Relion® 615 series

Feeder Protection and Control
REF615
DNP3 Point List Manual

Power and productivity
for a better world™

ABB

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This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95/EC). This conformity is the result of tests conducted by ABB in accordance with the product standards EN 50263 and EN 60255-26 for the EMC directive, and with the product standards EN 60255-1 and EN 60255-27 for the low voltage directive. The product is designed in accordance with the international standards of the IEC 60255 series.

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Section 1   Introduction

1.1   This manual

The point list manual describes the outlook and properties of the data points specific to the IED. The manual should be used in conjunction with the corresponding communication protocol manual.

1.2   Intended audience

This manual addresses the communication system engineer or system integrator responsible for pre-engineering and engineering for communication setup in a substation from an IED perspective.

The system engineer or system integrator must have a basic knowledge of communication in protection and control systems and thorough knowledge of the specific communication protocol.

1.3   Product documentation

1.3.1   Product documentation set

The application manual contains application descriptions and setting guidelines sorted per function. The manual can be used to find out when and for what purpose a typical protection function can be used. The manual can also be used when calculating settings.

The communication protocol manual describes a communication protocol supported by the IED. The manual concentrates on vendor-specific implementations.

The engineering guide provides information for IEC 61850 engineering of the protection IEDs with PCM600 and IET600. This guide concentrates especially on the configuration of GOOSE communication with these tools. The guide can be used as a technical reference during the engineering phase, installation and commissioning phase, and during normal service. For more details on tool usage, see the PCM600 documentation.

The engineering manual contains instructions on how to engineer the IEDs using the different tools in PCM600. The manual provides instructions on how to set up a PCM600 project and insert IEDs to the project structure. The manual also

recommends a sequence for engineering of protection and control functions, LHMI functions as well as communication engineering for IEC 61850 and other supported protocols.

The installation manual contains instructions on how to install the IED. The manual provides procedures for mechanical and electrical installation. The chapters are organized in chronological order in which the IED should be installed.

The operation manual contains instructions on how to operate the IED once it has been commissioned. The manual provides instructions for monitoring, controlling and setting the IED. The manual also describes how to identify disturbances and how to view calculated and measured power grid data to determine the cause of a fault.

The point list manual describes the outlook and properties of the data points specific to the IED. The manual should be used in conjunction with the corresponding communication protocol manual.

The technical manual contains application and functionality descriptions and lists function blocks, logic diagrams, input and output signals, setting parameters and technical data sorted per function. The manual can be used as a technical reference during the engineering phase, installation and commissioning phase, and during normal service.

1.3.2 Document revision history

Document revision/date	Product version	History
A/2009-03-04	2.0	First release
B/2009-07-03	2.0	Content updated
C/2010-06-11	3.0	Content updated to correspond to the product version
D/2012-05-11	4.0	Content updated to correspond to the product version
E/2013-02-21	4.0 FP1	Content updated to correspond to the product series version

Download the latest documents from the ABB Website http://www.abb.com/substationautomation.

1.3.3 Related documentation

Name of the document	Document ID
DNP3 Communication Protocol Manual	1MRS756709

1.4 Symbols and conventions

1.4.1 Symbols

The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.

The information icon alerts the reader of important facts and conditions.

The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although warning hazards are related to personal injury, it is necessary to understand that under certain operational conditions, operation of damaged equipment may result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms in this manual are spelled out in the glossary. The glossary also contains definitions of important terms.
- Push-button navigation in the LHMI menu structure is presented by using the push-button icons.
  To navigate between the options, use ↑ and ↓.
- HMI menu paths are presented in bold.
  Select **Main menu/Settings**.
- LHMI messages are shown in Courier font.
  To save the changes in non-volatile memory, select `Yes` and press ↵.
- Parameter names are shown in italics.
  The function can be enabled and disabled with the *Operation* setting.
- Parameter values are indicated with quotation marks.
  The corresponding parameter values are "On" and "Off".
- IED input/output messages and monitored data names are shown in Courier font.
  When the function starts, the `START` output is set to TRUE.

1.4.3   Functions, codes and symbols

Table 1:   REF615 functions, codes and symbols

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
Three-phase non-directional overcurrent protection, low stage	PHLPTOC1	3I> (1)	51P-1 (1)
Three-phase non-directional overcurrent protection, high stage	PHHPTOC1	3I>> (1)	51P-2 (1)
	PHHPTOC2	3I>> (2)	51P-2 (2)
Three-phase non-directional overcurrent protection, instantaneous stage	PHIPTOC1	3I>>> (1)	50P/51P (1)
Three-phase directional overcurrent protection, low stage	DPHLPDOC1	3I> -> (1)	67-1 (1)
	DPHLPDOC2	3I> -> (2)	67-1 (2)
Three-phase directional overcurrent protection, high stage	DPHHPDOC1	3I>> ->	67-2
Non-directional earth-fault protection, low stage	EFLPTOC1	Io> (1)	51N-1 (1)
	EFLPTOC2	Io> (2)	51N-1 (2)
Non-directional earth-fault protection, high stage	EFHPTOC1	Io>> (1)	51N-2 (1)
Non-directional earth-fault protection, instantaneous stage	EFIPTOC1	Io>>>	50N/51N
Directional earth-fault protection, low stage	DEFLPDEF1	Io> -> (1)	67N-1 (1)
	DEFLPDEF2	Io> -> (2)	67N-1 (2)
Directional earth-fault protection, high stage	DEFHPDEF1	Io>> ->	67N-2
Admittance based earth-fault protection	EFPADM1	Yo> -> (1)	21YN (1)
	EFPADM2	Yo> -> (2)	21YN (2)
	EFPADM3	Yo> -> (3)	21YN (3)
Wattmetric based earth-fault protection	WPWDE1	Po> -> (1)	32N (1)
	WPWDE2	Po> -> (2)	32N (2)
	WPWDE3	Po> -> (3)	32N (3)
Transient / intermittent earth-fault protection	INTRPTEF1	Io> -> IEF	67NIEF
Harmonics based earth-fault protection	HAEFPTOC1	Io>HA	51NHA
Non-directional (cross-country) earth fault protection, using calculated Io	EFHPTOC1	Io>> (1)	51N-2 (1)
Negative-sequence overcurrent protection	NSPTOC1	I2> (1)	46 (1)
	NSPTOC2	I2> (2)	46 (2)
Phase discontinuity protection	PDNSPTOC1	I2/I1>	46PD
Residual overvoltage protection	ROVPTOV1	Uo> (1)	59G (1)
	ROVPTOV2	Uo> (2)	59G (2)
	ROVPTOV3	Uo> (3)	59G (3)
Three-phase undervoltage protection	PHPTUV1	3U< (1)	27 (1)
	PHPTUV2	3U< (2)	27 (2)
	PHPTUV3	3U< (3)	27 (3)
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Three-phase overvoltage protection	PHPTOV1	3U> (1)	59 (1)
	PHPTOV2	3U> (2)	59 (2)
	PHPTOV3	3U> (3)	59 (3)
Positive-sequence undervoltage protection	PSPTUV1	U1< (1)	47U+ (1)
Negative-sequence overvoltage protection	NSPTOV1	U2> (1)	47O- (1)
Frequency protection	FRPFRQ1	f>/f<,df/dt (1)	81 (1)
	FRPFRQ2	f>/f<,df/dt (2)	81 (2)
	FRPFRQ3	f>/f<,df/dt (3)	81 (3)
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR1	3Ith>F	49F
Circuit breaker failure protection	CCBRBRF1	3I>/Io>BF	51BF/51NBF
Three-phase inrush detector	INRPHAR1	3I2f>	68
Master trip	TRPPTRC1	Master Trip (1)	94/86 (1)
	TRPPTRC2	Master Trip (2)	94/86 (2)
Arc protection	ARCSARC1	ARC (1)	50L/50NL (1)
	ARCSARC2	ARC (2)	50L/50NL (2)
	ARCSARC3	ARC (3)	50L/50NL (3)
Power quality			
Current total demand distortion	CMHAI1	PQM3I (1)	PQM3I (1)
Voltage total harmonic distortion	VMHAI1	PQM3U (1)	PQM3V (1)
Voltage variation	PHQVVR1	PQMU (1)	PQMV (1)
Control			
Circuit-breaker control	CBXCBR1	I <-> O CB	I <-> O CB
Disconnector control	DCXSWI1	I <-> O DCC (1)	I <-> O DCC (1)
	DCXSWI2	I <-> O DCC (2)	I <-> O DCC (2)
Earthing switch control	ESXSWI1	I <-> O ESC	I <-> O ESC
Disconnector position indication	DCSXSWI1	I <-> O DC (1)	I <-> O DC (1)
	DCSXSWI2	I <-> O DC (2)	I <-> O DC (2)
	DCSXSWI3	I <-> O DC (3)	I <-> O DC (3)
Earthing switch indication	ESSXSWI1	I <-> O ES (1)	I <-> O ES (1)
	ESSXSWI2	I <-> O ES (2)	I <-> O ES (2)
Auto-reclosing	DARREC1	O -> I	79
Synchronism and energizing check	SECRSYN1	SYNC	25
Condition monitoring			
Circuit-breaker condition monitoring	SSCBR1	CBCM	CBCM
Trip circuit supervision	TCSSCBR1	TCS (1)	TCM (1)
	TCSSCBR2	TCS (2)	TCM (2)
Current circuit supervision	CCRDIF1	MCS 3I	MCS 3I
Fuse failure supervision	SEQRFUF1	FUSEF	60
Measurement			
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Disturbance recorder	RDRE1	-	-
Three-phase current measurement	CMMXU1	3I	3I
Sequence current measurement	CSMSQI1	I1, I2, I0	I1, I2, I0
Residual current measurement	RESCMMXU1	Io	In
Three-phase voltage measurement	VMMXU1	3U	3U
Residual voltage measurement	RESVMMXU1	Uo	Vn
Sequence voltage measurement	VSMSQI1	U1, U2, U0	U1, U2, U0
Three-phase power and energy measurement	PEMMXU1	P, E	P, E
Frequency measurement	FMMXU1	f	f

Section 2   DNP3 data mappings

2.1   Overview

This document describes the DNP3 data points and structures available in the IED. The data points are unmapped as a default on the DNP3 level. The point lists describe a superset of all DNP3 data available through the standard configuration/s including the optional functionalities.

The point tables show all the available DNP3 data points in the IEDs. The data objects in the point tables are listed based on the AFL and data object IEC 61850 names.

As a default, the class assignments are Class 0 and Class 1 for binary inputs and Class 0 and Class 2 for analog inputs. These assignments can be modified later. Analog values are provided with default scalings. The scalings can be freely modified by the user.

This list represents the superset of DNP3 points. The actual set of available points, meaning the actual set of available applications, is determined by the IED's order code.

2.2   Supported functions

Table 2:   Supported functions in REF615

Function block	FE01	FE02	FE03	FE04	FE05	FE06	FE07	FE08	FE09
PHLPTOC1	●	●	●	●	●			●	
PHHPTOC1	●	●	●	●	●			●	
PHHPTOC2	●	●	●	●	●			●	
PHIPTOC1	●	●	●	●	●	●	●	●	●
DPHLPDOC1						●	●		●
DPHLPDOC2						●	●		●
DPHHPDOC1						●	●		●
EFLPTOC1			●	●				●	
EFLPTOC2			●	●				●	
EFHPTOC1	●	●	●	●	●	●	●	●	●
EFIPTOC1			●	●				●	
DEFLPDEF1	●	●			●	●	●		●
DEFLPDEF2	●	●			●	●	●		●
Table continues on next page									

Function block	FE01	FE02	FE03	FE04	FE05	FE06	FE07	FE08	FE09
DEFHPDEF1	●	●			●	●	●		●
EFPADM1	o	o			o	o	o		o
EFPADM2	o	o			o	o	o		o
EFPADM3	o	o			o	o	o		o
WPWDE1	o	o			o	o	o		o
WPWDE2	o	o			o	o	o		o
WPWDE3	o	o			o	o	o		o
INTRPTEF1	●	●			●	●			●
HAEFPTOC1		o		o		o			o
NSPTOC1	●	●	●	●	●	●	●	●	●
NSPTOC2	●	●	●	●	●	●	●	●	●
PDNSPTOC1	●	●	●	●	●	●	●	●	●
ROVPTOV1	●	●			●	●	●	●	●
ROVPTOV2	●	●			●	●	●	●	●
ROVPTOV3	●	●			●	●	●	●	●
PHPTUV1						●	●	●	●
PHPTUV2						●	●	●	●
PHPTUV3						●	●	●	●
PHPTOV1						●	●	●	●
PHPTOV2						●	●	●	●
PHPTOV3						●	●	●	●
PSPTUV1						●	●		●
NSPTOV1						●	●		●
FRPFRQ1								●	●
FRPFRQ2								●	●
FRPFRQ3								●	●
T1PTTR1	●	●	●	●	●	●	●		●
CCBRBRF1	●	●	●	●	●	●	●	●	●
INRPHAR1	●	●	●	●	●	●	●	●	●
TRPPTRC1	●	●	●	●	●	●	●	●	●
TRPPTRC2	●	●	●	●	●	●	●	●	●
ARCSARC1	o	o	o	o	o	o	o	o	o
ARCSARC2	o	o	o	o	o	o	o	o	o
ARCSARC3	o	o	o	o	o	o	o	o	o
CMHAI1									o
VMHAI1									o
PHQVVR1									o
CBXCBR1	●	●	●	●	●	●	●	●	●
DCXSWI1		●		●	●	●	●	●	●
Table continues on next page									

Function block	FE01	FE02	FE03	FE04	FE05	FE06	FE07	FE08	FE09
DCXSWI2		●		●	●	●	●	●	●
ESXSWI1		●		●	●	●	●	●	●
DCSXSWI1		●		●	●	●	●	●	●
DCSXSWI2		●		●	●	●	●	●	●
DCSXSWI3		●		●	●	●	●	●	●
ESSXSWI1		●		●	●	●	●	●	●
ESSXSWI2		●		●	●	●	●	●	●
DARREC1	o	o	o	o	o	o	o	o	o
SECRSYN1								●	●
SSCBR1		●		●	●	●	●	●	●
TCSSCBR1	●	●	●	●	●	●	●	●	●
TCSSCBR2	●	●	●	●	●	●	●	●	●
CCRDIF1					●	●	●	●	●
SEQRFUF1					●	●	●	●	●
RDRE1	●	●	●	●	●	●	●	●	●
CMMXU1	●	●	●	●	●	●	●	●	●
CSMSQI1	●	●	●	●	●	●	●	●	●
RESCMMXU1	●	●	●	●	●	●	●	●	●
VMMXU1					●	●	●	●	●
RESVMMXU1	●	●			●	●		●	●
VSMSQI1					●	●	●	●	●
PEMMXU1					●	●	●	●	●
FMMXU1								●	●

● = available in the device variant, o = optionally available in the device variant

2.3 Binary inputs

Table 3:   *Explanations of the binary input table columns*

Column name	Description
IEC 61850 name	Original IED data object identification. Described in the IEC 61850 format as Logical Device.Logical Node and thereafter .Data Object.Data Attribute. Logical Node is the same as the application function block name.
SA name	The signal may have a defined label that is visible for example in ACT.
Description	Short description of the signal. See the application function block documentation for more details.
Value	Meaning of the input states.

2.3.1 System functions

2.3.1.1 CTRL.LLN0 Local/remote state (also present in DNP IIN-bits)

Table 4: *CTRL.LLN0 Local/remote state (also present in DNP IIN-bits)*

IEC 61850 name	SA name	Description	Values
CTRL.LLN0			
.Loc.stVal		Remote/Local state	0/1=Rem/Loc

2.3.1.2 LD0.LLN0 Settings supervision

Table 5: *LD0.LLN0 Settings supervision*

IEC 61850 name	SA name	Description	Values
LD0.LLN0			
.SetChg.stVal	-	Settings changed	1=Changed
.SetSeld.stVal	-	Settings reserved	1=Reserved

2.3.2 Switchgear functions

2.3.2.1 CTRL.Cxxxxx1 Circuit breaker (1) CB object and failure protection

Table 6: *CTRL.Cxxxxx1 Circuit breaker (1) CB object and failure protection*

IEC 61850 name	SA name	Description	Values
CTRL.CBCILO1			
.EnaCls.stVal	ENA_CLOSE	Close enabled	1=Enabled
.EnaOpn.stVal	ENA_OPEN	Open enabled	1=Enabled
.ItlByPss.stVal	ITL_BYPASS	Interlocking bypass	1=Bypassed
CTRL.CBCSWI1			
.Pos.stSeld	SELECTED	CB selected	1=Selected
CTRL.CBXCBR1			
.BlkCls.stVal	BLK_CLOSE	Close blocked	1=Blocked
.BlkOpn.stVal	BLK_OPEN	Open blocked	1=Blocked
CTRL.CCBRBRF1			
.OpEx.general	TRBU	Failure ext.trip	1=Failure
.OpIn.general	TRRET	Operate, re-trip	1=Operate
.Str.general	CB_FAULT_AL	Start, timer running	1=Start

2.3.2.2 CTRL.Dxxxxx1 Controllable disconnector (1)

Table 7: CTRL.Dxxxxx1 Controllable disconnector (1)

IEC 61850 name	SA name	Description	Values
CTRL.DCCILO1			
.EnaCls.stVal	ENA_CLOSE	Close enabled	1=Enabled
.EnaOpn.stVal	ENA_OPEN	Open enabled	1=Enabled
.ItlByPss.stVal	ITL_BYPASS	Interlocking bypass	1=Bypassed
CTRL.DCCSWI1			
.Pos.stSeld	SELECTED	CB selected	1=Selected
CTRL.DCXSWI1			
.BlkCls.stVal	BLK_CLOSE	Close blocked	1=Blocked
.BlkOpn.stVal	BLK_OPEN	Open blocked	1=Blocked

2.3.2.3 CTRL.Dxxxxx2 Controllable disconnector (2)

Table 8: CTRL.Dxxxxx2 Controllable disconnector (2)

IEC 61850 name	SA name	Description	Values
CTRL.DCCILO2			
.EnaCls.stVal	ENA_CLOSE	Close enabled	1=Enabled
.EnaOpn.stVal	ENA_OPEN	Open enabled	1=Enabled
.ItlByPss.stVal	ITL_BYPASS	Interlocking bypass	1=Bypassed
CTRL.DCCSWI2			
.Pos.stSeld	SELECTED	CB selected	1=Selected
CTRL.DCXSWI2			
.BlkCls.stVal	BLK_CLOSE	Close blocked	1=Blocked
.BlkOpn.stVal	BLK_OPEN	Open blocked	1=Blocked

2.3.2.4 CTRL.Exxxxx1 Controllable earth switch (1)

Table 9: CTRL.Exxxxx1 Controllable earth switch (1)

IEC 61850 name	SA name	Description	Values
CTRL.ESCILO1			
.EnaCls.stVal	ENA_CLOSE	Close enabled	1=Enabled
.EnaOpn.stVal	ENA_OPEN	Open enabled	1=Enabled
.ItlByPss.stVal	ITL_BYPASS	Interlocking bypass	1=Bypassed
CTRL.ESCSWI1			
.Pos.stSeld	SELECTED	CB selected	1=Selected
CTRL.ESXSWI1			
.BlkCls.stVal	BLK_CLOSE	Close blocked	1=Blocked
.BlkOpn.stVal	BLK_OPEN	Open blocked	1=Blocked

2.3.3 Sensors and monitoring functions

2.3.3.1 LD0.ARCSARC1 Fault arc protection stage 1

Table 10:   LD0.ARCSARC1 Fault arc protection stage 1

IEC 61850 name	SA name	Description	Values
LD0.ARCSARC11			
.FADet.stVal	ARC_FLT_DET	Arc detected	1=Detected
LD0.ARCPTRC11			
.Op.general	OPERATE	Operate	1=Operate

2.3.3.2 LD0.ARCSARC2 Fault arc protection stage 2

Table 11:   LD0.ARCSARC2 Fault arc protection stage 2

IEC 61850 name	SA name	Description	Values
LD0.ARCSARC21			
.FADet.stVal	ARC_FLT_DET	Arc detected	1=Detected
LD0.ARCPTRC21			
.Op.general	OPERATE	Operate	1=Operate

2.3.3.3 LD0.ARCSARC3 Fault arc protection stage 3

Table 12:   LD0.ARCSARC3 Fault arc protection stage 3

IEC 61850 name	SA name	Description	Values
LD0.ARCSARC31			
.FADet.stVal	ARC_FLT_DET	Arc detected	1=Detected
LD0.ARCPTRC31			
.Op.general	OPERATE	Operate	1=Operate

2.3.3.4 LD0.SSCBR1 Circuit-breaker condition monitoring

Table 13:   LD0.SSCBR1 Circuit-breaker condition monitoring

IEC 61850 name	SA name	Description	Values
.APwrAlm.stVal	IPOW_ALM	Iyt alarm	1=Alarm
.APwrLO.stVal	IPOW_LO	Iyt lockout	1=Lockout
.CBLifAlm.stVal	CB_LIFE_ALM	CB lifetime alarm	1=Alarm
.ClsAlm.stVal	TRV_T_CL_ALM	Cls travel time alarm	1=Alarm
.LonTmAlm.stVal	MON_ALM	CB inactive alarm	1=Alarm
.OpnAlm.stVal	TRV_T_OP_ALM	Cls travel time alarm	1=Alarm
.OpNumAlm.stVal	OPR_ALM	CB operations alarm	1=Alarm
Table continues on next page			

IEC 61850 name	SA name	Description	Values
.OpNumLO.stVal	OPR_LO	CB operations lockout	1=Lockout
.PresAlm.stVal	PRES_ALM	Low pressure alarm	1=Alarm
.PresLO.stVal	PRES_LO	Low pressure lockout	1=Lockout
.SprChaAlm.stVal	SPR_CHR_ALM	Spring charge time alarm	1=Alarm

2.3.3.5 LD0.TCSSCBR1 Trip circuit supervision (1)

Table 14: *LD0.TCSSCBR1 Trip circuit supervision (1)*

IEC 61850 name	SA name	Description	Values
LD0.TCSSCBR1			
.CirAlm.stVal	ALARM	Supervision alarm	1=Alarm

2.3.3.6 LD0.TCSSCBR2 Trip circuit supervision (2)

Table 15: *LD0.TCSSCBR2 Trip circuit supervision (2)*

IEC 61850 name	SA name	Description	Values
LD0.TCSSCBR2			
.CirAlm.stVal	ALARM	Supervision alarm	1=Alarm

2.3.4 Metering and measurand functions

2.3.4.1 LD0.CMMXU1 Phase currents (1) limit supervision

Table 16: *LD0.CMMXU1 Phase currents (1) limit supervision*

IEC 61850 name	SA name	Description	Values
LD0.CMMXU1			
.HiAlm.stVal	HIGH_ALARM	High alarm	1=Alarm
.HiWrn.stVal	HIGH_WARN	High warning	1=Warning
.LoAlm.stVal	LOW_ALARM	Low alarm	1=Alarm
.LoWrn.stVal	LOW_WARN	Low warning	1=Warning

2.3.4.2 LD0.RESCMMXU1 Residual current limit supervision

Table 17: *LD0.RESCMMXU1 Residual current limit supervision*

IEC 61850 name	SA name	Description	Values
LD0.RESCMMXU1			
.HiAlm.stVal	HIGH_ALARM	High alarm	1=Alarm
.HiWrn.stVal	HIGH_WARN	High warning	1=Warning

2.3.4.3   LD0.VMMXU1 Three-phase voltage limit supervision

Table 18:   *LD0.VMMXU1 Three-phase voltage limit supervision*

IEC 61850 name	SA name	Description	Values
LD0.VMMXU1			
.HiAlm.stVal	HIGH_ALARM	High alarm	1=Alarm
.HiWrn.stVal	HIGH_WARN	High warning	1=Warning
.LoAlm.stVal	LOW_ALARM	Low alarm	1=Alarm
.LoWrn.stVal	LOW_WARN	Low warning	1=Warning

2.3.4.4   LD0.RESVMMXU1 Residual voltage limit supervision

Table 19:   *LD0.RESVMMXU1 Residual voltage limit supervision*

IEC 61850 name	SA name	Description	Values
LD0.RESVMMXU1			
.HiAlm.stVal	HIGH_ALARM	High alarm	1=Alarm
.HiWrn.stVal	HIGH_WARN	High warning	1=Warning

2.3.5   Power quality functions

2.3.5.1   LD0.CMHAI1 Power quality - current total demand distortion

Table 20:   *LD0.CMHAI1 Power quality - current total demand distortion*

IEC 61850 name	SA name	Description	Values
LD0.CMHAI1			
.Alm.stVal	ALARM	Distortion alarm	10=Alarm

2.3.5.2   LD0.PH1QVVR1 PQ - Voltage variation signals

Table 21:   *LD0.PH1QVVR1 PQ - Voltage variation signals*

IEC 61850 name	SA name	Description	Values
LD0.PH1QVVR1			
.VarStrGen.stVal	-	Variation event detected	1=Detected
.VarEnd.stVal	-	Variation event ended	1=Ended
.SwlOp.stVal	-	Swell event detected	1=Detected
.DipOp.stVal	-	Dip event detected	1=Detected
.IntrOp.stVal	-	Interruption event detected	1=Detected

2.3.5.3　　LD0.VMHAI1 PQ - Voltage total harmonic distortion

Table 22:　　*LD0.VMHAI1 PQ - Voltage total harmonic distortion*

IEC 61850 name	SA name	Description	Values
LD0.VMHAI1			
.Alm.stVal	-	Distortion alarm	1=Alarm

2.3.6　　Protection functions

2.3.6.1　　LD0.LEDPTRC1 Global protection signals

Table 23:　　*LD0.LEDPTRC1 Global protection signals*

IEC 61850 name	SA name	Description	Values
LD0.LEDPTRC1		Global protection signals	
.Op.general	-	-General Operate	1=Operate
.Op.phsA	-	-phsA Operate	1=Operate
.Op.phsB	-	-phsB Operate	1=Operate
.Op.phsC	-	-phsC Operate	1=Operate
.Str.general	-	-General Start	1=Start
.Str.phsA	-	-phsA Start	1=Start
.Str.phsB	-	-phsB Start	1=Start
.Str.phsC	-	-phsC Start	1=Start

2.3.6.2　　LD0.TRPPTRC1 Global conditioning (1)

Table 24:　　*LD0.TRPPTRC1 Global conditioning (1)*

IEC 61850 name	SA name	Description	Values
LD0.TRPPTRC1			
.Op.general	-	Operate input signal	1=Operate
.Tr.general	-	Trip output signal	1=Trip

2.3.6.3　　LD0.TRPPTRC2 Global conditioning (2)

Table 25:　　*LD0.TRPPTRC2 Global conditioning (2)*

IEC 61850 name	SA name	Description	Values
.Op.general	-	Operate input signal	1=Operate
.Tr.general	-	Trip output signal	1=Trip

2.3.6.4 LD0.DEFHPDEF1 Directional earth-fault protection - high stage 1

Table 26:   LD0.DEFHPDEF1 Directional earth-fault protection - high stage 1

IEC 61850 name	SA name	Description	Values
LD0.DEFHPTOC1		High stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.5 LD0.DEFLPDEF1 Directional earth-fault protection - low stage 1

Table 27:   LD0.DEFLPDEF1 Directional earth-fault protection - low stage 1

IEC 61850 name	SA name	Description	Values
LD0.DEFLPTOC1		Low stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.6 LD0.DEFLPDEF2 Directional earth-fault protection - low stage 2

Table 28:   LD0.DEFLPDEF2 Directional earth-fault protection - low stage 2

IEC 61850 name	SA name	Description	Values
LD0.DEFLPTOC2		Low stage (2)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.7 LD0.DPHLPDOC1 Three-phase directional overcurrent protection - low stage (1)

Table 29:   LD0.DPHLPDOC1 Three-phase directional overcurrent protection - low stage (1)

IEC 61850 name	SA name	Description	Values
LD0.DPHLPTOC1		Low stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.8 LD0.DPHLPDOC2 Three-phase directional overcurrent protection - low stage (2)

Table 30:   LD0.DPHLPDOC2 Three-phase directional overcurrent protection - low stage (2)

IEC 61850 name	SA name	Description	Values
LD0.DPHLPTOC2		Low stage (2)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.9 LD0.DPHHPDOC1 Three-phase directional overcurrent protection - high stage (1)

Table 31:   *LD0.DPHHPDOC1 Three-phase directional overcurrent protection - high stage (1)*

IEC 61850 name	SA name	Description	Values
LD0.DPHHPTOC1		High stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.10 LD0.EFHPTOC1 Non-directional earth-fault and sensitive earth-fault protection - high stage 1

Table 32:   *LD0.EFHPTOC1 Non-directional earth-fault and sensitive earth-fault protection - high stage 1*

IEC 61850 name	SA name	Description	Values
LD0.EFHPTOC1		High stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.11 LD0.EFIPTOC1 Non-directional earth-fault and sensitive earth-fault protection - instantaneous stage 1

Table 33:   *LD0.EFIPTOC1 Non-directional earth-fault and sensitive earth-fault protection - instantaneous stage 1*

IEC 61850 name	SA name	Description	Values
LD0.EFIPTOC1		Instant. stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.12 LD0.EFLPTOC1 Non-directional earth-fault and sensitive earth-fault protection - low stage 1

Table 34:   *LD0.EFLPTOC1 Non-directional earth-fault and sensitive earth-fault protection - low stage 1*

IEC 61850 name	SA name	Description	Values
LD0.EFLPTOC1		Low stage (1)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.13 LD0.EFLPTOC2 Non-directional earth-fault and sensitive earth-fault protection - low stage 2

Table 35:   LD0.EFLPTOC2 Non-directional earth-fault and sensitive earth-fault protection - low stage 2

IEC 61850 name	SA name	Description	Values
LD0.EFLPTOC2		Low stage (2)	
.Op.general	OPERATE	-Operate	1=Operate
.Str.general	START	-Start	1=Start

2.3.6.14 LD0.EFPADM1 Admittance-based earth-fault protection (1)

Table 36:   LD0.EFPADM1 Admittance-based earth-fault protection (1)

IEC 61850 name	SA name	Description	Values
LD0.EFPADM1			
.Str.general	START	Stage1 start	1=Start
.Op.general	OPERATE	Stage1 operate	1=Operate

2.3.6.15 LD0.EFPADM2 Admittance-based earth-fault protection (2)

Table 37:   LD0.EFPADM2 Admittance-based earth-fault protection (2)

IEC 61850 name	SA name	Description	Values
LD0.EFPADM2			
.Str.general	START	Stage2 start	1=Start
.Op.general	OPERATE	Stage2 operate	1=Operate

2.3.6.16 LD0.EFPADM3 Admittance-based earth-fault protection (3)

Table 38:   LD0.EFPADM3 Admittance-based earth-fault protection (3)

IEC 61850 name	SA name	Description	Values
LD0.EFPADM3			
.Str.general	START	Stage3 start	1=Start
.Op.general	OPERATE	Stage3 operate	1=Operate

2.3.6.17 LD0.FRPFRQ1 Frequency protection (1)

Table 39:   LD0.FRPFRQ1 Frequency protection (1)

IEC 61850 name	SA name	Description	Values
LD0.FRPTRC1			
.Str.general	START	Stage start	1=Start
LD0.FRPTOF1		Overfrequency	
Table continues on next page			

IEC 61850 name	SA name	Description	Values
.Op.general	OPR_OFRQ	-Operate	1=Operate
LD0.FRPTUF1		Underfrequency	
.Op.general	OPR_UFRQ	-Operate	1=Operate
LD0.FRPFRC1		Frequency gradient	
.Op.general	OPR_FRG	-Operate	1=Operate

2.3.6.18 LD0.FRPFRQ2 Frequency protection (2)

Table 40: LD0.FRPFRQ2 Frequency protection (2)

IEC 61850 name	SA name	Description	Values
LD0.FRPTRC2			
.Str.general	START	Stage start	1=Start
LD0.FRPTOF2		Overfrequency	
.Op.general	OPR_OFRQ	-Operate	1=Operate
LD0.FRPTUF2		Underfrequency	
.Op.general	OPR_UFRQ	-Operate	1=Operate
LD0.FRPFRC2		Frequency gradient	
.Op.general	OPR_FRG	-Operate	1=Operate

2.3.6.19 LD0.FRPFRQ3 Frequency protection (3)

Table 41: LD0.FRPFRQ3 Frequency protection (3)

IEC 61850 name	SA name	Description	Values
LD0.FRPTRC3			
.Str.general	START	Stage start	1=Start
LD0.FRPTOF3		Overfrequency	
.Op.general	OPR_OFRQ	-Operate	1=Operate
LD0.FRPTUF3		Underfrequency	
.Op.general	OPR_UFRQ	-Operate	1=Operate
LD0.FRPFRC3		Frequency gradient	
.Op.general	OPR_FRG	-Operate	1=Operate

2.3.6.20 LD0.HAEFPTOC1 Harmonics-based earth-fault protection

Table 42: LD0.HAEFPTOC1 Harmonics-based earth-fault protection

IEC 61850 name	SA name	Description	Values
LD0.HAEFPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.21 LD0.INPHAR1 Three-phase inrush detection

Table 43:   LD0.INPHAR1 Three-phase inrush detection

IEC 61850 name	SA name	Description	Values
LD0.INRPHAR1			
.Str.general	-	General start	1=Start

2.3.6.22 LD0.INTRPTEF1 Transient/intermittent earth-fault protection

Table 44:   LD0.INTRPTEF1 Transient/intermittent earth-fault protection

IEC 61850 name	SA name	Description	Values
LD0.INTRPTEF1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.23 LD0.NSPTOC1 Negative-sequence overcurrent protection (1)

Table 45:   LD0.NSPTOC1 Negative-sequence overcurrent protection (1)

IEC 61850 name	SA name	Description	Values
LD0.NSPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.24 LD0.NSPTOC2 Negative-sequence overcurrent protection (2)

Table 46:   LD0.NSPTOC2 Negative-sequence overcurrent protection (2)

IEC 61850 name	SA name	Description	Values
LD0.NSPTOC2			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.25 LD0.NSPTOV1 Negative-sequence overvoltage protection - stage 1

Table 47:   LD0.NSPTOV1 Negative-sequence overvoltage protection - stage 1

IEC 61850 name	SA name	Description	Values
LD0.NSPTOV1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.26 LD0.PDNSPTOC1 Phase discontinuity protection

Table 48: *LD0.PDNSPTOC1 Phase discontinuity protection*

IEC 61850 name	SA name	Description	Values
LD0.PDNSPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.27 LD0.PHHPTOC1 Phase overcurrent protection - high stage 1

Table 49: *LD0.PHHPTOC1 Phase overcurrent protection - high stage 1*

IEC 61850 name	SA name	Description	Values
LD0.PHHPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.28 LD0.PHHPTOC2 Phase overcurrent protection - high stage 2

Table 50: *LD0.PHHPTOC2 Phase overcurrent protection - high stage 2*

IEC 61850 name	SA name	Description	Values
LD0.PHHPTOC2			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.29 LD0.PHIPTOC1 Phase overcurrent protection - instantaneous stage 1

Table 51: *LD0.PHIPTOC1 Phase overcurrent protection - instantaneous stage 1*

IEC 61850 name	SA name	Description	Values
LD0.PHIPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.30 LD0.PHLPTOC1 Phase overcurrent protection - low stage 1

Table 52: *LD0.PHLPTOC1 Phase overcurrent protection - low stage 1*

IEC 61850 name	SA name	Description	Values
LD0.PHLPTOC1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.31 LD0.PHPTOV1 Phase overvoltage protection - stage 1

Table 53:   LD0.PHPTOV1 Phase overvoltage protection - stage 1

IEC 61850 name	SA name	Description	Values
LD0.PHPTOV1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.32 LD0.PHPTOV2 Phase overvoltage protection - stage 2

Table 54:   LD0.PHPTOV2 Phase overvoltage protection - stage 2

IEC 61850 name	SA name	Description	Values
LD0.PHPTOV2			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.33 LD0.PHPTOV3 Phase overvoltage protection - stage 3

Table 55:   LD0.PHPTOV3 Phase overvoltage protection - stage 3

IEC 61850 name	SA name	Description	Values
LD0.PHPTOV3			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.34 LD0.PHPTUV1 Phase undervoltage protection - stage 1

Table 56:   LD0.PHPTUV1 Phase undervoltage protection - stage 1

IEC 61850 name	SA name	Description	Values
LD0.PHPTUV1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.35 LD0.PHPTUV2 Phase undervoltage protection - stage 2

Table 57:   LD0.PHPTUV2 Phase undervoltage protection - stage 2

IEC 61850 name	SA name	Description	Values
LD0.PHPTUV2			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.36 LD0.PHPTUV3 Phase undervoltage protection - stage 3

Table 58:   LD0.PHPTUV3 Phase undervoltage protection - stage 3

IEC 61850 name	SA name	Description	Values
LD0.PHPTUV3			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.37 LD0.PSPTUV1 Positive-sequence undervoltage protection - stage 1

Table 59:   LD0.PSPTUV1 Positive-sequence undervoltage protection - stage 1

IEC 61850 name	SA name	Description	Values
LD0.PSPTUV1			
.Op.general	OPERATE	Stage operate	1=Operate
.Str.general	START	Stage start	1=Start

2.3.6.38 LD0.ROVPTOV1 Residual overvoltage protection (1)

Table 60:   LD0.ROVPTOV1 Residual overvoltage protection (1)

IEC 61850 name	SA name	Description	Values
LD0.ROVPTOV1			
.Op.general	OPERATE	Stage 1 operate	1=Operate
.Str.general	START	Stage 1 start	1=Start

2.3.6.39 LD0.ROVPTOV2 Residual overvoltage protection (2)

Table 61:   LD0.ROVPTOV2 Residual overvoltage protection (2)

IEC 61850 name	SA name	Description	Values
LD0.ROVPTOV2			
.Op.general	OPERATE	Stage 2 operate	1=Operate
.Str.general	START	Stage 2 start	1=Start

2.3.6.40 LD0.ROVPTOV3 Residual overvoltage protection (3)

Table 62:   LD0.ROVPTOV3 Residual overvoltage protection (3)

IEC 61850 name	SA name	Description	Values
LD0.ROVPTOV3			
.Op.general	OPERATE	Stage 3 operate	1=Operate
.Str.general	START	Stage 3 start	1=Start

2.3.6.41 LD0.T1PTTR1 Thermal protection (1)

Table 63:   LD0.T1PTTR1 Thermal protection (1)

IEC 61850 name	SA name	Description	Values
LD0.T1PTTR1			
.AlmThm.general	ALARM	Thermal alarm	1=Alarm
.Op.general	OPERATE	General operate	1=Operate
.Str.general	START	General start	1=Start

2.3.6.42 LD0.WPWDE1 Wattmetric-based earth-fault protection (1)

Table 64:   LD0.WPWDE1 Wattmetric-based earth-fault protection (1)

IEC 61850 name	SA name	Description	Values
LD0.WPDSE1			
.Str.general	START	Stage 1 start	1=Start
.Op.general	OPERATE	Stage 1 operate	1=Operate

2.3.6.43 LD0.WPWDE2 Wattmetric-based earth-fault protection (2)

Table 65:   LD0.WPWDE2 Wattmetric-based earth-fault protection (2)

IEC 61850 name	SA name	Description	Values
LD0.WPDSE2			
.Str.general	START	Stage 2 start	1=Start
.Op.general	OPERATE	Stage 2 operate	1=Operate

2.3.6.44 LD0.WPWDE3 Wattmetric-based earth-fault protection (3)

Table 66:   LD0.WPWDE3 Wattmetric-based earth-fault protection (3)

IEC 61850 name	SA name	Description	Values
LD0.WPDSE3			
.Str.general	START	Stage 3 start	1=Start
.Op.general	OPERATE	Stage 3 operate	1=Operate

2.3.7 Protection-related functions

2.3.7.1 LD0.CCRDIF1 Current circuit failure protection

Table 67:   LD0.CCRDIF1 Current circuit failure protection

IEC 61850 name	SA name	Description	Values
LD0.CCRDIF1			
.Alm.stVal	FAIL	Fail Alarm	1=Alarm
.Op.general	ALARM	Fail Operate	1=Operate

2.3.7.2 LD0.SEQRFUF1 Fuse failure protection

Table 68:   LD0.SEQRFUF1 Fuse failure protection

IEC 61850 name	SA name	Description	Values
LD0.SEQRFUF1			
.Str.general	FUSEF_U	General start	1=Start
.Str3Ph.general	FUSEF_3PH	Three-phase start	1=Start

2.3.7.3 LD0.DARREC1 Autorecloser

Table 69:   LD0.DARREC1 Autorecloser

IEC 61850 name	SA name	Description	Values
LD0.DARREC1			
.PrgRec1.stVal	INPRO_1	AR 1st reclose	1=In progress
.PrgRec2.stVal	INPRO_2	AR 2nd reclose	1=In progress
.PrgRec3.stVal	INPRO_3	AR 3rd reclose	1=In progress
.PrgRec4.stVal	INPRO_4	AR 4th reclose	1=In progress
.PrgRec5.stVal	INPRO_5	AR 5th reclose	1=In progress
.PrgRec.stVal	INPRO	AR in progress	1=In progress
.CBManCls.stVal	MAN_CB_CL	CB manually closed	1=CB closed
.LO.stVal	LOCKED	Lockout status	1=Lockout
.UnsRec.stVal	UNSUC_RECL	Reclose fail status	1=Failed
.InBlkThm.stVal	-	Thermal block (status)	1=Block
.RdyRec.stVal	READY	Ready reclose status	1=Ready
.ActRec.stVal	ACTIVE	Active reclose status	1=Active
.PrgDsr.stVal	DISCR_INPRO	Discrimination time in p.	1=In progress
.PrgCutOut.stVal	CUTOUT_INPRO	Cutout time in progress	1=In progress
.FrqOpAlm.stVal	FRQ_OP_ALM	Frequent operation alarm	1=Alarm
.RclTmStr.stVal	-	Reclaim time started	1=Started
.ProCrd.stVal	-	Protection coordination	1=In progress
Table continues on next page			

IEC 61850 name	SA name	Description	Values
.Op.general	CLOSE_CB	Operate (close XCBR)	1=Close CB
.OpOpn.general	OPEN_CB	Operate (open XCBR)	1=Open CB
.UnsCBCls.stVal	UNSUC_CB	CB closing failed	1=Failed
.WtMstr.stVal	CMD_WAIT	Master signal to follower	1=Signal

2.3.7.4 DR.RDRE1 Disturbance recorder

Table 70:   DR.RDRE1 Disturbance recorder

IEC 61850 name	SA name	Description	Values
DR.RDRE1			
.RcdMade.stVal		DR recording made	1=Made

2.3.7.5 LD0.SECRSYN1 Synchrocheck

Table 71:   LD0.SECRSYN1 Synchrocheck

IEC 61850 name	SA name	Description	Values
LD0.SECRSYN1			
.SynPrg.stVal	SYNC_INPRO	Synch in progress	1=In progress
.FailCmd.stVal	CMD_FAIL_AL	CB close request failed	1=Failed
.FailSyn.stVal	CL_FAIL_AL	CB close command failed	1=Failed

2.3.8 Generic functions

2.3.8.1 LD0.MVGAPC1 Multipurpose binary inputs (1)

Table 72:   LD0.MVGAPC1 Multipurpose binary inputs (1)

IEC 61850 name	SA name	Description	Values
LD0.MVGAPC1			
.Q1.stVal	-	Input 1 signal	0/1=Off/On
.Q2.stVal	-	Input 2 signal	0/1=Off/On
.Q3.stVal	-	Input 3 signal	0/1=Off/On
.Q4.stVal	-	Input 4 signal	0/1=Off/On
.Q5.stVal	-	Input 5 signal	0/1=Off/On
.Q6.stVal	-	Input 6 signal	0/1=Off/On
.Q7.stVal	-	Input 7 signal	0/1=Off/On
.Q8.stVal	-	Input 8 signal	0/1=Off/On

2.3.8.2   LD0.MVGAPC2 Multipurpose binary inputs (2)

Table 73:   LD0.MVGAPC2 Multipurpose binary inputs (2)

IEC 61850 name	SA name	Description	Values
LD0.MVGAPC2			
.Q1.stVal	-	Input 1 signal	0/1=Off/On
.Q2.stVal	-	Input 2 signal	0/1=Off/On
.Q3.stVal	-	Input 3 signal	0/1=Off/On
.Q4.stVal	-	Input 4 signal	0/1=Off/On
.Q5.stVal	-	Input 5 signal	0/1=Off/On
.Q6.stVal	-	Input 6 signal	0/1=Off/On
.Q7.stVal	-	Input 7 signal	0/1=Off/On
.Q8.stVal	-	Input 8 signal	0/1=Off/On

2.3.8.3   LD0.SPCGGIO2 Multipurpose binary outputs - status (2)

Table 74:   LD0.SPCGGIO2 Multipurpose binary outputs - status (2)

IEC 61850 name	SA name	Description	Values
LD0.SPCGGIO2			
.SPCS01.stVal	-	Output 1 state	0/1=Off/On
.SPCS02.stVal	-	Output 2 state	0/1=Off/On
.SPCS03.stVal	-	Output 3 state	0/1=Off/On
.SPCS04.stVal	-	Output 4 state	0/1=Off/On
.SPCS05.stVal	-	Output 5 state	0/1=Off/On
.SPCS06.stVal	-	Output 6 state	0/1=Off/On
.SPCS07.stVal	-	Output 7 state	0/1=Off/On
.SPCS08.stVal	-	Output 8 state	0/1=Off/On
.SPCS09.stVal	-	Output 9 state	0/1=Off/On
.SPCS10.stVal	-	Output 10 state	0/1=Off/On
.SPCS11.stVal	-	Output 11 state	0/1=Off/On
.SPCS12.stVal	-	Output 12 state	0/1=Off/On
.SPCS13.stVal	-	Output 13 state	0/1=Off/On
.SPCS14.stVal	-	Output 14 state	0/1=Off/On
.SPCS15.stVal	-	Output 15 state	0/1=Off/On
.SPCS16.stVal	-	Output 16 state	0/1=Off/On

2.3.9 Physical and raw I/O data

2.3.9.1 LD0.XAGGIO130 Physical I/O

Table 75: LD0.XAGGIO130 Physical I/O

IEC 61850 name	SA name	Description	Values
LD0.XAGGIO130			
.Ind1.stVal	-	X130-Input 1	1/0=ON/OFF
.Ind2.stVal	-	X130-Input 2	1/0=ON/OFF
.Ind3.stVal	-	X130-Input 3	1/0=ON/OFF
.Ind4.stVal	-	X130-Input 4	1/0=ON/OFF

2.3.9.2 LD0.XGGIO100 Physical I/O

Table 76: LD0.XGGIO100 Physical I/O

IEC 61850 name	SA name	Description	Values
LD0.XGGIO100			
.SPCSO1.stVal	-	X100-Output 1	1/0=ON/OFF
.SPCSO2.stVal	-	X100-Output 2	1/0=ON/OFF
.SPCSO3.stVal	-	X100-Output 3	1/0=ON/OFF
.SPCSO4.stVal	-	X100-Output 4	1/0=ON/OFF
.SPCSO5.stVal	-	X100-Output 5	1/0=ON/OFF
.SPCSO6.stVal	-	X100-Output 6	1/0=ON/OFF

2.3.9.3 LD0.XGGIO110 Physical I/O

Table 77: LD0.XGGIO110 Physical I/O

IEC 61850 name	SA name	Description	Values
LD0.XGGIO110			
.Ind1.stVal	-	X110-Input 1	1/0=ON/OFF
.Ind2.stVal	-	X110-Input 2	1/0=ON/OFF
.Ind3.stVal	-	X110-Input 3	1/0=ON/OFF
.Ind4.stVal	-	X110-Input 4	1/0=ON/OFF
.Ind5.stVal	-	X110-Input 5	1/0=ON/OFF
.Ind6.stVal	-	X110-Input 6	1/0=ON/OFF
.Ind7.stVal	-	X110-Input 7	1/0=ON/OFF
.Ind8.stVal	-	X110-Input 8	1/0=ON/OFF
.SPCSO1.stVal	-	X110-Output 1	1/0=ON/OFF
.SPCSO2.stVal	-	X110-Output 2	1/0=ON/OFF
.SPCSO3.stVal	-	X110-Output 3	1/0=ON/OFF
.SPCSO4.stVal	-	X110-Output 4	1/0=ON/OFF

2.3.9.4 LD0.XGGIO120 Physical I/O

Table 78:   *LD0.XGGIO120 Physical I/O*

IEC 61850 name	SA name	Description	Values
LD0.XGGIO120			
.Ind1.stVal	-	X120-Input 1	1/0=ON/OFF
.Ind2.stVal	-	X120-Input 2	1/0=ON/OFF
.Ind3.stVal	-	X120-Input 3	1/0=ON/OFF
.Ind4.stVal	-	X120-Input 4	1/0=ON/OFF

2.3.9.5 LD0.XGGIO130 Physical I/O

Table 79:   *LD0.XGGIO130 Physical I/O*

IEC 61850 name	SA name	Description	Values
LD0.XGGIO130			
.Ind1.stVal	-	X130-Input 1	1/0=ON/OFF
.Ind2.stVal	-	X130-Input 2	1/0=ON/OFF
.Ind3.stVal	-	X130-Input 3	1/0=ON/OFF
.Ind4.stVal	-	X130-Input 4	1/0=ON/OFF
.Ind5.stVal	-	X130-Input 5	1/0=ON/OFF
.Ind6.stVal	-	X130-Input 6	1/0=ON/OFF
.SPCSO1.stVal	-	X130-Output 1	1/0=ON/OFF
.SPCSO2.stVal	-	X130-Output 2	1/0=ON/OFF
.SPCSO3.stVal	-	X130-Output 3	1/0=ON/OFF

2.4 Binary outputs

Table 80:   *Explanations of the binary output table columns*

Column name	Description
IEC 61850 name	Original IED data object identification. Described in the IEC 61850 format as Logical Device.Logical Node and thereafter .Data Object.Data Attribute. Logical Node is the same as the application function block name.
SA name	The signal may have a defined label that is visible for example in ACT.
Description	Short description of the signal. See the application function block documentation for more details.
Type	Output type. Some outputs can only be controlled with value "On". Writing "Off" to these points does not affect the function of the output. See DNP3 control relay output block parameters.

2.4.1 System functions

2.4.1.1 LD0.LLN0/LPHD1 Reset indications and LEDs, reset device

Table 81:   LD0.LLN0/LPHD1 Reset indications and LEDs, reset device

IEC 61850 name	SA name	Description	Type
LD0.LLN0			
.LEDRs1.Oper.ctlVal	-	Reset indications and LEDs	On
.LEDRs2.Oper.ctlVal	-	Reset alarm LEDs	On
LD0.LPHD1			
.RsDev.Oper.ctlVal	-	Reset device	On

2.4.1.2 LD0.DNPGGIO1 Parameter setting group control

Table 82:   LD0.DNPGGIO1 Parameter setting group control

IEC 61850 name	SA name	Description	Type
LD0.DNPGGIO1			
.ActSG1.ctlVal	-	Setting group 1	On
.ActSG2.ctlVal	-	Setting group 2	On
.ActSG3.ctlVal	-	Setting group 3	On
.ActSG4.ctlVal	-	Setting group 4	On
.ActSG5.ctlVal	-	Setting group 5	On
.ActSG6.ctlVal	-	Setting group 6	On

2.4.2 Switchgear functions

2.4.2.1 CTRL.CBCSWI1 Circuit breaker control

Table 83:   CTRL.CBCSWI1 Circuit breaker control

IEC 61850 name	SA name	Description	Type
CTRL.CBCSWI1			
.Pos.Oper.ctlVal	-	Circuit breaker control	On/Off

2.4.2.2 CTRL.DCCSWI1 Controllable disconnector (1) control

Table 84:   CTRL.DCCSWI1 Controllable disconnector (1) control

IEC 61850 name	SA name	Description	Type
CTRL.DCCSWI1			
.Pos.Oper.ctlVal	-	Disconnector control	On/Off

2.4.2.3 CTRL.DCCSWI2 Controllable disconnector (2) control

Table 85: CTRL.DCCSWI2 Controllable disconnector (2) control

IEC 61850 name	SA name	Description	Type
CTRL.DCCSWI2			
.Pos.Oper.ctlVal	-	Disconnector control	On/Off

2.4.2.4 CTRL.ESCSWI2 Controllable earth switch (2) control

Table 86: CTRL.ESCSWI2 Controllable earth switch (2) control

IEC 61850 name	SA name	Description	Type
CTRL.ESCSWI2			
.Pos.Oper.ctlVal	-	Earth switch control	On/Off

2.4.3 Sensors and monitoring functions

2.4.3.1 LD0.SSCBR1 Reset signals of CB condition monitoring

Table 87: LD0.SSCBR1 Reset signals of CB condition monitoring

IEC 61850 name	SA name	Description	Type
LD0.SSCBR1			
.RsAccAPwr.Oper.ctlVal	RST_IPOW	Reset accum. energy	On
.RsCBWear.Oper.ctlVal	RST_CB_WEAR	Reset CB life and op. counter	On
.RsSprChaTm.Oper.ctlVal	RST_SPR_T	Reset spring charge alarm	On
.RsTrvTm.Oper.ctlVal	RST_TRV_T	Reset travel time alarm	On

2.4.4 Metering and measurand functions

2.4.4.1 LD0.PEMMXU1 Reset accumulated energy values

Table 88: LD0.PEMMXU1 Reset accumulated energy values

IEC 61850 name	SA name	Description	Type
LD0.PEMMXU1			
.SupDmdRs.Oper.ctlVal	RSTACM	Reset accum. energy	On

2.4.5 Protection-related functions

2.4.5.1 LD0.DARREC1 Autoreclosing reset signals

Table 89: LD0.DARREC1 Autoreclosing reset signals

IEC 61850 name	SA name	Description	Type
LD0.DARREC1			
.RsCnt.Oper.ctlVal	-	AR reset all counters	On
.RsRec.Oper.ctlVal	-	AR reset	On

2.4.5.2 DR.RDRE1 Disturbance recorder

Table 90: DR.RDRE1 Disturbance recorder

IEC 61850 name	SA name	Description	Type
DR.RDRE1			
.MemClr.Oper.ctlVal	-	Clear all records	On
.RcdTrg.Oper.ctlVal	-	Trig recording	On

2.4.6 Generic functions

2.4.6.1 LD0.SPCGGIO1 Multipurpose binary outputs (1)

The binary outputs may be configured either as pulse- or persistent-type outputs. Pulse-type outputs are triggered with the write value "1". Persistent-type outputs can be written with both "1" and "0" values. The persistent type is the same as the toggled mode on LHMI and WHMI.

Table 91: LD0.SPCGGIO1 Multipurpose binary outputs (1)

IEC 61850 name	SA name	Description	Type
LD0.SPCGGIO1			
.SPCS01.ctlVal	-	Output 1 control	On/Off
.SPCS02.ctlVal	-	Output 2 control	On/Off
.SPCS03.ctlVal	-	Output 3 control	On/Off
.SPCS04.ctlVal	-	Output 4 control	On/Off
.SPCS05.ctlVal	-	Output 5 control	On/Off
.SPCS06.ctlVal	-	Output 6 control	On/Off
.SPCS07.ctlVal	-	Output 7 control	On/Off
.SPCS08.ctlVal	-	Output 8 control	On/Off
.SPCS09.ctlVal	-	Output 9 control	On/Off
.SPCS10.ctlVal	-	Output 10 control	On/Off
.SPCS11.ctlVal	-	Output 11 control	On/Off
Table continues on next page			

IEC 61850 name	SA name	Description	Type
.SPCS12.ctlVal	-	Output 12 control	On/Off
.SPCS13.ctlVal	-	Output 13 control	On/Off
.SPCS14.ctlVal	-	Output 14 control	On/Off
.SPCS15.ctlVal	-	Output 15 control	On/Off
.SPCS16.ctlVal	-	Output 16 control	On/Off

2.4.6.2 LD0.SPCGGIO2 Multipurpose binary outputs (2)

The binary outputs may be configured either as pulse- or persistent-type outputs. Pulse-type outputs are triggered with the write value "1". Persistent-type outputs can be written with both "1" and "0" values. The persistent type is the same as the toggled mode on LHMI and WHMI.

Table 92:   LD0.SPCGGIO2 Multipurpose binary outputs (2)

IEC 61850 name	SA name	Description	Type
LD0.SPCGGIO2			
.SPCS01.ctlVal	-	Output 1 control	On/Off
.SPCS02.ctlVal	-	Output 2 control	On/Off
.SPCS03.ctlVal	-	Output 3 control	On/Off
.SPCS04.ctlVal	-	Output 4 control	On/Off
.SPCS05.ctlVal	-	Output 5 control	On/Off
.SPCS06.ctlVal	-	Output 6 control	On/Off
.SPCS07.ctlVal	-	Output 7 control	On/Off
.SPCS08.ctlVal	-	Output 8 control	On/Off
.SPCS09.ctlVal	-	Output 9 control	On/Off
.SPCS10.ctlVal	-	Output 10 control	On/Off
.SPCS11.ctlVal	-	Output 11 control	On/Off
.SPCS12.ctlVal	-	Output 12 control	On/Off
.SPCS13.ctlVal	-	Output 13 control	On/Off
.SPCS14.ctlVal	-	Output 14 control	On/Off
.SPCS15.ctlVal	-	Output 15 control	On/Off
.SPCS16.ctlVal	-	Output 16 control	On/Off

2.4.6.3 LD0.SRGAPC1 Multipurpose binary outputs - flip-flop resets (1)

Table 93:   LD0.SRGAPC1 Multipurpose binary outputs - flip-flop resets (1)

IEC 61850 name	SA name	Description	Type
LD0.SRGAPC1			
.Rs1.ctlVal	-	Reset flip-flop 1	On
.Rs2.ctlVal	-	Reset flip-flop 2	On
Table continues on next page			

IEC 61850 name	SA name	Description	Type
.Rs3.ctlVal	-	Reset flip-flop 3	On
.Rs4.ctlVal	-	Reset flip-flop 4	On
.Rs5.ctlVal	-	Reset flip-flop 5	On
.Rs6.ctlVal	-	Reset flip-flop 6	On
.Rs7.ctlVal	-	Reset flip-flop 7	On
.Rs8.ctlVal	-	Reset flip-flop 8	On

2.4.6.4 LD0.SRGAPC2 Multipurpose binary outputs - flip-flop resets (2)

Table 94: LD0.SRGAPC2 Multipurpose binary outputs - flip-flop resets (2)

IEC 61850 name	SA name	Description	Type
LD0.SRGAPC2			
.Rs1.ctlVal	-	Reset flip-flop 1	On
.Rs2.ctlVal	-	Reset flip-flop 2	On
.Rs3.ctlVal	-	Reset flip-flop 3	On
.Rs4.ctlVal	-	Reset flip-flop 4	On
.Rs5.ctlVal	-	Reset flip-flop 5	On
.Rs6.ctlVal	-	Reset flip-flop 6	On
.Rs7.ctlVal	-	Reset flip-flop 7	On
.Rs8.ctlVal	-	Reset flip-flop 8	On

2.5 Analog inputs

Table 95: Explanations of the analog input table columns

Column name	Description
IEC 61850 name	Original IED data object identification. Described in the IEC 61850 format as Logical Device.Logical Node and thereafter .Data Object.Data Attribute. Logical Node is the same as the application function block name.
SA name	The signal may have a defined label that is visible for example in ACT.
Description	Short description of the signal. See the application function block documentation for more details.
Values	The value range of the original IEC 61850 data. Scaling is needed to convert floating point data into DNP3 integer values.
S	Scaling type selected as default. Default "R" means ratio scaling. See the DNP communication protocol manual for details.
Arg 1, 2, 3, 4	Scaling argument values as default. When ratio scaling is selected, the four values correspond to min value in, max value in, min value out, and max value out. See the DNP communication protocol manual for details.

2.5.1 System functions

2.5.1.1 CTRL.LLN0 Local remote station off

Table 96:   CTRL.LLN0 Local remote station off

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.LLN0					
.LocRem.stVal	-	Off=0; Loc=1; Rem=2; Station=3	0…3	R	0,3,0,3

2.5.1.2 LD0.LPHD1 System values

Table 97:   LD0.LPHD1 System values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.LPHD1					
.NumCmpChg.stVal	-	Num.of comp. changes	0…65535	R	0,65535,0,65535
.NumPwrUp.stVal	-	Num.of power ups	0…65535	R	0,65535,0,65535
.PhyHealth1.stVal	Warning	Warning code	0…65535	R	0,65535,0,65535
.PhyHealth2.stVal	Internal Fault	Internal fault code	0…65535	R	0,65535,0,65535
.WacTrg.stVal	-	Num.of watchdog resets	0…65535	R	0,65535,0,65535
.WrmStr.stVal	-	Num.of warm starts	0…65535	R	0,65535,0,65535

2.5.1.3 LD0.DNPGGIO1 Active parameter setting group

Table 98:   LD0.DNPGGIO1 Active parameter setting group

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.DNPGGIO1					
.ActSG.stVal	-	Active setting group	1…6	R	1,6,1,6

2.5.1.4 LD0.LEDGGIO1 LHMI LED indications (3 states)

Table 99:   LD0.LEDGGIO1 LHMI LED indications (3 states)

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.LEDGGIO1					
.ISCSO1.stVal	-	LED 1 state	0/1/3=Off/Ok/Alarm	R	0,3,0,3
.ISCSO2.stVal	-	LED 2 state	0/1/3=Off/Ok/Alarm	R	0,3,0,3
.ISCSO3.stVal	-	LED 3 state	0/1/3=Off/Ok/Alarm	R	0,3,0,3
.ISCSO4.stVal	-	LED 4 state	0/1/3=Off/Ok/Alarm	R	0,3,0,3
Table continues on next page					

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
.ISCSO5.stVal	-	LED 5 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO6.stVal	-	LED 6 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO7.stVal	-	LED 7 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO8.stVal	-	LED 8 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO9.stVal	-	LED 9 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO10.stVal	-	LED 10 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3
.ISCSO11.stVal	-	LED 11 state	0/1/3=Off/Ok/ Alarm	R	0,3,0,3

2.5.2 Switchgear functions

2.5.2.1 CTRL.CBCSWI1 CB 4-pole (2 bit) position value

Table 100: CTRL.CBCSWI1 CB 4-pole (2 bit) position value

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.CBCSWI1					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.2 CTRL.DCSXSWI1 Disconnector 1, 4-pole (2 bit) position values

Table 101: CTRL.DCSXSWI1 Disconnector 1, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.DCSXSWI1					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.3 CTRL.DCSXSWI2 Disconnector 2, 4-pole (2 bit) position values

Table 102: CTRL.DCSXSWI2 Disconnector 2, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.DCSXSWI2					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.4 CTRL.DCSXSWI3 Disconnector 3, 4-pole (2 bit) position values

Table 103: CTRL.DCSXSWI3 Disconnector 3, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.DCSXSWI3					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.5 CTRL.DCXSWI1 Controllable disconnector 1, 4-pole (2 bit) position values

Table 104: CTRL.DCXSWI1 Controllable disconnector 1, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.DCXSWI1					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.6 CTRL.DCXSWI2 Controllable disconnector 2, 4-pole (2 bit) position values

Table 105: CTRL.DCXSWI2 Controllable disconnector 2, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.DCXSWI2					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.7 CTRL.ESSXSWI1 Earth switch 1, 4-pole (2 bit) position values

Table 106: CTRL.ESSXSWI1 Earth switch 1, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.ESSXSWI1					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.8 CTRL.ESSXSWI2 Earth switch 2, 4-pole (2 bit) position values

Table 107: CTRL.ESSXSWI2 Earth switch 2, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.ESSXSWI2					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.2.9 CTRL.ESXSWI1 Controllable earth switch 1, 4-pole (2 bit) position values

Table 108:   CTRL.ESXSWI1 Controllable earth switch 1, 4-pole (2 bit) position values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
CTRL.ESXSWI1					
.Pos.stVal	POSITION	Intermediate=0; Off=1; On=2; Bad=3	0…3	R	0,3,0,3

2.5.3 Metering and measurand functions

2.5.3.1 LD0.CMMXU1 Phase currents (1)

Table 109:   LD0.CMMXU1 Phase currents (1)

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.CMMXU1		Phase-to-ground current			
.A.phsA.instCVal.mag	I_INST_A	-phsA magnitude	0.00..40.0 [xIn]	R	0,40,0,4000
.A.phsB.instCVal.mag	I_INST_B	-phsB magnitude	0.00..40.0 [xIn]	R	0,40,0,4000
.A.phsC.instCVal.mag	I_INST_C	-phsC magnitude	0.00..40.0 [xIn]	R	0,40,0,4000

2.5.3.2 LD0.RESCMMXU1 Residual current (1)

Table 110:   LD0.RESCMMXU1 Residual current (1)

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.RESCMMXU1					
.A.res.instCVal.mag	I0_INST	Residual current	0.00..40.0 [xIn]	R	0,40,0,4000

2.5.3.3 LD0.CSMSQI1 Sequence of currents

Table 111:   LD0.CSMSQI1 Sequence of currents

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.CSMSQI1		Sequence of currents			
.SeqA.c1.instCVal.mag	I1_INST	-Positive magnitude	0.00..40.0 [xIn]	R	0,40,0,4000
.SeqA.c2.instCVal.mag	I2_INST	-Negative magnitude	0.00..40.0 [xIn]	R	0,40,0,4000
.SeqA.c3.instCVal.mag	I3_INST	-Zero magnitude	0.00..40.0 [xIn]	R	0,40,0,4000

2.5.3.4   LD0.VMMXU1 Voltage measurement

Table 112:   *LD0.VMMXU1 Voltage measurement*

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.VMMXU1.PhV		Phase-to-ground voltage			
.phsA.cVal.mag	U_DB_A	-phsA magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.phsB.cVal.mag	U_DB_B	-phsB magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.phsC.cVal.mag	U_DB_C	-phsC magnitude	0.00…4.00 [xUn]	R	0,4,0,400
LD0.VMMXU1.PPV		Phase-to-phase voltage			
.phsAB.cVal.mag	U_DB_AB	-phsAB magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.phsBC.cVal.mag	U_DB_BC	-phsBC magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.phsCA.cVal.mag	U_DB_CA	-phsCA magnitude	0.00…4.00 [xUn]	R	0,4,0,400

2.5.3.5   LD0.RESVMMXU1 Residual voltage (1)

Table 113:   *LD0.RESVMMXU1 Residual voltage (1)*

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.RESVMMXU1					
.PhV.res.instCVal.mag	U0_INST	Residual voltage	0.00..4.00 [xUn]	R	0,4,0,400

2.5.3.6   LD0.VSMSQI1 Sequence of voltage measurement

Table 114:   *LD0.VSMSQI1 Sequence of voltage measurement*

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.VSMSQI1		Sequence of voltages			
.SeqV.c1.cVal.mag	I1_DB	-Positive magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.SeqV.c2.cVal.mag	I2_DB	-Negative magnitude	0.00…4.00 [xUn]	R	0,4,0,400
.SeqV.c3.cVal.mag	I3_DB	-Zero magnitude	0.00…4.00 [xUn]	R	0,4,0,400

2.5.3.7 LD0.PEMMTR1 Power measurement and accumulated power values

Table 115:   LD0.PEMMTR1 Power measurement and accumulated power values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.PEMMTR1					
.DmdVArh.actVal	ER_RV_ACM	Forward reactive energy	0…1e10	R	0,1E10,0,1E10
.DmdWh.actVal	EA_RV_ACM	Forward active energy	0…1e10	R	0,1E10,0,1E10
.SupVArh.actVal	ER_FWD_ACM	Reverse reactive energy	0…1e10	R	0,1E10,0,1E10
.SupWh.actVal	EA_FWD_ACM	Reverse active energy	0…1e10	R	0,1E10,0,1E10
.TotPF.instMag	PF_INST	Average power factor	-1…1	R	-1,1,-100,100
.TotW.instMag	P_INST	Active power	0…999999	R	0,999999,0,999999
.TotVA.instMag	S_INST	Apparent power	0…999999	R	0,999999,0,999999
.TotVAr.instMag	Q_INST	Reactive power	0…999999	R	0,999999,0,999999

2.5.3.8 LD0.FMMXU1 Frequency measurement

Table 116:   LD0.FMMXU1 Frequency measurement

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.FMMXU1					
.Hz.mag	-	Frequency value	35…75 [Hz]	R	35,75,3500,7500

2.5.3.9 LD0.HAEFMHAI1 Current harmonics

Table 117:   LD0.HAEFMHAI1 Current harmonics

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.HAEFMHAI					
.HRmsA.res.cVal.mag	-	Current harmonics	0…250 [A]	R	0,250,0,250

2.5.4 Protection functions

2.5.4.1 LD0.T1PTTR1 Temperature protection values (1)

Table 118:   LD0.T1PTTR1 Temperature protection values (1)

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.T1PTTR1					
.Tmp.mag	-	Object temperature	-100…9999.9	R	-100,9999.9.0,-1000,99999
.TmpRl.mag	-	Relative temperature	0…99.9	R	0,99.9,0,999

2.5.5 Protection-related functions

2.5.5.1 LD0.DARREC1 Autoreclosing values

Table 119:   LD0.DARREC1 Autoreclosing values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.DARREC1					
.AutoRecSt.stVal	STATUS	Autorec. status	-2…4	R	-2,4,-2,4
.ShotPntr.stVal	SHOT_PTR	Shot pointer value	0…65535	R	0,65535,0,65535

2.5.5.2 DR.RDRE1 Disturbance recorder values

Table 120:   DR.RDRE1 Disturbance recorder values

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
DR.RDRE1					
.FltNum.stVal	-	Number of recordings	0…65535	R	0,65535,0,65535
.MemUsed.stVal	-	Rec. memory used	0…100 [%]	R	0,100,0,100

2.5.5.3 LD0.SECRSYN1 Synchrocheck line and bus state

Table 121:   LD0.SECRSYN1 Synchrocheck line and bus state

IEC 61850 name	SA name	Description	Values	S	Arg 1,2,3,4
LD0.SECRSYN1					
.EnSt.stVal	-	Energization state	0…4	R	0,4,0,4

Section 3   DNP3 protocol implementation

3.1   DNP3 device profile

The following table provides a device profile document in the standard format defined in the DNP3 Subset Definitions Document. In the DNP3 Subset Definitions Document it is referred to as a document, although it is in fact a table and only a component of a total interoperability guide. The table, in combination with the Implementation table and the point list tables, provides a complete configuration/interoperability guide for communicating with a device.

Table 122:   Device profile document

DNP3 device profile document		
Vendor name:	ABB Oy	
Device name:	REF615	
Highest DNP level supported:	Device function:	
For requests: Level 2+	○ Master	
For responses: Level 2+	● Slave	
Notable objects, functions, and/or qualifiers supported in addition to the highest DNP levels supported (the complete list is described in the attached table): For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported. Static object requests sent with qualifiers 07, or 08, will be responded with qualifiers 00 or 01. 16-bit and 32-bit Analog Change Events with Time may be requested.		
Maximum data link frame size (octets):	Maximum application fragment size (octets):	
Transmitted: 292	Transmitted: Configurable (256...2048)	
Received: 292	Received: 2048	
Maximum data link re-tries:	Maximum application layer re-tries:	
○ None	● None	
○ Fixed	○ Configurable	
● Configurable (0...65535)		
Requires data link layer confirmation:		
○ Never		
○ Always		
○ Sometimes		
● Configurable as: "Never", "Only for multi-frame messages", or "Always"		
Requires application layer confirmation:		
○ Never		
○ Always		
○ When reporting event data (slave devices only)		
○ When sending multi-fragment responses (slave devices only)		
Table continues on next page		

DNP3 device profile document

	○	Sometimes					
	●	Configurable as: "Only when reporting event data", or "When reporting event data or multi-fragment messages"					

Timeouts while waiting for:

Data link confirm:	○	None	○	Fixed at ____	○	Variable	●	Configurable
Complete appl. fragment:	●	None	○	Fixed at ____	○	Variable	○	Configurable
Application confirm:	○	None	○	Fixed at ____	○	Variable	●	Configurable
Complete appl. response:	●	None	○	Fixed at ____	○	Variable	○	Configurable

Others:	Select/Operate Arm timeout, configurable in DNP setting parameters. Regrdless of the select timeout in the HMI. Need time interval, configurable Unsolicited notification delay, configurable Unsolicited response retry delay, configurable Unsolicited offline Interval, configurable

Sends/Executes Control Operations:

WRITE binary outputs	●	Never	○	Always	○	Sometimes	○	Configurable
SELECT/ OPERATE	○	Never	○	Always	○	Sometimes	●	Configurable
DIRECT OPERATE	○	Never	○	Always	○	Sometimes	●	Configurable
DIRECT OPERATE - NO ACK	○	Never	○	Always	○	Sometimes	●	Configurable
Count > 1 (Count > 1 is accepted but ignored)	●	Never	○	Always	○	Sometimes	○	Configurable
Pulse on	●	Never	○	Always	○	Sometimes	○	Configurable
Pulse off	●	Never	○	Always	○	Sometimes	○	Configurable
Latch on	○	Never	●	Always	○	Sometimes	○	Configurable
Latch off	○	Never	●	Always	○	Sometimes	○	Configurable
Queue	●	Never	○	Always	○	Sometimes	○	Configurable
Clear queue	●	Never	○	Always	○	Sometimes	○	Configurable

The circuit breaker control model is configurable for either direct or SBO mode in the circuit breaker settings. If the operation mode does not match the CROB, the returned CROB status is hardware error (4). All other control points may be controlled by either direct or SBO controls.

Reports binary input change events when no specific variation requested:		Reports time-tagged binary input change events when no specific variation requested:	
○	Never	○	Never
○	Only when time-tagged	○	Binary input change with time
○	Only non-time-tagged	○	Binary input change with relative time
●	Configurable to send one or the other	●	Configurable

Sends unsolicited responses:		Sends static data in unsolicited responses:	
●	Never	●	Never

Table continues on next page

DNP3 device profile document			
○ Configurable		○ When device restarts	
○ Only certain objects		○ When status flags change	
○ Sometimes (attach explanation)			
○ ENABLE/DISABLE UNSOLICITED function codes supported		No other options are permitted.	
Default counter object/variation:		Counters roll over at:	
● No counters reported		● No counters reported	
○ Configurable		○ Configurable (attach explanation)	
○ Default object Default variation:		○ 16 bits	
○ Point-by-point list attached		○ 32 bits	
		○ Other value: _____	
		○ Point-by-point list attached	
Sends multi-fragment responses:			
● Yes			
○ No			
○ Configurable			
Sequential file transfer support:			
Append file mode	○ Yes	● No	
Custom status code strings	○ Yes	● No	
Permissions field	○ Yes	● No	
File events assigned to class	○ Yes	● No	
File events send immediately	○ Yes	● No	
Multiple blocks in a fragment	○ Yes	● No	
Max number of files open	0		
● = Selected, ○ = Not selected			

3.2   DNP3 implementation table

The following table identifies which object variations, function codes and qualifiers the IED supports in both request messages and response messages. For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07 or 08 are responded with qualifiers 00 or 01. Requests sent with qualifiers 17 or 28 are responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

Table 123:   Implementation table

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object number	Variation number	Description	Function codes (dec)	Qualifier codes (hex)	Function codes (dec)	Qualifier codes (hex)
1	0	Binary input – any variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
1	1 (default) [1]	Binary input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
1	2	Binary input with status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
2	0	Binary input change – any variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1	Binary input change without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	2 [1]	Binary input change with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
2	3	Binary input change with relative time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
10	0	Binary output status – any variation	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
10	1	Binary output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
12	1	Control relay output block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	17, 28 (index)	129 (response)	echo of request
30	0	Analog input - any variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
30	1	32-bit analog input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]

Table continues on next page

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
30	2 (default) [1]	16-bit analog input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
30	3	32-bit analog input without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
30	4	16-bit analog input without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
32	0	Analog change event – any variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1	32-bit analog change event without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	2	16-bit analog change event without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	3	32-bit analog change event with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
32	4 (default) [1]	16-bit analog change event with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
50	0	Time and date				
50	1 (default) [1]	Time and date	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07 (limited qty = 1l) 08 (limited qty)	129 (response)	00, 01 (start-stop) 17, 28 (index) [2]
			2 (write)	07 (limited qty = 1l)		
50	3	Time and date last recorded time	2 (write)	07 (limited qty)		
51	1	Time and date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
51	2	Unsynchronized time and date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
Table continues on next page						

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
52	2	Time delay fine			129 (response)	07 (limited qty) (qty = 1)
60	0	Not defined				
60	1	Class 0 data	1 (read)	06 (no range, or all)		
60	2	Class 1 data	1 (read)	06 (no range, or all)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	07, 08 (limited qty) 06 (no range, or all)		
60	3	Class 2 data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
60	4	Class 3 data	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab. unsol.) 22 (assign class)	06 (no range, or all)		
80	1	Internal indications	1 (read)	00, 01 (start-stop)		
			2 (write) [3]	00 (start-stop) index=7		
No object (function code only)			13 (cold restart)		[4]	
No object (function code only)			14 (warm restart)		[4]	
No object (function code only)			23 (delay meas.)			
No object (function code only)			24 (record current time)			

1) A default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans. Default variations are configurable; however, default settings for the configuration parameters are indicated in the table above.
2) For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)
3) Writes of internal indications are only supported for index 7 (Restart IIN1-7)
4) Cold and warm restarts return an application layer acknowledge, but no restart action is taken.

Section 4   Glossary

AFL	Application function block library
CROB	Control relay output block
CTO	Common time of occurrence. The time and date CTO object is an information object that represents the absolute time of day.
DNP3	A distributed network protocol originally developed by Westronic. The DNP3 Users Group has the ownership of the protocol and assumes responsibility for its evolution.
EMC	Electromagnetic compatibility
HMI	Human-machine interface
IEC	International Electrotechnical Commission
IEC 61850	International standard for substation communication and modeling
IED	Intelligent electronic device
IET600	Integrated Engineering Toolbox in PCM600
LHMI	Local human-machine interface
PCM600	Protection and Control IED Manager
SBO	Select-before-operate

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