type depends of the DO usage. Enum type is used with Mod, Beh and Health Data Objects. Otherwise Int32. Others????

7.3 Common Data Classes

NOTE – Different variants of the CDC type exist based on the connectivity packet short address information (sAddr). Underlined information indicates the basic type. E.g. ACT uses general or phase attributes.

7.3.1 Single point status (SPS)

Table 9 – Single point status common data class definition

SPS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			Status			
stVal	BOOLEAN	ST	dchg	TRUE | FALSE	M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
			Substitution			
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	BOOLEAN	SV		TRUE | FALSE	PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*

			configuration, description and extension			
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

7.3.2 Double point status (DPS)

Table 10 – Double point status common data class specification

DPS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			status			
stVal	CODED ENUM	ST	dchg	intermediate-state | off | on | bad-state	M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
			substitution			
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	CODED ENUM	SV		intermediate-state | off | on | bad-state	PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
			configuration, description and extension			
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

7.3.3 Integer status (INS)

Table 11 – Integer status common data class specification

INS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			status			
stVal	CtxInt	ST	dchg		M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
			substitution			
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	INT32	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*

				configuration, description and extension			
d	VISIBLE STRING255	DC		Text		O	*Supported*
dU	UNICODE STRING255	DC				O	*Not Supported*
CdcNs	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
DataNs	VISIBLE STRING255	EX				AC_DLN_M	*Not supported*

Protection activation information (ACT)

Table 12 – Protection activation information common data class specification

ACT class							
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**		**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)						*Supported*
DataAttribute							
				Status			
general	BOOLEAN	ST	dchg			M	***Supported***
phsA	BOOLEAN	ST	dchg			O	*Supported*
phsB	BOOLEAN	ST	dchg			O	*Supported*
phsC	BOOLEAN	ST	dchg			O	*Supported*
neut	BOOLEAN	ST	dchg			O	*Supported*
q	Quality	ST	qchg			M	*Supported*
t	TimeStamp	ST				M	*Supported*
				configuration, description and extension			
operTim	TimeStamp	CF				O	*Not supported*
d	VISIBLE STRING255	DC		Text		O	*Supported*
dU	UNICODE STRING255	DC				O	*Not Supported*
cdcNs	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX				AC_DLN_M	*Not supported*

NOTE – Different variants of the type exist based on the connectivity packet short address information (sAddr). Underlined information indicates the basic type.

7.3.4 Directional protection activation information (ACD)

Table 13 – Directional protection activation information common data class specification

ACD class							
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**		**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)						*Supported*
DataAttribute							
				Status			
general	BOOLEAN	ST	dchg			M	*Supported*
dirGeneral	ENUMERATED	ST	dchg	unknown | forward | backward | both		M	*Supported*
PhsA	BOOLEAN	ST	dchg			GC_2 (1)	*Supported*
dirPhsA	ENUMERATED	ST	dchg	unknown | forward | backward		GC_2 (1)	*Supported*
PhsB	BOOLEAN	ST	dchg			GC_2 (2)	*Supported*
dirPhsB	ENUMERATED	ST	dchg	unknown | forward | backward		GC_2 (2)	*Supported*
PhsC	BOOLEAN	ST	dchg			GC_2 (3)	*Supported*
dirPhsC	ENUMERATED	ST	dchg	unknown | forward | backward		GC_2 (3)	*Supported*

Neut	BOOLEAN	ST	dchg		GC_2 (4)	*Supported*
dirNeut	ENUMERATED	ST	dchg	unknown | forward | backward	GC_2 (4)	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
				configuration, description and extension		
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – Different variants of the type exist based on the connectivity packet short address information (sAddr). Underlined information indicates the basic type.

7.3.5 Binary counter reading (BCR)

Table 14 – Binary counter reading common data class specification

BCR class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Not supported*
DataAttribute						
				status		
actVal	INT128	ST	dchg		M	*Not supported*
frVal	INT128	ST	dupd		GC_2 (1)	*Not supported*
frTim	TimeStamp	ST	dupd		GC_2 (1)	*Not supported*
q	Quality	ST	qchg		M	*Not supported*
t	TimeStamp	ST			M	*Not supported*
				configuration, description and extension		
units	Unit	CF			O	*Not supported*
pulsQty	FLOAT32	CF			M	*Not supported*
frEna	BOOLEAN	CF			GC_2 (1)	*Not supported*
strTim	TimeStamp	CF			GC_2 (1)	*Not supported*
frPd	INT32	CF			GC_2 (1)	*Not supported*
frRs	BOOLEAN	CF			GC_2 (1)	*Not supported*
d	VISIBLE STRING255	DC			O	*Not supported*
dU	UNICODE STRING255	DC			O	*Not supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

7.3.6 Measured value (MV)

Table 15 – Measured value

MV class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
				measured values		
instMag	AnalogueValue	MX			O	*Not supported*
mag	AnalogueValue	MX	dchg		M	*Supported*
range	ENUMERATED	MX	dchg	normal | high | low | high-high | low-low | ...	O	*Supported*
q	Quality	MX	qchg		M	*Supported*
t	TimeStamp	MX			M	*Supported*

7 *substitution*						
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subMag	AnalogueValue	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
7 *configuration, description and extension*						
units	Unit	CF			O	*Not supported*
db	INT32U	CF		0 ... 100'000	O	*Not supported*
zeroDb	INT32U	CF		0 ... 100'000	O	*Not supported*
sVC	ScaledValueConfig	CF			AC_SCAV	*Not supported*
rangeC	RangeConfig	CF			GC_CON	*Supported*
smpRate	INT32U	CF			O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – Different variants of the type exist based on the connectivity packet short address information (sAddr). Underlined information indicates the basic type.

7.3.7 Complex measured value (CMV)

Table 16 – Complex measured value

CMV class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	5 Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
7 *measured values*						
instCVal	Vector	MX			O	*Not supported*
cVal	Vector	MX	dchg		M	*Supported*
range	ENUMERATED	MX	dchg	normal | high | low | high-high | low-low | ...	O	*Supported*
q	Quality	MX	qchg		M	*Supported*
t	TimeStamp	MX			M	*Supported*
7 *substitution*						
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subCVal	Vector	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
7 *configuration, description and extension*						
units	Unit	CF			O	*Not supported*
db	INT32U	CF		0 ... 100'000	O	*Not supported*
zeroDb	INT32U	CF		0 ... 100'000	O	*Not supported*
rangeC	RangeConfig	CF			GC_CON	*Supported*
magSVC	ScaledValueConfig	CF			AC_SCAV	*Not supported*
angSVC	ScaledValueConfig	CF			AC_SCAV	*Not supported*
angRef	ENUMERATED	CF		V | A | other ...	O	*Not supported*
smpRate	INT32U	CF			O	*Not supported*

d	VISIBLE STRING255	DC		Text		O	*Supported*
dU	UNICODE STRING255	DC				O	*Not Supported*
cdcNs	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX				AC_DLN_M	*Not supported*

NOTE – Different variants of the type exist based on the connectivity packet short address information (sAddr). Underlined information indicates the basic type.

7.3.8 Phase to ground related measured values of a three phase system (WYE)

Table 17 – WYE

WYE class							
Attribute Name	Attribute Type	FC	TrgOp	Value / Value Range		M/O/C	REF-Eth61850 comments
DataName	Inherited from Data Class (see IEC 61850-7-2)						*Supported*
Data							
phsA	CMV					GC_1	*Supported*
phsB	CMV					GC_1	*Supported*
phsC	CMV					GC_1	*Supported*
neut	CMV					GC_1	*Supported*
net	CMV					GC_1	*Not supported*
res	CMV					GC_1	*Not supported*
DataAttribute							
			configuration, description and extension				
angRef	ENUMERATED	CF		Va | Vb | Vc | Aa | Ab | Ac | Vab | Vbc | Vca | Vother | Aother		O	*Not supported*
d	VISIBLE STRING255	DC		Text		O	*Supported*
dU	UNICODE STRING255	DC				O	*Not Supported*
cdcNs	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX				AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX				AC_DLN_M	*Not supported*

NOTE – Different variants of type exist based on the CMV type variant

7.3.9 Delta (DEL)

Table 18 – Delta

DEL class							
Attribute Name	Attribute Type	FC	TrgOp	Value / Value Range		M/O/C	REF-Eth61850 comments
DataName	Inherited from Data Class (see IEC 61850-7-2)						*Supported*
Data							
phsAB	CMV					GC_1	*Supported*
phsBC	CMV					GC_1	*Supported*
phsCA	CMV					GC_1	*Supported*

DataAttribute						
configuration, description and extension						
AngRef	ENUMERATED	CF		Va | Vb | Vc | Aa | Ab | Ac | Vab | Vbc | Vca | Vother | Aother	O	*Not supported*
D	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – Different variants of type exist based on the CMV type variant

7.3.10 Controllable single point (SPC)

Table 19 – Controllable single point

SPC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
control and status						
ctlVal	BOOLEAN	CO		off (FALSE) | on (TRUE)	AC_CO_M	*Supported*
operTim	TimeStamp	CO			AC_CO_O	*Not supported*
Origin	Originator	CO, ST			AC_CO_O	*Not supported*
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	*Not supported*
stVal	BOOLEAN	ST	dchg	FALSE | TRUE	AC_ST	*Supported*
Q	Quality	ST	qchg		AC_ST	*Supported*
T	TimeStamp	ST			AC_ST	*Supported*
stSeld	BOOLEAN	ST	dchg		AC_CO_O	*Not supported*
Substitution						
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	BOOLEAN	SV		FALSE | TRUE	PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
configuration, description and extension						
pulseConfig	PulseConfig	CF			AC_CO_O	*Not supported*
ctlModel	ENUMERATED	CF		status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M	*Supported*
sboTimeout	INT32U	CF			AC_CO_O	*Not supported*
sboClass	ENUMERATED	CF		operate-once | operate-many	AC_CO_O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Supported*

NOTE – Different variants of the type exist based on the control model (ctlModel) and connectivity packet short address information (sAddr). Underlined information indicates the basic type.

7.3.11 Controllable double point (DPC)

Table 20 – Controllable double point

DPC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			control and status			
ctlVal	BOOLEAN	CO		off (FALSE) | on (TRUE)	AC_CO_M	*Supported*
operTim	TimeStamp	CO			AC_CO_O	*Not supported*
origin	Originator	CO, ST			AC_CO_O	*Not supported*
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	*Not supported*
stVal	CODED ENUM	ST	dchg	intermediate-state | off | on | bad-state	M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
stSeld	BOOLEAN	ST	dchg		AC_CO_O	*Supported*
			substitution			
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	CODED ENUM	SV		intermediate-state | off | on | bad-state	PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
			configuration, description and extension			
pulseConfig	PulseConfig	CF			AC_CO_O	*Not supported*
ctlModel	ENUMERATED	CF		status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M	*Supported*
sboTimeout	INT32U	CF			AC_CO_O	*Not supported*
sboClass	ENUMERATED	CF		operate-once | operate-many	AC_CO_O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE 1 – Different variants of the type exist based on the control model (ctlModel) and connectivity packet short address information. Underlined information indicates the basic type.

7.3.12 Controllable integer status (INC)

Table 21 – Controllable integer status

Attribute Name	Attribute Type	FC	TrgOp	Value / Value Range	M/O/C	REF-Eth61850 comments
INC class						
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
control and status						
ctlVal	CtxInt	CO			AC_CO_M	*Supported*
operTim	TimeStamp	CO			AC_CO_O	*Not supported*
origin	Originator	CO, ST			AC_CO_O	*Not supported*
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	*Not supported*
stVal	CtxInt	ST	dchg		M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
stSeld	BOOLEAN	ST	dchg		AC_CO_O	*Not supported*
Substitution						
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	INT32	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
configuration, description and extension						
ctlModel	ENUMERATED	CF		status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M	*Supported*
sboTimeout	INT32U	CF			AC_CO_O	*Not supported*
sboClass	ENUMERATED	CF		operate-once | operate-many	AC_CO_O	*Not supported*
minVal	INT32	CF			O	*Not supported*
maxVal	INT32	CF			O	*Not supported*
stepSize	INT32U	CF		1 ... (maxVal – minVal)	O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*(Supported) See NOTE.*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Supported*

NOTE – Different variants of the type exist based on the control model (ctlModel) and connectivity packet short address information (sAddr). Underlined information indicates the basic type.

NOTE – cdcNs only used for the LD0.Mod diagnostics. It is not possible to change it.

7.3.13 Binary controlled step position information (BSC)

Table 22 – Binary controlled step position information

BSC class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Not supported*
DataAttribute						
				control and status		
ctlVal	CODED ENUM	CO		stop | lower | higher | reserved	AC_CO_M	*Not supported*
operTim	TimeStamp	CO			AC_CO_O	*Not supported*
origin	Originator	CO, ST			AC_CO_O	*Not supported*
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	*Not supported*
valWTr	ValWithTrans	ST	dchg		AC_ST	*Not supported*
q	Quality	ST	qchg		AC_ST	*Not supported*
t	TimeStamp	ST			AC_ST	*Not supported*
stSeld	BOOLEAN	ST	dchg		AC_CO_O	*Not supported*
				substitution		
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	ValWithTrans	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
				configuration, description and extension		
persistent	BOOLEAN	CF			M	*Not supported*
ctlModel	ENUMERATED	CF		status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M	*Not supported*
sboTimeout	INT32U	CF			AC_CO_O	*Not supported*
sboClass	ENUMERATED	CF		operate-once | operate-many	AC_CO_O	*Not supported*
minVal	INT8	CF			O	*Not supported*
maxVal	INT8	CF			O	*Not supported*
stepSize	INT8U	CF		1 ... (maxVal – minVal)	O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Not supported*
dU	UNICODE STRING255	DC			O	*Not supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – Different variants of the type exist based on the control model (ctlModel) and connectivity packet short address information. Underlined information indicates the basic type.

7.3.14 Integer controlled step position information (ISC)

Table 23 – Integer controlled step position information

Attribute Name	Attribute Type	FC	TrgOp	Value / Value Range	M/O/C	REF-Eth61850 comments
ISC class						
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Not supported*
DataAttribute						
control and status						
ctlVal	INT8	CO		-64 ... 63	AC_CO_M	*Not supported*
operTim	TimeStamp	CO			AC_CO_O	*Not supported*
origin	Originator	CO, ST			AC_CO_O	*Not supported*
ctlNum	INT8U	CO, ST		0..255	AC_CO_O	*Not supported*
valWTr	ValWithTrans	ST	dchg		AC_ST	*Not supported*
q	Quality	ST	qchg		AC_ST	*Not supported*
t	TimeStamp	ST			AC_ST	*Not supported*
stSeld	BOOLEAN	ST	dchg		AC_CO_O	*Not supported*
substitution						
subEna	BOOLEAN	SV			PICS_SUBST	*Not supported*
subVal	ValWithTrans	SV			PICS_SUBST	*Not supported*
subQ	Quality	SV			PICS_SUBST	*Not supported*
subID	VISIBLE STRING64	SV			PICS_SUBST	*Not supported*
configuration, description and extension						
ctlModel	ENUMERATED	CF		status-only | direct-with-normal-security | sbo-with-normal-security | direct-with-enhanced-security | sbo-with-enhanced-security	M	*Not supported*
sboTimeout	INT32U	CF			AC_CO_O	*Not supported*
sboClass	ENUMERATED	CF		operate-once | operate-many	AC_CO_O	*Not supported*
minVal	INT8	CF			O	*Not supported*
maxVal	INT8	CF			O	*Not supported*
stepSize	INT8U	CF		1 ... (maxVal – minVal)	O	*Not supported*
d	VISIBLE STRING255	DC		Text	O	*Not supported*
dU	UNICODE STRING255	DC			O	*Not supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – Status-only only supported for the ctlModel.

7.3.15 Device name plate (DPL)

Table 24 – Device name plate common data class specification

DPL class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			configuration, description and extension			
vendor	VISIBLE STRING255	DC			M	*Supported*
hwRev	VISIBLE STRING255	DC			O	*Supported*
swRev	VISIBLE STRING255	DC			O	*Supported*
serNum	VISIBLE STRING255	DC			O	*Supported*
model	VISIBLE STRING255	DC			O	*Not supported*
location	VISIBLE STRING255	DC			O	*Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

7.3.16 Logical node name plate (LPL).

Table 25 – Logical node name plate common data class specification

LPL class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
			configuration, description and extension			
vendor	VISIBLE STRING255	DC			M	*Supported*
swRev	VISIBLE STRING255	DC			M	*Supported*
d	VISIBLE STRING255	DC			M	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
configRev	VISIBLE STRING255	DC			AC_LN0_M	*Supported*
ldNs	VISIBLE STRING255	EX		shall be included in **LLN0** only; e.g. "IEC61850-7-4:2002"	AC_LN0_M	*Supported*
lnNs	VISIBLE STRING255	EX			AC_DLD_M	*Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Not supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Not supported*

NOTE – For lnNs the value (val) needs to be set after specific short address (sAddr

7.4 Common Data Classes Device Extensions

7.4.1 Redundancy Supervision Status (RSS).

Table 26 Redundancy Supervision Status common data class specification

RSS class						
Attribute Name	**Attribute Type**	**FC**	**TrgOp**	**Value / Value Range**	**M/O/C**	**REF-Eth61850 comments**
DataName	Inherited from Data Class (see IEC 61850-7-2)					*Supported*
DataAttribute						
	configuration, description and extension					
stValA	BOOLEAN	ST	dchg		M	*Supported*
stValB	BOOLEAN	ST	dchg		M	*Supported*
q	Quality	ST	qchg		M	*Supported*
t	TimeStamp	ST			M	*Supported*
errRateA	INT32U	ST			M	*Supported*
ErrRateB	INT32U	ST			M	*Supported*
addr	VISIBLE STRING255	CF			M	*Supported*
d	VISIBLE STRING255	DC			M	*Supported*
dU	UNICODE STRING255	DC			O	*Not Supported*
configRev	VISIBLE STRING255	DC			AC_LN0_M	*Supported*
lnNs	VISIBLE STRING255	EX			AC_DLD_M	*Supported*
cdcNs	VISIBLE STRING255	EX			AC_DLNDA_M	*Supported*
cdcName	VISIBLE STRING255	EX			AC_DLNDA_M	*Supported*
dataNs	VISIBLE STRING255	EX			AC_DLN_M	*Supported*

7.4.2 Data Attribute Semantic

Table 27 Semantics of data attributes

Data attribute name	Semantics
StValA	TRUE | FALSE: channel A link is up and at least 1 frame is received in the last 10 seconds.
StValB	TRUE | FALSE: channel A link is up and at least 1 frame is received in the last 10 seconds.
ErrRateA	Error rate in channel A, errors per 1000 telegrams. Valid only for PRP.
ErrRateB	Error rate in channel B, errors per 1000 telegrams. Valid only for PRP.
addr	IP address of supervised source, or empty

7.5 Logical Node conformance statement

The following table shows logical node classes that are supported:

Logical Node	Supported
Logical Nodes for management functions LN Group: L	
LN: Physical device information Name: LPHD	X
LN: Logical node zero Name: LLN0	X

Logical Node	Supported
Logical Nodes for protection functions LN Group: P	
LN: Differential Name: PDIF	X
LN: Direction comparison Name: PDIR	
LN: Distance Name: PDIS	X
LN: Directional overpower Name: PDOP	X
LN: Directional underpower Name: PDUP	X
LN: Rate of change of frequency Name: PFRC	
LN: Harmonic restraint Name: PHAR	X
LN: Ground detector Name: PHIZ	
LN: Instantaneous overcurrent Name: PIOC	X
LN: Motor restart inhibition Name: PMRI	X
LN: Motor starting time supervision Name: PMSS	X
LN: Over power factor Name: POPF	
LN: Phase angle measuring Name: PPAM	
LN: Protection scheme Name: PSCH	
LN: Sensitive directional earthfault Name: PSDE	X
LN: Transient earth fault Name: PTEF	
LN: Time overcurrent Name: PTOC	X
LN: Over frequency Name: PTOF	
LN: Overvoltage Name: PTOV	X
LN: Protection trip conditioning Name: PTRC	X
LN: Thermal overload Name: PTTR	X
LN: Undercurrent Name: PTUC	
LN: Undervoltage Name: PTUV	X
LN: Under power factor Name: PUPF	
LN: Under frequency Name: PTUF	X
LN: Voltage controlled time overcurrent Name: PVOC	
LN: Volts per Hz Name: PVPH	
LN: Zero speed or underspeed Name: PZSU	

Logical Node	Supported
Logical Nodes for protection related functions LN Group: R	
LN: Disturbance recorder function Name: RDRE	
LN: Disturbance recorder channel analogue Name: RADR	
LN: Disturbance recorder channel binary Name: RBDR	
LN: Disturbance record handling Name: RDRS	
LN: Breaker failure Name: RBRF	X
LN: Directional element Name: RDIR	
LN: Fault locator Name: RFLO	X
LN: Power swing detection/blocking Name: RPSB	
LN: Autoreclosing Name: RREC	X
LN: Synchronism-check or synchronising Name: RSYN	X
Logical Nodes for control LN Group: C	
LN: Alarm handling Name: CALH	
LN: Cooling Group Control Name: CCGR	
LN: Interlocking Name: CILO	X
LN: Point-on-wave switching Name: CPOW	
LN: Switch controller Name: CSWI	X
Logical nodes for generic references LN Group: G	
LN: Generic automatic process control Name: GAPC	
LN: Generic process I/O Name: GGIO	X
LN: Generic security application Name: GSAL	
Logical Nodes for interfacing and archiving LN Group: I	
LN: Archiving Name: IARC	
LN: Human machine interface Name: IHMI	
LN: Telecontrol interface Name: ITCI	
LN: Telemonitoring interface Name: ITMI	
Logical Nodes for automatic control LN Group: A	
LN: Neutral current regulator Name: ANCR	
LN: Reactive power control Name: ARCO	
LN: Automatic tap changer controller Name: ATCC	
LN: Voltage control Name: AVCO	
Logical Nodes for metering and measurement LN Group: M	
LN: Differential measurements Name: MDIF	
LN: Harmonics or interharmonics Name: MHAI	
LN: Non phase related harmonics or interharmonics Name: MHAN	
LN: Metering Name: MMTR	
LN: Non phase related Measurement Name: MMXN	
LN: Measurement Name: MMXU	X
LN: Sequence & imbalance Name: MSQI	
LN: Metering Statistics Name: MSTA	

Logical Node	Supported
Logical Nodes for sensors and monitoring LN Group: S	
LN: Monitoring and diagnostics for arcs Name: SARC	
LN: Insulation medium supervision (gas) Name: SIMG	X
LN: Insulation medium supervision (liquid) Name: SIML	
LN: Monitoring and diagnostics for partial discharges Name: SPDC	
Logical Nodes for switchgear LN Group: X	
LN: Circuit breaker Name: XCBR	X
LN: Circuit switch Name: XSWI	X
Logical Nodes for instrument transformers LN Group: T	
LN: Current transformer Name: TCTR	
LN: Voltage transformer Name: TVTR	
Logical Nodes for power transformers LN Group: Y	
LN: Earth fault neutralizer (Petersen coil) Name: YEFN	
LN: Tap changer Name: YLTC	
LN: Power shunt Name: YPSH	
LN: Power transformer Name: YPTR	
Logical Nodes for Further Power System Equipment LN Group: Z	
LN: Auxiliary network Name: ZAXN	
LN: Battery Name: ZBAT	
LN: Bushing Name: ZBSH	
LN: Power cable Name: ZCAB	
LN: Capacitor bank Name: ZCAP	
LN: Converter Name: ZCON	
LN: Generator Name: ZGEN	
LN: Gas insulated line Name: ZGIL	
LN: Power overhead line Name: ZLIN	
LN: Motor Name: ZMOT	
LN: Reactor Name: ZREA	
LN: Rotating reactive component Name: ZRRC	
LN: Surge arrestor Name: ZSAR	
LN: Thyristor controlled frequency converter Name: ZTCF	
LN: Thyristor controlled reactive component Name: ZTCR	
Custom Logical Nodes	
LN: Switch on to fault Name: PSOF	

Table 28 Supported logical node classes

7.6 System Logical Nodes LN Group: L

System Logical Nodes LN Group: L

7.6.1 LN: Physical device information Name: LPHD

LPHD class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see7-2).		
Data				
PhyName	DPL	Physical device name plate	M	Y
PhyHealth	INS	Physical device health	M	Y
OutOv	SPS	Output communications buffer overflow	O	N
Proxy	SPS	Indicates if this LN is a proxy	M	Y
InOv	SPS	Input communications buffer overflow	O	Y
NumPwrUp	INS	Number of Power ups	O	N
WrmStr	INS	Number of Warm Starts	O	N
WacTrg	INS	Number of watchdog device resets detected	O	N
PwrUp	SPS	Power Up detected	O	N
PwrDn	SPS	Power Down detected	O	N
PwrSupAlm	SPS	External power supply alarm	O	N
RsStat	SPC	Reset device statistics	O	N
Device Extensions				
SrcSt	RSS	Status values of Ethernet communication port 1 and port 2		Y[1]

(1) only present for LD0.LPHD

7.6.2 Common Logical Node

Common Logical Node class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-ETH61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Mandatory Logical Node Information (Shall be inherited by ALL LN but LPHD)				
Mod	INC	Mode	M	Y
Beh	INS	Behaviour	M	Y
Health	INS	Health	M	Y
NamPlt	LPL	Name Plate	M	Y
Optional Logical Node Information				
Loc	SPS	Local operation	O	N
EEHealth	INS	External equipment health	O	N
EEName	DPL	External equipment name plate	O	N
OpCntRs	INC	Operation counter resetable	O	N
OpCnt	INS	Operation counter	O	N
OpTmh	INS	Operation time	O	N

7.6.3 LN: Logical node zero   Name: LLN0

LLN0 class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-ETH61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Loc	SPS	Local operation for complete logical device	O	Y[1]
OpTmh	INS	Operation time	O	N
Controls				
Diag	SPC	Run Diagnostics	O	N
LEDRs	SPC	LED reset	O	Y[1]

(1) only present for LD1.LLN0

7.7 Logical Nodes for protection functions LN Group: P

The relationship between this IEC61850 and the REF542plus functions is done by the SPA channel number. The SPA channel number is taken for the Logical Node instance (inst) number. All SPA register with no relationship to the LN Group P are present under a GGIO with the same Logical Node instance (inst) number similar to the P LN.

For example SPA channel number = **52** (Overcurrent definite time, high set) will be found in the IEC61850 world as:
DTH PTOC **52** and
DTHOI GGIO **52**.

7.7.1 LN: Differential   Name: PDIF

PDIF class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-ETH61850**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	O	Y[2]
Op	ACT	Operate	M	Y
TmASt	CSD	Active curve characteristic	O	N
Measured Values				
DifAClc	WYE	Differential Current	O	N
RstA	WYE	Restraint Current	O	N
Settings				
LinCapac	ASG	Line capacitance (for load currents)	O	**N**
LoSet	ING	Low operate value, percentage of the nominal current	O	N
HiSet	ING	High operate value, percentage of the nominal current	O	N
MinOpTmms	ING	Minimum Operate Time	O	N
MaxOpTmms	ING	Maximum Operate Time	O	N
RstMod	ING	Restraint Mode	O	N
RsDlTmms	ING	Reset Delay Time	O	N
TmACrv	CURVE	Operating Curve Type	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsStr	INC	Resetable start counter general	O	Y[2]

Used for the following protection functions:
SPA channel number 79   Differential protection   this function supports (1)
SPA channel number 95   Restricted differential protection   this function supports (1) and (2)

7.7.2 LN: Distance   Name: PDIS

Attribute Name	Attr. Type	Explanation	M / O	REF-Eth61850
PTUF class				
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	N
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
Settings				
PoRch	ASG	Polar Reach is the diameter of the Mho diagram	O	N
PhStr	ASG	Phase Start Value	O	N
GndStr	ASG	Ground Start Value	O	N
DirMod	ASG	Directional Mode	O	N
PctRch	ASG	Percent Reach	O	N
Ofs	ASG	Offset	O	N
PctOfs	ASG	Percent Offset	O	N
RisLod	ASG	Resistive reach for load area	O	N
AngLod	ASG	Angle for load area	O	N
TmDlMod	SPG	Operate Time Delay Mode	O	N
OpDlTmms	ING	Operate Time Delay	O	N
PhDlMod	SPG	Operate Time Delay Multiphase Mode	O	N
PhDlTmms	ING	Operate Time Delay for Multiphase Faults	O	N
GndDlMod	SPG	Operate Time Delay for Single Phase Ground Mode	O	N
GndDlTmms	ING	Operate Time Delay for single phase ground faults	O	N
X1	ASG	Positive sequence line (reach) reactance	O	N
LinAng	ASG	Line Angle	O	N
RisGndRch	ASG	Resistive Ground Reach	O	N
RisPhRch	ASG	Resistive Phase Reach	O	N
K0Fact	ASG	Residual Compensation Factor K_0	O	N
K0FactAng	ASG	Residual Compensation Factor Angle	O	N
RsDlTmms	ING	Reset Time Delay	O	N
Device Extensions				
BlkOpn	SPC	Distance_ProtectionV2_Network_1-2_PTRC_General_Block_Status		Y

Used for the following protection functions:
SPA channel number 270   Distance protection V2 Net1

SPA channel number 271-278   Distance protection V2 Net1 Stages

SPA channel number 280   Distance protection V2 Net2

SPA channel number 281-288   Distance protection V2 Net2 Stages

7.7.3 LN: Directional overpower Name: PDOP

Attribute Name	Attr. Type	Explanation	M / O	REF-ETH61850
PDOP class				
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
Settings				
DirMod	ING	Directional Mode	O	N
StrVal	ASG	Start Value	O	N
OpDlTmms	ING	Operate Delay Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:
SPA channel number 76   Directional power protection   this function supports (1)

7.7.4 LN: Directional underpower   Name: PDUP

PDUP class				
Attribute Name	**Attr. Type**		**M / O**	**REF-ETH61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
Settings				
StrVal	ASG	Start Value	M	N
OpDlTmms	ING	Operate Delay Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
DirMod	ING	Directional Mode	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:
SPA channel number 77   Low load protection   this function supports (1)

7.7.5 LN: Instantaneous overcurrent   Name: PIOC

PIOC class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	O	Y
Op	ACT	Operate	M	Y
Settings				
StrVal	ASG	Start Value	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:

SPA channel number 50	Inrush blocking	this function supports (1) and (2)
SPA channel number 51	Overcurrent instantaneous	this function supports (1) and (2)

7.7.6 LN: Motor restart inhibition   Name: PMRI

PMRI class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Op	ACT	Operate	O	Y
StrInh	SPS	Restart inhibited	O	N
StrInhTmm	INS	Restart Inhibition Time	O	N
Settings				
SetA	ASG	Current setting for motor start-up	O	N
SetTms	ING	Time Setting for motor start-up	O	N
MaxNumStr	ING	Maximum number of starts (also for cold starts)	O	N
MaxWrmStr	ING	Maximum Warm Starts, permissible number of warm starts	O	N
MaxStrTmm	ING	Time period for the maximum number of starts	O	N
EqTmm	ING	Temperature Equalisation Time	O	N
InhTmm	ING	Restart Inhibit Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y

Used for the following protection functions:

SPA channel number 87   Number of Starts

7.7.7 LN: Motor starting time supervision   Name: PMSS

PMSS class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data				
Common Logical Node Information				
		LN shall inherit all Mandatory Data from Common Logical Node Class.	M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	O	Y
Op	ACT	Operate	O	Y
Settings				
SetA	ASG	Current setting for motor start-up	O	N
SetTms	ING	Time Setting for motor start-up	O	N
MotStr	ASG	I Motor Startup, (current pickup value of motor starting)	O	N
LokRotTms	ING	Lock Rotor Time, permissible locked rotor time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:
SPA channel number 80   Motorstart protection   this function supports (1)
SPA channel number 86   Blocked rotor protection   this function supports (1) and (2)

7.7.8 LN: Sensitive directional earthfault   Name: PSDE

PSDE class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see IEC 61850-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	O	Y
Settings				
Ang	ASG	Angle between voltage (U0) and current (I0)	O	N
GndStr	ASG	Ground Start Value (3U0)	O	N
GndOp	ASG	Ground Operate Value (3I0)	O	N
StrDlTmms	ING	Start Delay Time	O	N
OpDlTmms	ING	Operate Delay Time	O	N
DirMod	ING	Directional Mode	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:

SPA channel number 88   Sensitive Earthfault directional   this function supports (1)

7.7.9 LN: Time overcurrent   Name: PTOC

Attribute Name	Attr. Type	Explanation	M / O	REF-Eth61850
PTOC class				
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
TmASt	CSD	Active curve characteristic	O	N
Settings				
TmACrv	CURVE	Operating Curve Type	O	N
StrVal	ASG	Start Value	O	N
TmMult	ASG	Time Dial Multiplier	O	N
MinOpTmms	ING	Minimum Operate Time	O	N
MaxOpTmms	ING	Maximum Operate Time	O	N
OpDlTmms	ING	Operate Delay Time	O	N
TypRsCrv	ING	Type of Reset Curve	O	N
RsDlTmms	ING	Reset Delay Time	O	N
DirMod	ING	Directional Mode	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]
OpCntRsN	INC	Resetable start counter neut	O	Y[3]

Used for the following protection functions:

SPA channel number 52	Overcurrent definite time, high set	this function supports (1) and (2)
SPA channel number 53	Overcurrent definite time, low set	this function supports (1) and (2)
SPA channel number 54	Overcurrent directional, high set	this function supports (1) and (2)
SPA channel number 55	Overcurrent directional, low set	this function supports (1) and (2)
SPA channel number 56	Overcurrent IDMT normally inverse	this function supports (1) and (2)
SPA channel number 57	Overcurrent IDMT Very inverse	this function supports (1) and (2)
SPA channel number 58	Overcurrent IDMT Extremely inverse	this function supports (1) and (2)
SPA channel number 59	Overcurrent IDMT Long-time inverse	this function supports (1) and (2)
SPA channel number 66	Earthfault non-directional, high set	this function supports (1)
SPA channel number 67	Earthfault non-directional, low set	this function supports (1)
SPA channel number 68	Earthfault IDMT Normal Inverse	this function supports (1)
SPA channel number 69	Earthfault IDMT Very Inverse	this function supports (1)
SPA channel number 70	Earthfault IDMT Extremely Inverse	this function supports (1)
SPA channel number 71	Earthfault IDMT Long time Inverse	this function supports (1)
SPA channel number 72	Earthfault directional, high set	this function supports (1)
SPA channel number 73	Earthfault directional, low set	this function supports (1)
SPA channel number 75	Asymmetrical load (Unbalanced load I)	this function supports (1)
SPA channel number 190-199	Earthfault directional sector	this function supports (1)
SPA channel number 200-207	Earthfault directional sector	this function supports (1) and (2)
SPA channel number 210-217	Overcurrent directional	this function supports (1) and (2)

SPA channel number 220-227　Earthfault non-directional　　　　this function supports (1) and (3)
SPA channel number 230-237　Earthfault directional　　　　　　this function supports (1) and (3)

7.7.10　LN: Overvoltage　　Name: PTOV

PTOV class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	O	Y
TmVSt	CSD	Active curve characteristic	O	N
Settings				
TmVCrv	CURVE	Operating Curve Type	O	N
StrVal	ASG	Start Value	O	N
TmMult	ASG	Time Dial Multiplier	O	N
MinOpTmms	ING	Minimum Operate Time	O	N
MaxOpTmms	ING	Maximum Operate Time	O	N
OpDlTmms	ING	Operate Delay Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:
SPA channel number 60　　　Overvoltage instantaneous　　　　　　this function supports (1) and (2)
SPA channel number 61　　　Overvoltage definite time, high set　　this function supports (1) and (2)
SPA channel number 62　　　Overvoltage definite time, low set　　this function supports (1) and (2)
SPA channel number 82　　　Residual overvoltage definite time high　this function supports (1)
SPA channel number 83　　　Residual overvoltage definite time low　this function supports (1)
SPA channel number 89　　　Switching Resonance　　　　　　　　this function supports (1) and (2)
SPA channel number 93　　　High Harmonic　　　　　　　　　　this function supports (1) and (2)

7.7.11 LN: Protection trip conditioning   Name: PTRC

Attribute Name	Attr. Type	Explanation	M / O	REF-Eth61850
PTRC class				
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter trip	O	Y
Status Information				
Tr	ACT	Trip	C	Y
Op	ACT	Operate (combination of subscribed Op from protection functions)	C	N
Str	ACD	Sum of all starts of all connected Logical Nodes	O	Y
Settings				
TrMod	ING	Trip Mode	O	N
TrPlsTmms	ING	Trip Pulse Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:

SPA channel number 260   PTRC General   this function supports (1)

7.7.12 LN: Thermal overload   Name: PTTR

Attribute Name	Attr. Type	Explanation	M / O	REF-Eth61850
PTTR class				
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Measured Values				
Amp	MV	Current for thermal load model	O	N
Tmp	MV	Temperature for thermal load	O	N
TmpRl	MV	Relation between temperature and max. temperature	O	N
LodRsvAlm	MV	Load reserve to alarm	O	N
LodRsvTr	MV	Load reserve to trip	O	N
AgeRat	MV	Ageing rate	O	N
Status Information				
Str	ACD	Start	O	**N**
Op	ACT	Operate	M	Y
AlmThm	ACT	Thermal Alarm	O	Y
TmTmpSt	CSD	Active curve characteristic	O	N
TmASt	CSD	Active curve characteristic	O	N
Settings				
TmTmpCrv	CURVE	Characteristic Curve for temperature measurement	O	N
TmACrv	CURVE	Characteristic Curve for current measurement /Thermal model	O	N
TmpMax	ASG	Maximum allowed temperature	O	N
StrVal	ASG	Start Value	O	N
OpDlTmms	ING	Operate Delay Time	O	N
MinOpTmms	ING	Minimum Operate Time	O	N
MaxOpTmms	ING	Maximum Operate Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
ConsTms	ING	Time constant of the thermal model	O	N
AlmVal	ASG	Alarm Value	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsThm	INC	Resetable Thermal Alarm counter	O	Y[1]

Used for the following protection functions:
SPA channel number 74   Thermal Overload   this function supports (1)

7.7.13 LN: Undervoltage   Name: PTUV

PTUV class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
TmVSt	CSD	Active curve characteristic	O	N
Settings				
TmVCrv	CURVE	Operating Curve Type	O	N
StrVal	ASG	Start Value	O	N
TmMult	ASG	Time Dial Multiplier	O	N
MinOpTmms	ING	Minimum Operate Time	O	N
MaxOpTmms	ING	Maximum Operate Time	O	N
OpDlTmms	ING	Operate Delay Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:
SPA channel number 63   Undervoltage instantaneous   this function supports (1) and (2)
SPA channel number 64   Undervoltage definite time, high set   this function supports (1) and (2)
SPA channel number 65   Undervoltage definite time, low set   this function supports (1) and (2))
SPA channel number 150-155 Frequency protection   this function supports (1)
SPA channel number 160-165 Frequency protection   this function supports (1)

7.7.14 LN: Undervoltage   Name: PTUF

Attribute Name	Attr. Type	Explanation	M / O	REF-Eth61850
PTUF class				
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Status Information				
Str	ACD	Start	M	Y
Op	ACT	Operate	M	Y
BlkV	SPS	Blocked because of voltage	O	N
Settings				
StrVal	CURVE	Start Value (frequency)	O	N
BlkVal	ASG	Voltage Block Value	O	N
OpDlTmms	ING	Operate Delay Time	O	N
RsDlTmms	ING	Reset Delay Time	O	N
Device Extensions				
BlkOpn	SPC	Block opening	M	Y[1]
OpCntRsA	INC	Resetable start counter phase A	O	Y[2]
OpCntRsB	INC	Resetable start counter phase B	O	Y[2]
OpCntRsC	INC	Resetable start counter phase C	O	Y[2]
OpCntRsStr	INC	Resetable start counter general	O	Y[1]

Used for the following protection functions:

SPA channel number 63   Undervoltage instantaneous   this function supports (1) and (2)
SPA channel number 64   Undervoltage definite time, high set   this function supports (1) and (2)
SPA channel number 65   Undervoltage definite time, low set   this function supports (1) and (2)

7.8 Logical Nodes for protection related functions　　LN Group: R

The relationship between this IEC61850 and the REF542plus functions is done by the SPA channel number. The SPA channel number is taken for the Logical Node instance (inst) number. All SPA register with no relationship to the LN Group R are present under a GGIO with the same Logical Node instance (inst) number similar to the R LN.

7.8.1 LN: CB Failure　　Name: RBRF

RREC class					
Attribute Name	**Attr. Type**	**Explanation**		**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).			
Data					
Common Logical Node Information					
LN shall inherit all Mandatory Data from Common Logical Node Class.				M	Y
OpCntRs	INC	Resetable operation counter		O	Y
Status Information					
Str	ACD	Start, timer running		O	Y
OpEx	ACT	Breaker failure trip ("external trip")		C	Y
OpIn	ACT	Operate, retrip ("internal trip")		C	N
Settings					
FailMod	ING	Breaker Failure Detection Mode (current, breaker status, both, other)		O	N
FailTmms	ING	Breaker Failure Time Delay for bus bar trip		O	N
SPlTrTmms	ING	Single Pole Retrip Time Delay		O	N
TPTrTmms	ING	Three Pole Retrip Time Delay		O	N
DetValA	ASG	Current Detector Value		O	N
ReTrMod	ING	Retrip Mode		O	N
Device Extensions					
Op	ACT	CB_Failure_Operate			Y
OpCntRsStr	INC	CB_Failure_Number_of_starts			Y

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

Used for the following protection functions:
SPA channel number 91

7.8.2 LN: Fault Locator　　Name: RFLO

RFLO class					
Attribute Name	**Attr. Type**	**Explanation**		**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).			
Data					
Common Logical Node Information					
LN shall inherit all Mandatory Data from Common Logical Node Class.				M	Y

OpCntRs	INC	Resetable operation counter	O	Y
Status Information				
FltLoop	INS	Fault Loop	O	Y
Measured values				
FltZ	CMV	Calculated Difference in Voltage	M	Y
FltDiskm	MV	Calculated Difference in Frequency	M	Y
Settings				
LinLenKm	ASG	Line length in km	O	N
R1	ASG	Positive-sequence line resistance	O	N
X1	ASG	Positive-sequence line reactance	O	N
R0	ASG	Zero-sequence line resistance	O	N
X0	ASG	Zero-sequence line reactance	O	N
Z1Mod	ASG	Positive-sequence line impedance value	O	N
Z1Ang	ASG	Positive-sequence line impedance angle	O	N
Z0Mod	ASG	Zero-sequence line impedance value	O	N
Z0Ang	ASG	Zero-sequence line impedance angle	O	N
Rm0	ASG	Mutual resistance	O	N
Xm0	ASG	Mutual reactance	O	N
Zm0Mod	ASG	Mutual impedance value	O	N
Zm0Ang	ASG	Mutual impedance angle	O	N
Device Extensions				
BlkOpn	SPC	Fault_Locator_Net_1_Protection_Block		Y
Str	ACD	Fault locator Start		Y
Op	ACT	Fault locator Operate		Y
OpCntRsStr	INC	Faul locator Start counter		Y

Used for the following protection functions:
SPA channel number 290   Faul Locator Net1

SPA channel number 291   Faul Locator Net2

7.8.3 LN: Autoreclosing   Name: RREC

RREC class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
OpCntRs	INC	Resetable operation counter operate general	O	Y
Controls				
BlkRec	SPC	Block Reclosing	O	N
ChkRec	SPC	Check Reclosing	O	N
Status Information				
Auto	SPS	Automatic Operation (external switch status)	O	N
Op	ACT	Operate (used here to provide close to XCBR)	M	Y
AutoRecSt	INS	Auto Reclosing Status	M	Y
Settings				
Rec1Tmms	ING	First Reclose Time	O	N
Rec2Tmms	ING	Second Reclose Time	O	N
Rec3Tmms	ING	Third Reclose Time	O	N
PlsTmms	ING	Close Pulse Time	O	N
RclTmms	ING	Reclaim Time	O	N
Device Extensions				
BlkCls	SPC	Block closing	M	Y[1]

Used for the following protection functions:
SPA channel number 250   Autoreclose 2 (AR2)   this function supports (1)

7.8.4 LN: Synchronism-check or synchronising   Name: RSYN

RSYN class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Controls				
RHz	SPC	Raise Frequency	O	N
LHz	SPC	Lower Frequency	O	N
RV	SPC	Raise Voltage	O	N
LV	SPC	Lower Voltage	O	N
Status Information				
Rel	SPS	Release	M	Y
VInd	SPS	Voltage Difference Indicator	O	N
AngInd	SPS	Angle Difference Indicator	O	N
HzInd	SPS	Frequency Difference Indicator	O	N
SynPrg	SPS	Synchronising in progress	O	Y
Measured values				
DifVClc	MV	Calculated Difference in Voltage	O	N
DifHzClc	MV	Calculated Difference in Frequency	O	N
DifAngClc	MV	Calculated Difference of Phase Angle	O	N
Settings				
DifV	ASG	Difference Voltage	O	N
DifHz	ASG	Difference Frequency	O	N
DifAng	ASG	Difference Phase Angle	O	N
LivDeaMod	ING	Live Dead Mode	O	N
DeaLinVal	ASG	Dead Line Value	O	N
LivLinVal	ASG	Live Line Value	O	N
DeaBusVal	ASG	Dead Bus Value	O	N
LivBusVal	ASG	Live Bus Value	O	N
PlsTmms	ING	Close Pulse Time	O	N
BkrTmms	ING	Closing time of breaker	O	N
Device Extensions				
BlkCls	SPC	Block closing	M	Y[1]

Used for the following protection functions:
SPA channel number 85   Synchro Check   this function supports (1)

7.9 Logical Nodes for control   LN Group: C

The relationship between this IEC61850 and the REF542plus functions is done by the SPA channel number. The SPA channel number is taken for the Logical Node instance (inst) number.

The supported REF542plus functions for this Logical Node Group are:

- Switching object 2-2
  for the primary devices circuit breaker, disconnector and earthing switch.

- Switching object 2-2-H Bridge
  for the primary devices disconnector.

- Switching object 4-4-H Bridge
  for the primary devices disconnector and earthing switch

The CILO Logical Node is only present, when the primary switch is configured as electrical controllable.

7.9.1 LN: Interlocking   Name: CILO

CILO class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Status information				
EnaOpn	SPS	Enable Open	M	Y
EnaCls	SPS	Enable Close	M	Y

The following table gives an overview of the possible configuration variants. The presents of the items are dependent on the configuration in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description

EnaOpn	5/49 or 111/129I17	Open Interlocked (position independant) used for primary divices controlled with:
		    an Switching object 2-2 or
		    an Switching object 2-2-H and
		    an Switching object 4-4-H ES part

EnaOpn	5/49 or 111/129I19	Open Interlocked (position independant) used for primary divices controlled with: an Switching object 4-4-H DC part

EnaCls	5/49 or 111/129I18	Close Interlocked (position independant) used for primary divices controlled with:
		    an Switching object 2-2 or
		    an Switching object 2-2-H and
		    an Switching object 4-4-H ES part

EnaCls	5/49 or 111/129I20	Close Interlocked (position independant) used for primary divices controlled with: an Switching object 4-4-H DC part

7.9.2 LN: Switch controller   Name: CSWI

CSWI class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Loc	SPS	Local operation	O	Y
OpCntRs	INC	Resetable operation counter	O	N
Controls				
Pos	DPC	Switch, general	M	Y
PosA	DPC	Switch L1	O	N
PosB	DPC	Switch L2	O	N
PosC	DPC	Switch L3	O	N
OpOpn	ACT	Operation "Open Switch"	O	N
OpCls	ACT	Operation "Close Switch"	O	N

The following table gives an overview of the possible configuration variants. The presents of the item s are dependent on the configuration in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description
Loc	0V10	Remote Control Status
Pos.SBOw	5/49 or 111/129 V14 (on) V13 (off)	Position Indication CB, DC or ES controlled with: an Switching object 2-2
Pos.SBOw	5/49 or 111/129 V26 (on) V25 (off)	Position Indication DC controlled with: an Switching object 2-2-H and an Switching object 4-4-H
Pos.SBOw	5/49 or 111/129 V36 (on) V35 (off)	Position Indication ES controlled with: an Switching object 4-4-H
Pos.Oper	5/49 or 111/129 V10 (on) V11 (off)	Position Indication CB, DC or ES controlled with: an Switching object 2-2
Pos.Oper	5/49 or 111/129 V22 (on) V23 (off)	Position Indication DC controlled with: an Switching object 2-2-H and an Switching object 4-4-H
Pos.Oper	5/49 or 111/129 V32 (on) V33 (off)	Position Indication ES controlled with: an Switching object 4-4-H
Pos.Cancel	5/49 or 111/129V12	Position Indication CB, DC or ES controlled with: an Switching object 2-2
Pos.Cancel	5/49 or 111/129V24	Position Indication DC controlled with: an Switching object 2-2-H and an Switching object 4-4-H
Pos.Cancel	5/49 or 111/129V34	Position Indication ES controlled with: an Switching object 4-4-H
Pos.stVal	5/49 or 111/129I1	Position Indication CB, DC or ES controlled with: an Switching object 2-2

IEC reference	SPA reference	SPA description
Pos.stVal	5/49 or 111/129I11	Position Indication DC controlled with: an Switching object 2-2-H and an Switching object 4-4-H
Pos.stVal	5/49 or 111/129I12	Position Indication ES controlled with: an Switching object 4-4-H
Pos.stSeld	5/49 or 111/129V1	Position Indication CB, DC or ES controlled with: an Switching object 2-2 and an Switching object 4-4-H DC part
Pos.stSeld	5/49 or 111/129V9	Position Indication DC controlled with: an Switching object 2-2-H
Pos.stSeld	5/49 or 111/129V19	Position Indication ES controlled with: an Switching object 4-4-H

7.10 Logical Nodes for generic references   LN Group: G

The supported REF542plus functions for this Logical Node Group are:

- All protection functions have additional information on an GGIO.
  The GGIO instance number is the SPA channel number of the protection function.

- For IntIn
  the 16-Bit Read object could be used.

- For Alm,Ind and the status part of the SPCSO
  the switching object 0-1 and
  the binary read object could be used.

- For SPCSO control part
  the switching object 1-0 and
  the binary write object could be used.

- The Direct Read-Write object could be used for a SPCSO.

- For ISCSO
  the 16-Bit Read object could be used for the status and
  the 16-Bit Write object could be used for the control.

- AnIn is used to map SPA analog Va lues, which are not listed in t he MMXU Logical Node.

The configuration of the GGIO's has to be done in the SCL tool.

7.10.1 LN: Generic process I/O   Name: GGIO

GGIO class					
Attribute Name	**Attr. Type**	**Explanation**		**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).			
Data					
Common Logical Node Information					
LN shall inherit all Mandatory Data from Common Logical Node Class.				M	Y
EEHealth	INS	External equipment health (external sensor)		O	N
EEName	DPL	External equipment name plate		O	N
Loc	SPS	Local operation		O	Y
OpCntRs	INC	Resetable operation counter		O	Y
Measured values					
AnIn	MV	Analogue input		O	Y
Controls					
SPCSO	SPC	Single point controllable status output		O	Y
DPCSO	DPC	Double point controllable status output		O	N
ISCSO	INC	Integer status controllable status output		O	Y
Status Information					
IntIn	INS	Integer status input		O	Y
Alm	SPS	General single alarm		O	Y
Ind	SPS	General indication (binary input)		O	Y

The following table gives an overview of the possible configuration variants.
The presents of the item s are dependent on the configuration in the tools,
REF542plus configuration and SCL.
The prefix and the instance number of the GGIO and the number extension
of the attributes could be configured by the user in the SCL tool.
In the table the ? character is used for replacement.

IEC reference	SPA reference	SPA description
LD1.????GGIO???.Alm??	98I1/32	Object: Binary Read
LD1.????GGIO???.Alm??	5/49 or 111/127I4	Switching object 0-1
LD1.????GGIO???.Ind??	98I1/32	Object: Binary Read
LD1.????GGIO???.Ind??	5/49 or 111/127I4	Switching object 0-1
LD1.????GGIO???.IntIn??	99I1/64	Object: 16-Bit Read
LD1.????GGIO???.SPCSO??.Oper	98O1/32	Object: Binary Write
LD1.????GGIO???.SPCSO??.Oper	5/49 or 111/127O4	Switching object 1-0
LD1.????GGIO???.SPCSO??.Oper LD1.????GGIO???.SPCSO??.stVal	101O1/99 and 101I1/99	Object: Direct-Read-Write
LD1.????GGIO???.SPCSO??.Oper LD1.????GGIO???.SPCSO??.stVal	98O1/32 and 98I1/32	Object: Binary Write and Object: Binary Read
LD1.????GGIO???.SPCSO??.Oper LD1.????GGIO???.SPCSO??.stVal	98O1/32 and 5/49 or 111/127I4	Object: Binary Write and Switching object 0-1
LD1.????GGIO???.SPCSO??.Oper LD1.????GGIO???.SPCSO??.stVal	5/49 or 111/127O4 and 98I1/32	Switching object 1-0 and Object: Binary Read
LD1.????GGIO???.SPCSO??.Oper LD1.????GGIO???.SPCSO??.stVal	5/49 or 111/127O4 and 5/49 or 111/127I4	Switching object 1-0 and Switching object 0-1
LD1.????GGIO???.ISCSO??.Oper	99O1/64	Object: 16-Bit Write
LD1.????GGIO???.ISCSO??.Oper LD1.????GGIO???.ISCSO??.stVal	99O1/64 and 99I1/64	Object: 16-Bit Write and Object: 16-Bit Read

The following table gives an overview of the additional supported measure-
ments. The presents of the measurements are dependent on the configura-
tion in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description
LD1.UIGGIO1.AnIn1006	1I1006	Demand current L1
LD1.UIGGIO1.AnIn1007	1I1007	Demand current L2
LD1.UIGGIO1.AnIn1008	1I1008	Demand current L3
LD1.UIGGIO1.AnIn1009	1I1009	Maximal demand current L1
LD1.UIGGIO1.AnIn1010	1I1010	Maximal demand current L2
LD1.UIGGIO1.AnIn1011	1I1011	Maximal demand current L3
LD1.UIGGIO1.SPCSO102	101 O 102	Reset maximum bar (Maximal demand current L1, L2, L3)
LD1.UIGGIO1.AnIn1020	1I1020	Max voltage U1_2
LD1.UIGGIO1.AnIn1021	1I1021	Max voltage U2_3
LD1.UIGGIO1.AnIn1022	1I1022	Max voltage U3_1
LD1.UIGGIO1.AnIn1023	1I1023	Min voltage U1_2
LD1.UIGGIO1.AnIn1024	1I1024	Min voltage U2_3
LD1.UIGGIO1.AnIn1025	1I1025	Min voltage U3_1
LD1.UIGGIO1.SPCSO121	101 O 121	Reset min/max voltages network 1
LD1.UIGGIO1.AnIn1026	1I1026	Voltage THD U1_N

IEC reference	SPA reference	SPA description
LD1.UIGGIO1.AnIn1027	1I1027	Voltage THD U2_N
LD1.UIGGIO1.AnIn1028	1I1028	Voltage THD U3_N
LD1.UIGGIO1.AnIn1029	1I1029	Residual Voltage THD U0 (Sensor)
LD1.UIGGIO1.AnIn1030	1I1030	Voltage THD U1_2
LD1.UIGGIO1.AnIn1031	1I1031	Voltage THD U2_3
LD1.UIGGIO1.AnIn1032	1I1032	Voltage THD U3_1
LD1.UIGGIO1.AnIn1033	1I1033	NPS Current
LD1.UIGGIO1.AnIn1034	1I1034	NPS Voltage
LD1.UIGGIO1.AnIn1035	1I1035	PPS Current
LD1.UIGGIO1.AnIn1036	1I1036	PPS Voltage
LD1.UIGGIO1.AnIn87	1I87	Real Energy
LD1.UIGGIO1.AnIn88	1I88	Reactive Energy
LD1.UIGGIO1.AnIn175	1I175	Forward Real Energy (positive)
LD1.UIGGIO1.AnIn176	1I176	Backward Real Energy (negative)
LD1.UIGGIO1.AnIn177	1I177	Forward Reactive Energy (positive)
LD1.UIGGIO1.AnIn178	1I178	Backward Reactive Energy (negative)
LD1.UIGGIO1.SPCSO103	101 O 103	Reset energy (measurements and value in energy pulse counter FUPLA object)
LD1.UIGGIO2.AnIn1106	1I1106	Demand current L1
LD1.UIGGIO2.AnIn1107	1I1107	Demand current L2
LD1.UIGGIO2.AnIn1108	1I1108	Demand current L3
LD1.UIGGIO2.AnIn1109	1I1109	Maximal demand current L1
LD1.UIGGIO2.AnIn1110	1I1110	Maximal demand current L2
LD1.UIGGIO2.AnIn1111	1I1111	Maximal demand current L3
LD1.UIGGIO2.SPCSO102	101 O 102	Reset maximum bar (Maximal demand current L1, L2, L3)
LD1.UIGGIO2.AnIn1120	1I1120	Max voltage U1_2
LD1.UIGGIO2.AnIn1121	1I1121	Max voltage U2_3
LD1.UIGGIO2.AnIn1122	1I1122	Max voltage U3_1
LD1.UIGGIO2.AnIn1123	1I1123	Min voltage U1_2
LD1.UIGGIO2.AnIn1124	1I1124	Min voltage U2_3
LD1.UIGGIO2.AnIn1125	1I1125	Min voltage U3_1
LD1.UIGGIO2.SPCSO122	101 O 122	Reset min/max voltages network 2
LD1.UIGGIO2.AnIn1126	1I1126	Voltage THD U1_N
LD1.UIGGIO2.AnIn1127	1I1127	Voltage THD U2_N
LD1.UIGGIO2.AnIn1128	1I1128	Voltage THD U3_N
LD1.UIGGIO2.AnIn1129	1I1129	Residual Voltage THD U0 (Sensor)
LD1.UIGGIO2.AnIn1130	1I1130	Voltage THD U1_2
1LD1.UIGGIO2.AnIn1131	1I1131	Voltage THD U2_3
LD1.UIGGIO2.AnIn1132	1I1132	Voltage THD U3_1
LD1.UIGGIO2.AnIn1133	1I1133	NPS Current

IEC reference	SPA reference	SPA description
LD1.UIGGIO2.AnIn1134	1I1134	NPS Voltage
LD1.UIGGIO2.AnIn1135	1I1135	PPS Current
LD1.UIGGIO2.AnIn1136	1I1136	PPS Voltage
LD1.UIGGIO2.AnIn87	1I87	Real Energy
LD1.UIGGIO2.AnIn88	1I88	Reactive Energy
LD1.UIGGIO2.AnIn175	1I175	Forward Real Energy (positive)
LD1.UIGGIO2.AnIn176	1I176	Backward Real Energy (negative)
LD1.UIGGIO2.AnIn177	1I177	Forward Reactive Energy (positive)
LD1.UIGGIO2.AnIn178	1I178	Backward Reactive Energy (negative)
LD1.UIGGIO2.SPCSO103	101 O 103	Reset energy (measurements and value in energy pulse counter FUPLA object)

7.11 Logical Nodes for metering and measurements   LN Group: M

7.11.1 LN: Measurement   Name: MMXU

The measurements of this Logical Node could be present on two MMXU's. The instance number is related to the configured net 1 or 2.

Measurements which doesn't fit into this Logical Node are present under an GGIO Logical Node.

MMXU class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health (external sensor)	O	N
Measured values				
TotW	MV	Total Active Power (Total P)	O	Y
TotVAr	MV	Total Reactive Power (Total Q)	O	Y
TotVA	MV	Total Apparent Power (Total S)	O	Y
TotPF	MV	Average Power factor (Total PF)	O	Y
Hz	MV	Frequency	O	Y
PPV	DEL	Phase to phase voltages (VL1VL2, …)	O	Y
PhV	WYE	Phase to ground voltages (VL1ER, …)	O	Y
A	WYE	Phase currents (IL1, IL2, IL3)	O	Y
W	WYE	Phase active power (P)	O	N
VAr	WYE	Phase reactive power (Q)	O	N
VA	WYE	Phase apparent power (S)	O	N
PF	WYE	Phase power factor	O	N
Z	WYE	Phase Impedance	O	N

The following table gives an overview of the supported measurements. The presents of the measurements are dependent on the configuration in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description
LD1.UIMMXU1.TotW	1I83	Active power (P)
LD1.UIMMXU1.TotVar	1I84	Reactive power (Q)
LD1.UIMMXU1.TotVA	1I85	Apparent power (S)
LD1.UIMMXU1.TotPF	1I82	Power factor cos(phi)
LD1.UIMMXU1.Hz	1I1037	Frequency
LD1.UIMMXU1.PPV.PhsAB	1I1017	Voltage U1_2
LD1.UIMMXU1.PPV.PhsBC	1I1018	Voltage U2_3
LD1.UIMMXU1.PPV.PhsCA	1I1019	Voltage U3_1

IEC reference	SPA reference	SPA description
LD1.UIMMXU1.PhV.phsA	1I1012	Voltage U1_N
LD1.UIMMXU1.PhV.phsB	1I1013	Voltage U2_N
LD1.UIMMXU1.PhV.phsC	1I1014	Voltage U3_N
LD1.UIMMXU1.PhV.neut	1I1015 or 1I1016	Residual Voltage U0 (Sensor) or Residual Voltage U0 (Calculated)
LD1.UIMMXU1.A.phsA	1I1001	Current L1
LD1.UIMMXU1.A.phsB	1I1002	Current L2
LD1.UIMMXU1.A.phsC	1I1003	Current L3
LD1.UIMMXU1.A.neut	1I1004 or 1I1005	Earth Current L0 (Sensor) or Earth Current L0 (Calculated)
LD1.UIMMXU2.TotW	1I83	Active power (P)
LD1.UIMMXU2.TotVar	1I84	Reactive power (Q)
LD1.UIMMXU2.TotVA	1I85	Apparent power (S)
LD1.UIMMXU2.TotPF	1I82	Power factor cos(phi)
LD1.UIMMXU2.Hz	1I1137	Frequency
LD1.UIMMXU2.PPV.PhsAB	1I1117	Voltage U1_2
LD1.UIMMXU2.PPV.PhsBC	1I1118	Voltage U2_3
LD1.UIMMXU2.PPV.PhsCA	1I1119	Voltage U3_1
LD1.UIMMXU2.PhV.phsA	1I1112	Voltage U1_N
LD1.UIMMXU2.PhV.phsB	1I1113	Voltage U2_N
LD1.UIMMXU2.PhV.phsC	1I1114	Voltage U3_N
LD1.UIMMXU2.PhV.neut	1I1115 or 1I1116	Residual Voltage U0 (Sensor) or Residual Voltage U0 (Calculated)
LD1.UIMMXU2.A.phsA	1I1101	Current L1
LD1.UIMMXU2.A.phsB	1I1102	Current L2
LD1.UIMMXU2.A.phsC	1I1103	Current L3
LD1.UIMMXU2.A.neut	1I1104 or 1I1105	Earth Current L0 (Sensor) or Earth Current L0 (Calculated)

7.12 Logical Nodes for switchgear   LN Group: S

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

SIMG class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see -7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
EEHealth	INS	External equipment health	O	Y
EEName	DPL	External equipment name plate	O	N
Measured values				
Pres	MV	Isolation gas pressure	O	Y
Den	MV	Isolation gas density	O	Y
Tmp	MV	Isolation gas temperature	O	Y
Status Information				
InsAlm	SPS	Insulation gas critical (refill isolation medium)	M	Y
InsBlk	SPS	Insulation gas not safe (block device operation)	O	Y
InsTr	SPS	Insulation gas dangerous (trip for device isolation)	O	Y
PresAlm	SPS	Isolation gas pressure alarm	C	N
DenAlm	SPS	Isolation gas density alarm	C	N
TmpAlm	SPS	Isolation gas temperature alarm	C	N
InsLevMax	SPS	Insulation gas level maximum (relates to predefined filling value)	O	N
InsLevMin	SPS	Insulation gas level minimum (relates to predefined filling value)	O	N
Device Extensions				
PresAv	MV	Isolation gas average pressure	O	Y

Condition C: depending on the supervised properties of the insulation gas, at least one statusinformation shall be used.

7.13 Logical Nodes for switchgear   LN Group: X

The relationship between this IEC61850 and the REF542plus functions is done by the SPA channel number. The SPA channel number is taken for the Logical Node instance (inst) number.

The supported REF542plus functions for this Logical Node Group are:

- 2-2 Object
  for the primary devices circuit breaker, disconnector and earthing switch.

- 2-2-H bridge object
  for the primary devices disconnector.

- 4-4-H bridge object
  for the primary devices disconnector and earthing switch

7.13.1 LN: Circuit breaker Name: XCBR

XCBR class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see -7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Loc	SPS	Local operation (local means without substation automation communication, hardwired direct control)	M	Y
EEHealth	INS	External equipment health	O	N
EEName	DPL	External equipment name plate	O	N
OpCnt	INS	Operation counter	M	Y
Controls				
Pos	DPC	Switch position	M	Y
BlkOpn	SPC	Block opening	M	Y
BlkCls	SPC	Block closing	M	Y
ChaMotEna	SPC	Charger motor enabled	O	N
Metered Values				
SumSwARs	BCR	Sum of Switched Amperes, resetable	O	N
Status Information				
CBOpCap	INS	Circuit breaker operating capability	M	Y
POWCap	INS	Point On Wave switching capability	O	N
MaxOpCap	INS	Circuit breaker operating capability when fully charged	O	Y
Device Extensions				
OpnColFlt	SPS	Open Coil Fault The information from the coil supervision will be here present.	O	Y
ClsColFlt	SPS	Close Coil Fault The information from the coil supervision will be here present.	O	Y

The following table gives an overview of the possible configuration variants. The presents of the item s are dependent on the configuration in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description
Loc	0V10	Remote Control Status
OpCnt	5/49 or 111/129V100	Number of cycles of switching object CB controlled with: an Switching object 2-2
Pos.stVal	5/49 or 111/129I1	Position Indication CB controlled with: an Switching object 2-2
BlkOpn	5/49 or 111/129I14	Device Operation Blocked controlled with: an Switching object 2-2
BlkCls	5/49 or 111/129I14	Device Operation Blocked controlled with: an Switching object 2-2
CBOpCap	No register	Fix Open-Close-Open
MaxOpCap	No register	Fix Open-Close-Open
OpnColFlt	98I1/32 or 5/49 or 111/127I4 or 0V103/108	Object: Binary Read or Switching object 0-1 or Coil continuity binary output 1 or 2, I/O card 1,2 or 3
ClsColFlt	98I1/32 or 5/49 or 111/127I4 or 0V103/108	Object: Binary Read or Switching object 0-1 or Coil continuity binary output 1 or 2, I/O card 1,2 or 3

7.13.2 LN: Circuit switch Name: XSWI

XSWI class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.			M	Y
Loc	SPS	Local operation	M	Y
EEHealth	INS	External equipment health	O	N
EEName	DPL	External equipment name plate	O	N
OpCnt	INS	Operation counter	M	Y
Controls				
Pos	DPC	Switch position	M	Y
BlkOpn	SPC	Block opening	M	Y
BlkCls	SPC	Block closing	M	Y
ChaMotEna	SPC	Charger motor enabled	O	N
Status Information				
SwTyp	INS	Switch type	M	Y
SwOpCap	INS	Switch operating capability	M	Y
MaxOpCap	INS	Circuit switch operating capability when fully charged	O	Y

The following table gives an overview of the possible configuration variants. The presents of the item s are dependent on the configuration in the tools, REF542plus configuration and SCL.

IEC reference	SPA reference	SPA description
Loc	0V10	Remote Control Status

OpCnt	5/49 or 111/129V100
	5/49 or 111/129V104
	5/49 or 111/129V105
		Number of cycles of switching object controlled with:
		    an Switching object 2-2 DC,ES
		    an Switching object 2-2-H or 4-4-H DC
		    an Switching object 4-4-H ES

Pos.stVal	5/49 or 111/129I1
	5/49 or 111/129I11
	5/49 or 111/129I12
		Position Indication controlled with:
		    an Switching object 2-2 DC,ES
		    an Switching object 2-2-H or 4-4-H DC
		    an Switching object 4-4-H ES

BlkOpn	5/49 or 111/129I14	Device Operation Blocked valid for all Switching objects
BlkCls	5/49 or 111/129I14	Device Operation Blocked valid for all Switching objects
SwTyp	No register	Fix Disconnertor or Earthing Switch
SwOpCap	No register	Fix Open and Close
MaxOpCap	No register	Fix Open and Close

7.14 Logical Nodes Classes Device Extensions

7.14.1 LN: Switch on to fault   Name: PSOF

PTUF class				
Attribute Name	**Attr. Type**	**Explanation**	**M / O**	**REF-Eth61850**
LNName		Shall be inherited from Logical-Node Class (see-7-2).		
Data				
Common Logical Node Information				
LN shall inherit all Mandatory Data from Common Logical Node Class.				Y
Status Information				
Str	ACD	Start		Y
Op	ACT	Operate		Y
BlkOpn	SPC	Protection_Block		Y

Used for the following protection functions:
SPA channel number 292   Switch On To Fault Net1

SPA channel number 293   Switch On To Fault Net2

8 SCL conformance statement

Defines several degrees of conformance for which implementations may declare support of the substation configuration language. [1]

Table 8-1 – SCL conformance degrees

	SCL Conformance	Client-CR			Server-CR		
		Base	F/S	Value/Range	Base	F/S	Value/Range
SCL.1	SCL File for Implementation Available (offline)				m	m	*Supported, CID file import*
SCL.2	SCL File available from imple-mentation online	O	o		o	o	*Supported, CID file export, available on FTP online*
SCL.3	SCL implementation reconfigu-ration supported online	O	o		o	o	*Supported, see NOTE*

NOTE. The CID file is used to configure the device. Notice that you have to preserve the Communication Engineering Tool's (CET) private sections to configure a device again. CET knows product limitations and it is recommended to configure a device only with CET.

Implementations claiming conformance to SCL.2 or SCL.3 may support the ACSI services defined in Table 4-2

Table 8-2 – Supported ACSI services for SCL.2 and SCL.3

	SCL Conformance	Client-CR			Server-CR		
		Base	F/S	Value/Range	Base	F/S	Value/Range
ACSI Services							*Not supported*
	GetFileAttributeValues	O	o		o	m	*Not supported*
	GetFile	O	c2		o	c2	*Not supported*
	SetFile	O	c3		o	c3	*Not supported*
	DeleteFile	O	o		o	c3	*Not supported*
	GetDataValues	O	c1		o	c1	*Not supported*
	SetDataValues	O	c2		o	c2	*Not supported*
							Not supported
	SCL Control Block	I	i		o	c3	*Not supported*
	SCL File Structure	I	m		i	m	*Not supported*
	Remote Creation of SCL File	I	o		i	o	*Not supported*
c1 – shall be 'm' if support for SCL.2 or SCL.3 is declared.							
c2 – shall be 'm' if support for SCL.2 is declared.							
c3 – shall be 'm' if support for SCL.3 is declared.							

The additional MMS services of Table D.3 shall be supported if support for SCL.2 or SCL.3 is declared.

Table 8-3 – Additional MMS services for SCL.2 and SCL.3

	SCL Conformance	Client-CR			Server-CR		
		Base	F/S	Value/Range	Base	F/S	Value/Range
MMS Services							
	GetCapabilityList	O	i		o	i	*Not supported*
	GetDomainAttributes	O	o		o	m	*Not supported*
	LoadDomain	O	c1		o	c1	*Not supported*
	StoreDomain	O	c2		o	c2	*Not supported*
C1 – shall be 'm' if support SCL.3 is declared.							
c2 – shall be 'm' if support for remote creation of a SCL is declared.							

8.1 SCL control block

The SCL control block shall have a functional constraint of "SC". This control block shall occur in LLN0 only.

The SCL control block shall be a structured MMS TypeDefinition that contains the ordered NamedComponents defined in Table D.4.

Table 8-4 – Definition of SCL control block

IEC 61850-8-1 Component Name	MMS TypeDescription	r/w	m/o	Comments	DUT
validate	VISIBLE-STRING size of 64 octets	r w	m o	shall be 'm' if support for remote activation of a SCL is declared.	*Not supported*
valState	Unsigned Integer – 8 bits	r	m	(0) – NOT-VALIDATED (1) – VALIDATION-ERROR (2) – VALIDATED (3) – VALIDATION-IN-PROGRESS (4) – NOT-SUPPORTED (5) – VALIDATE-FILE-PRESENT	*Not supported*
activate	VISIBLE-STRING size of 64 octets	r w	m o	shall be 'm' if support for remote activation of a SCL is declared.	*Not supported*

9 PICS – Protocol conformance statement

9.1 Profile conformance

Table 9-1 and Table 9-2 define the basic conformance statement.

Table 9-1 – PICS for A-Profile support

		Client		Server		Value/Comment
		F/S		F/S		
A1	Client/Server A-Profile	c1		c1		*Supported*
A2	GOOSE/GSE Management A-Profle	c2		c2		*Not supported*
A3	GSSE A-Profile	c3		c3		*Not supported*
A4	TimeSync A-Profile	c4		c4		*Supported*
c1 – shall be 'm' if support for any service specified for Client/S are declared within the ACSI basic conformance statement.						
c2 – shall be 'm' if support for any service specified for GOOSE/GSE Management are declared within the ACSI basic conformance statement.						
c3 – shall be 'm' if support for any service specified for GSSE A-Profile are declared within the ACSI basic conformance statement						
c4 – support for at least one other A-Profile shall be declared (e.g. in A1-A3) in order to claim conformance to IEC 61850-8-1.						

Table 9-2 – PICS for T-Profile support

		Client		Server		Value/Comment
		F/S		F/S		
T1	TCP/IP T-Profile	c1		c1		*Supported*
T2	OSI T-Profile	c2		c2		*Not supported*
T3	GOOSE/GSE T-Profile	c3		c3		*Not supported*
T4	GSSE T-Profile	c4		c4		*Not supported*
T5	TimeSync T-Profile	o		o		*Supported*
c1 – shall be 'm' if support for A1 is declared. Otherwise, shall be "i"						
c2 – shall be "o" if support for A1 is declared. Otherwise, shall be "i".						
c3 – shall be 'm' if support for A2 is declared. Otherwise, shall be "i".						
c4 – shall be 'm' if support for A3 is declared. Otherwise, shall be "i".						

9.2 MMS Conformance

MMS conformance quaranteed by MMS stack vendor, ie. Sisco Inc..

All needed services supporting the ACSI services stated to be supported in paragraph 2. are supported by the MMS stack used.

10 PIXIT

In this chapter, the essentials for device communication configuration and integration are described. PIXIT is given as a separate document.

11 Appendix B: Index of Tables

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ABB