



Relion® 615 series

Voltage Protection and Control REU615 DNP3 Point List Manual



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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 IED 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

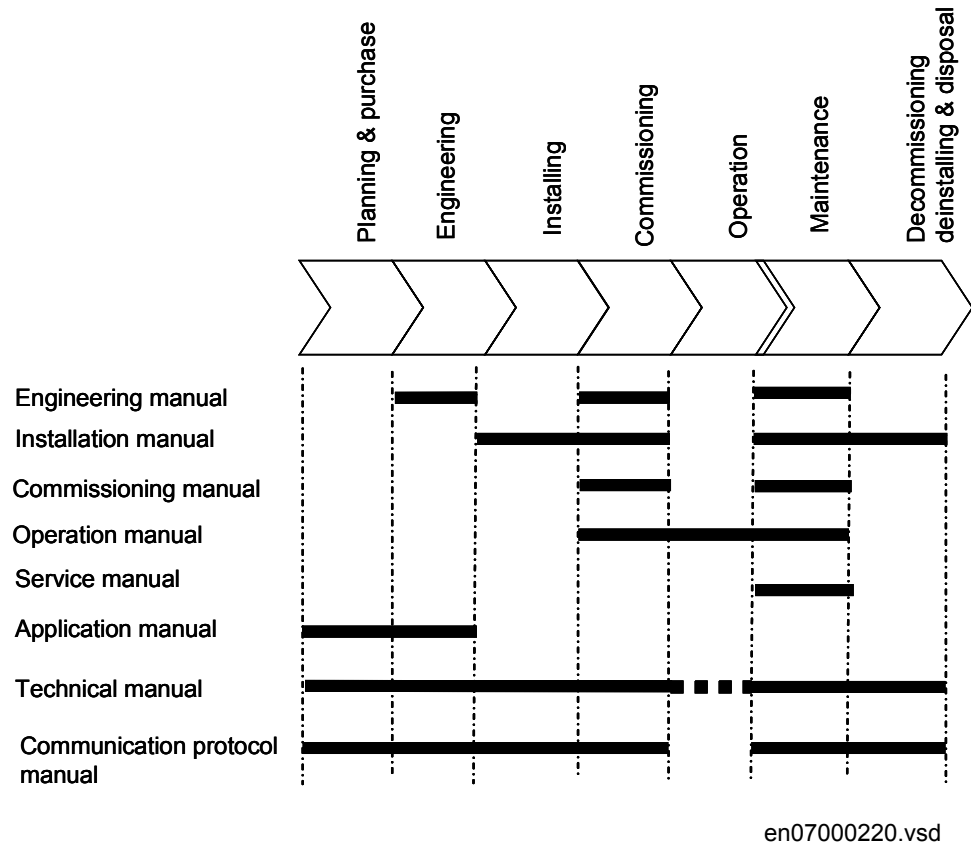


Figure 1: The intended use of manuals in different lifecycles

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 commissioning manual contains instructions on how to commission the IED. The manual can also be used by system engineers and maintenance personnel for assistance during the testing phase. The manual provides procedures for checking of external circuitry and energizing the IED, parameter setting and configuration as

well as verifying settings by secondary injection. The manual describes the process of testing an IED in a substation which is not in service. The chapters are organized in chronological order in which the IED should be commissioned.

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 service manual contains instructions on how to service and maintain the IED. The manual also provides procedures for de-energizing, de-commissioning and disposal of the IED.

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 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.

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

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.



Some of the manuals are not available yet.

1.3.2

Document revision history

Document revision/date	Product version	History
A/2010-06-11	3.0	First release



Download the latest documents from the ABB web site <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 Safety indication 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 to 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 should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.4.2 Manual conventions

Conventions used in IED manuals. 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, for example:
To navigate between the options, use  and .
- HMI menu paths are presented in bold, for example:
Select **Main menu/Settings**.
- LHMI messages are shown in Courier font, for example:
To save the changes in non-volatile memory, select `Yes` and press .
- Parameter names are shown in italics, for example:
The function can be enabled and disabled with the *Operation* setting.
- Parameter values are indicated with quotation marks, for example:

The corresponding parameter values are "On" and "Off".

- IED input/output messages and monitored data names are shown in Courier font, for example:

When the function starts, the `START` output is set to `TRUE`.

1.4.3

Functions, codes and symbols

Table 1: *REU615 Functions, codes and symbols*

Function	IEC 61850	IEC 60617	IEC-ANSI
Protection			
Three-phase non-directional overcurrent protection, low stage, instance 1	PHLPTOC1	3I> (1)	51P-1 (1)
Three-phase non-directional overcurrent protection, high stage, instance 1	PHHPTOC1	3I>> (1)	51P-2 (1)
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	PHIPTOC1	3I>>> (1)	50P/51P (1)
Residual overvoltage protection, instance 1	ROVPTOV1	Uo> (1)	59G (1)
Residual overvoltage protection, instance 2	ROVPTOV2	Uo> (2)	59G (2)
Residual overvoltage protection, instance 3	ROVPTOV3	Uo> (3)	59G (3)
Three-phase undervoltage protection, instance 1	PHPTUV1	3U< (1)	27 (1)
Three-phase undervoltage protection, instance 2	PHPTUV2	3U< (2)	27 (2)
Three-phase undervoltage protection, instance 3	PHPTUV3	3U< (3)	27 (3)
Three-phase overvoltage protection, instance 1	PHPTOV1	3U> (1)	59 (1)
Three-phase overvoltage protection, instance 2	PHPTOV2	3U> (2)	59 (2)
Three-phase overvoltage protection, instance 3	PHPTOV3	3U> (3)	59 (3)
Positive-sequence undervoltage protection, instance 1	PSPTUV1	U1< (1)	47U+ (1)
Positive-sequence undervoltage protection, instance 2	PSPTUV2	U1< (2)	47U+ (2)
Negative-sequence overvoltage protection, instance 1	NSPTOV1	U2> (1)	47O- (1)
Negative-sequence overvoltage protection, instance 2	NSPTOV2	U2> (2)	47O- (2)
Frequency protection, instance 1	FRPFRQ1	f>/f<,df/dt (1)	81 (1)
Frequency protection, instance 2	FRPFRQ2	f>/f<,df/dt (2)	81 (2)
Frequency protection, instance 3	FRPFRQ3	f>/f<,df/dt (3)	81 (3)
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Frequency protection, instance 4	FRPFRQ4	f>/f<,df/dt (4)	81 (4)
Frequency protection, instance 5	FRPFRQ5	f>/f<,df/dt (5)	81 (5)
Frequency protection, instance 6	FRPFRQ6	f>/f<,df/dt (6)	81 (6)
Three-phase thermal overload protection for power transformers, two time constants	T2PTTR1	3lth>T	49T
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)
Arc protection, instance 1	ARCSARC1	ARC (1)	50L/50NL (1)
Arc protection, instance 2	ARCSARC2	ARC (2)	50L/50NL (2)
Arc protection, instance 3	ARCSARC3	ARC (3)	50L/50NL (3)
Multi-purpose protection, instance 1 ¹⁾	MAPGAPC1	MAP (1)	MAP (1)
Multi-purpose protection, instance 2 ¹⁾	MAPGAPC2	MAP (2)	MAP (2)
Multi-purpose protection, instance 3 ¹⁾	MAPGAPC3	MAP (3)	MAP (3)
Load shedding and restoration, instance 1	LSHDPFRQ1	UFLS/R (1)	81LSH (1)
Load shedding and restoration, instance 2	LSHDPFRQ2	UFLS/R (2)	81LSH (2)
Load shedding and restoration, instance 3	LSHDPFRQ3	UFLS/R (3)	81LSH (3)
Load shedding and restoration, instance 4	LSHDPFRQ4	UFLS/R (4)	81LSH (4)
Load shedding and restoration, instance 5	LSHDPFRQ5	UFLS/R (5)	81LSH (5)
Control			
Circuit-breaker control	CBXCBR1	I <-> O CB	I <-> O CB
Disconnecter position indication, instance 1	DCSXSWI1	I <-> O DC (1)	I <-> O DC (1)
Disconnecter position indication, instance 2	DCSXSWI2	I <-> O DC (2)	I <-> O DC (2)
Disconnecter position indication, instance 3	DCSXSWI3	I <-> O DC (3)	I <-> O DC (3)
Earthing switch indication	ESSXSWI1	I <-> O ES	I <-> O ES
Tap changer position indication	TPOSSLTC1	TPOSM	84M
Tap changer control with voltage regulator	OLATCC1	COLTC	90V
Synchronism and energizing check	SECRSYN1	SYNC	25
Condition monitoring			
Trip circuit supervision, instance 1	TCSSCBR1	TCS (1)	TCM (1)
Trip circuit supervision, instance 2	TCSSCBR2	TCS (2)	TCM (2)
Current circuit supervision	CCRDIF1	MCS 3I	MCS 3I
Fuse failure supervision	SEQRUFUF1	FUSEF	60
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Measurement			
Disturbance recorder	RDRE1	-	-
Three-phase current measurement, instance 1	CMMXU1	3I	3I
Sequence current measurement	CSMSQI1	I1, I2, I0	I1, I2, I0
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, including power factor	PEMMXU1	P, E	P, E
RTD/mA measurement	XRGGIO130	X130 (RTD)	X130 (RTD)
Frequency measurement	FMMXU1	f	f

1) Multi-purpose protection is used for, for example, RTD/mA based protection.

Section 2 DNP3 data mappings

2.1 Overview

This document describes the DNP3 data points and structures available in REU615 Ver. 3.0. The data points are unmapped as a default. The point lists describe a superset of all data available through the standard configuration A and B including the optional functionalities. The names of the standard configurations are UE01 and UE02 respectively.

The point tables show all the available DNP3 data points in this IED. The data objects in the point tables are listed in alphabetical order based on the objects' IEC61850 names. The DNP3 points can be freely added, removed, reorganized and reconfigured using PCM600.

As a default, the class assignments are Class 0 and Class 1 for binary inputs and Class 0 and Class 2 for analog inputs. 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 is determined by the IED's ordercode.

2.2 Point list for REU615 Ver.3.0 UE01-02

Table 2: Binary inputs

IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
Arc protection			
LD0.ARCPTRC11.Op.general	ARCSARC1.OPERATE	ARCSARC1, Operate, general	1 = Operate
LD0.ARCPTRC21.Op.general	ARCSARC2.OPERATE	ARCSARC2, Operate, general	1 = Operate
LD0.ARCPTRC31.Op.general	ARCSARC3.OPERATE	ARCSARC3, Operate, general	1 = Operate
LD0.ARCSARC11.FADet.stVal	ARCSARC1.ARC_FLT_DET	ARCSARC1, Remote fault arc detected, stVal	1 = Fault arc detected
LD0.ARCSARC11.InRemFA.stVal	-	ARCSARC1, Fault arc detected, stVal	1 = Fault arc detected
LD0.ARCSARC21.FADet.stVal	ARCSARC2.ARC_FLT_DET	ARCSARC2, Remote fault arc detected, stVal	1 = Fault arc detected
LD0.ARCSARC21.InRemFA.stVal	-	ARCSARC2, Fault arc detected, stVal	1 = Fault arc detected
LD0.ARCSARC31.FADet.stVal	ARCSARC3.ARC_FLT_DET	ARCSARC3, Remote fault arc detected, stVal	1 = Fault arc detected
LD0.ARCSARC31.InRemFA.stVal	-	ARCSARC3, Fault arc detected, stVal	1 = Fault arc detected
Circuit-breaker related signals (CB pos is found in AI)			
CTRL.CBCILO1.EnaCls.stVal	CBXCBR1.ENA_CLOSE	CBXCBR1, ENA_CLOSE, stVal	1 = Close enabled
CTRL.CBCILO1.EnaOpn.stVal	CBXCBR1.ENA_OPEN	CBXCBR1, ENA_OPEN, stVal	1 = Open enabled
CTRL.CBCILO1.IbByPss.stVal	CBXCBR1.ITL_BYPASS	CBXCBR1, ITL_BYPASS, stVal	1 = Interlocking bypassed
CTRL.CBCSW11.Pos.stSeld	CBXCBR1.SELECTED	CBXCBR1, Switch, general, stSeld	1 = CB control selected
CTRL.CBXCBR1.BlkCls.stVal	CBXCBR1.BLK_CLOSE	CBXCBR1, Block closing, stVal	1 = Close blocked
CTRL.CBXCBR1.BlkOpn.stVal	CBXCBR1.BLK_OPEN	CBXCBR1, Block opening, stVal	1 = Open blocked
Circuit-breaker failure protection			
CTRL.CCBRRBF1.OpEx.general	CCBRBF1.TRBU	CCBRBF1, Breaker failure trip (external trip), general	1 = Breaker failure trip
CTRL.CCBRRBF1.OpIn.general	CCBRBF1.TRRET	CCBRBF1, Operate, retrip (internal trip), general	1 = Operate, re-trip
CTRL.CCBRRBF1.Str.general	CCBRBF1.CB_FAULT_AL	CCBRBF1, Delayed CB failure alarm, general	1 = Start, timer running
Current circuit supervision			
CTRL.CCRDIF1.Alm.stVal	CCRDIF1.ALARM	CCRDIF1, Alarm, stVal	1 = Alarm
CTRL.CCRDIF1.Op.general	CCRDIF1.FAIL	CCRDIF1, Detection of current circuit failure, general	1 = Failure
Three-phase current limit supervision			
LD0.CMMXU1.HiAlm.stVal	CMMXU1.HIGH_ALARM	CMMXU1, High alarm, stVal	1 = High alarm
LD0.CMMXU1.HiWrn.stVal	CMMXU1.HIGH_WARN	CMMXU1, High warning, stVal	1 = High warning
LD0.CMMXU1.LoAlm.stVal	CMMXU1.LOW_ALARM	CMMXU1, Low alarm, stVal	1 = Low alarm
LD0.CMMXU1.LoWrn.stVal	CMMXU1.LOW_WARN	CMMXU1, Low warning, stVal	1 = Low warning
Frequency protection (6 stages)			
LD0.FRPTRC1.Str.general	FRPFRQ1.START	FRPFRQ1, Stage 1 start	1 = Start
LD0.FRPTOF1.Op.general	FRPFRQ1.OPR_OFRQ	FRPFRQ1, Operate 1 signal for overfrequency	1 = Operate
LD0.FRPTUF1.Op.general	FRPFRQ1.OPR_UFRQ	FRPFRQ1, Operate 1 signal for underfrequency	1 = Operate
LD0.FRPFRC1.Op.general	FRPFRQ1.OPR_FRG	FRPFRQ1, Operate 1 signal for frequency gradient	1 = Operate
LD0.FRPTRC2.Str.general	FRPFRQ2.START	FRPFRQ2, Stage 2 start	1 = Start
LD0.FRPTOF2.Op.general	FRPFRQ2.OPR_OFRQ	FRPFRQ2, Operate 2 signal for overfrequency	1 = Operate
LD0.FRPTUF2.Op.general	FRPFRQ2.OPR_UFRQ	FRPFRQ2, Operate 2 signal for underfrequency	1 = Operate
LD0.FRPFRC2.Op.general	FRPFRQ2.OPR_FRG	FRPFRQ2, Operate 2 signal for frequency gradient	1 = Operate

Table continues on next page

IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
LD0.FRPTRC3.Str.general	FRPFRQ3_START	FRPFRQ3, Stage 3 start	1 = Start
LD0.FRPTOF3.Op.general	FRPFRQ3_OPR_OFRQ	FRPFRQ3, Operate 3 signal for overfrequency	1 = Operate
LD0.FRPTUF3.Op.general	FRPFRQ3_OPR_UFRQ	FRPFRQ3, Operate 3 signal for underfrequency	1 = Operate
LD0.FRPFRC3.Op.general	FRPFRQ3_OPR_FRG	FRPFRQ3, Operate 3 signal for frequency gradient	1 = Operate
LD0.FRPTRC4.Str.general	FRPFRQ4_START	FRPFRQ3, Stage 4 start	1 = Start
LD0.FRPTOF4.Op.general	FRPFRQ4_OPR_OFRQ	FRPFRQ3, Operate 4 signal for overfrequency	1 = Operate
LD0.FRPTUF4.Op.general	FRPFRQ4_OPR_UFRQ	FRPFRQ3, Operate 4 signal for underfrequency	1 = Operate
LD0.FRPFRC4.Op.general	FRPFRQ4_OPR_FRG	FRPFRQ3, Operate 4 signal for frequency gradient	1 = Operate
LD0.FRPTRC5.Str.general	FRPFRQ5_START	FRPFRQ3, Stage 5 start	1 = Start
LD0.FRPTOF5.Op.general	FRPFRQ5_OPR_OFRQ	FRPFRQ3, Operate 5 signal for overfrequency	1 = Operate
LD0.FRPTUF5.Op.general	FRPFRQ5_OPR_UFRQ	FRPFRQ3, Operate 5 signal for underfrequency	1 = Operate
LD0.FRPFRC5.Op.general	FRPFRQ5_OPR_FRG	FRPFRQ3, Operate 5 signal for frequency gradient	1 = Operate
LD0.FRPTRC6.Str.general	FRPFRQ6_START	FRPFRQ3, Stage 6 start	1 = Start
LD0.FRPTOF6.Op.general	FRPFRQ6_OPR_OFRQ	FRPFRQ3, Operate 6 signal for overfrequency	1 = Operate
LD0.FRPTUF6.Op.general	FRPFRQ6_OPR_UFRQ	FRPFRQ3, Operate 6 signal for underfrequency	1 = Operate
LD0.FRPFRC6.Op.general	FRPFRQ6_OPR_FRG	FRPFRQ3, Operate 6 signal for frequency gradient	1 = Operate
LED states			
LD0.LEDGGIO1.SPCSO1.stVal	-	LED States, LED 1, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO2.stVal	-	LED States, LED 2, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO3.stVal	-	LED States, LED 3, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO4.stVal	-	LED States, LED 4, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO5.stVal	-	LED States, LED 5, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO6.stVal	-	LED States, LED 6, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO7.stVal	-	LED States, LED 7, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO8.stVal	-	LED States, LED 8, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO9.stVal	-	LED States, LED 9, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO10.stVal	-	LED States, LED 10, stVal	1 = ON, 0 = OFF
LD0.LEDGGIO1.SPCSO11.stVal	-	LED States, LED 11, stVal	1 = ON, 0 = OFF
Global conditioning			
LD0.LEDPTRC1.Op.general	-	Global conditioning, Operate, general	1 = Operate
LD0.LEDPTRC1.Str.general	-	Global conditioning, Start, general	1 = Start
Load shedding, 5 stages			
LD0.LSHDPTRC1.Op.general	LSHDPFRQ1.OPERATE	LSHDPFRQ1, Operate, general	1 = Operate
LD0.LSHDPTRC1.Str.general	LSHDPFRQ1.START	LSHDPFRQ1, Start, general	1 = Start
LD0.LSHDPTRC1.RestLodOp.general	LSHDPFRQ1.RESTORE	LSHDPFRQ1, Restore the load, general	1 = Restore load
LD0.LSHDPTRC1.RestLodStr.general	LSHDPFRQ1.ST_REST	LSHDPFRQ1, Start of restore, general	1 = Start of restore
LD0.LSHDPTRC2.Op.general	LSHDPFRQ2.OPERATE	LSHDPFRQ2, Operate, general	1 = Operate
LD0.LSHDPTRC2.Str.general	LSHDPFRQ2.START	LSHDPFRQ2, Start, general	1 = Start

Table continues on next page

IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
LD0.LSHDPTRC2.RestLodOp.gener al	LSHDPFRQ2.RESTORE	LSHDPFRQ2, Restore the load, general	1 = Restore load
LD0.LSHDPTRC2.RestLodStr.gener al	LSHDPFRQ2.ST_REST	LSHDPFRQ2, Start of restore, general	1 = Start of restore
LD0.LSHDPTRC3.Op.general	LSHDPFRQ3.OPERATE	LSHDPFRQ3, Operate, general	1 = Operate
LD0.LSHDPTRC3.Str.general	LSHDPFRQ3.START	LSHDPFRQ3, Start, general	1 = Start
LD0.LSHDPTRC3.RestLodOp.gener al	LSHDPFRQ3.RESTORE	LSHDPFRQ3, Restore the load, general	1 = Restore load
LD0.LSHDPTRC3.RestLodStr.gener al	LSHDPFRQ3.ST_REST	LSHDPFRQ3, Start of restore, general	1 = Start of restore
LD0.LSHDPTRC4.Op.general	LSHDPFRQ4.OPERATE	LSHDPFRQ4, Operate, general	1 = Operate
LD0.LSHDPTRC4.Str.general	LSHDPFRQ4.START	LSHDPFRQ4, Start, general	1 = Start
LD0.LSHDPTRC4.RestLodOp.gener al	LSHDPFRQ4.RESTORE	LSHDPFRQ4, Restore the load, general	1 = Restore load
LD0.LSHDPTRC4.RestLodStr.gener al	LSHDPFRQ4.ST_REST	LSHDPFRQ4, Start of restore, general	1 = Start of restore
LD0.LSHDPTRC5.Op.general	LSHDPFRQ5.OPERATE	LSHDPFRQ5, Operate, general	1 = Operate
LD0.LSHDPTRC5.Str.general	LSHDPFRQ5.START	LSHDPFRQ5, Start, general	1 = Start
LD0.LSHDPTRC5.RestLodOp.gener al	LSHDPFRQ5.RESTORE	LSHDPFRQ5, Restore the load, general	1 = Restore load
LD0.LSHDPTRC5.RestLodStr.gener al	LSHDPFRQ5.ST_REST	LSHDPFRQ5, Start of restore, general	1 = Start of restore
CTRL.LLN0.Loc.stVal	-	Local/remote (also present in IIN)	1 = Local
		Control LLN0, Local / remote, stVal	
		Multipurpose analog protection functions (3 stages)	
LD0.MAGAPC1.Op.general	MAPGAPC1_OPERATE	MAPGAPC1, Operate, general	1 = Operate
LD0.MAGAPC1.Str.general	MAPGAPC1_START	MAPGAPC1, Start, general	1 = Start
LD0.MAGAPC2.Op.general	MAPGAPC2_OPERATE	MAPGAPC2, Operate, general	1 = Operate
LD0.MAGAPC2.Str.general	MAPGAPC2_START	MAPGAPC2, Start, general	1 = Start
LD0.MAGAPC3.Op.general	MAPGAPC3_OPERATE	MAPGAPC3, Operate, general	1 = Operate
LD0.MAGAPC3.Str.general	MAPGAPC3_START	MAPGAPC3, Start, general	1 = Start
		Multipurpose inputs (All variants)	
LD0.MVGAPC1.Q1.stVal	-	MVGAPC1, Input 1 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q2.stVal	-	MVGAPC1, Input 2 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q3.stVal	-	MVGAPC1, Input 3 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q4.stVal	-	MVGAPC1, Input 4 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q5.stVal	-	MVGAPC1, Input 5 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q6.stVal	-	MVGAPC1, Input 6 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q7.stVal	-	MVGAPC1, Input 7 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q8.stVal	-	MVGAPC1, Input 8 [stVal]	0 = Input OFF, 1 = Input ON
		Negative-sequence overvoltage protection (2 stages)	
LD0.NSPTOV1.Op.general	NSPTOV1_OPERATE	NSPTOV1, Operate, general	1 = Operate

IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
LD0.NSPTOV1.Str.general	NSPTOV1.START	NSPTOV1, Start, general	1 = Start
LD0.NSPTOV2.Op.general	NSPTOV2.OPERATE	NSPTOV2, Operate, general	1 = Operate
LD0.NSPTOV2.Str.general	NSPTOV2.START	NSPTOV2, Start, general	1 = Start
On-Load tap changer controller			
LD0.OLATCC1.TapOpR.stVal	OLATCC1.RAISE_OW_N	OLATCC1, Raise command, stVal	1 = Raise command
LD0.OLATCC1.TapOpL.stVal	OLATCC1.LOWER_OW_N	OLATCC1, Lower command, stVal	1 = Lower command
LD0.OLATCC1.TapOpErr.stVal	OLATCC1.ALARM	OLATCC1, Alarm, stVal	1 = Alarm
LD0.OLATCC1.EndPosR.stVal	-	OLATCC1, Block raise	1=Raise
LD0.OLATCC1.EndPosL.stVal	-	OLATCC1, Block lower	1=Lower
LD0.OLATCC1.LTCBkAhI.stVal	OLATCC1.BLKD_I_LOD	OLATCC1, Over current blocking	1=Blocking
LD0.OLATCC1.LTCBkVLo.stVal	OLATCC1.BLKD_U_UN	OLATCC1, Under voltage blocking	1=Blocking
LD0.OLATCC1.LTCRnbnk.stVal	OLATCC1.RNBK_U_OV	OLATCC1, Raise voltage runback	1=Blocking
LD0.OLATCC1.LTCBkCrA.stVal	OLATCC1.BLKD_I_CIR	OLATCC1, High circulating current blocking	1=Blocking
LD0.OLATCC1.LTCBkSt.stVal	OLATCC1.BLKD_LTCBLK	OLATCC1, External blocking	1=Blocking
LD0.OLATCC1.ErrParTra.stVal	OLATCC1.PAR_FAIL	OLATCC1, Parallel failure detected	1=Failure
Phase overcurrent protection (3 stages)			
LD0.PHIPTOC1.Op.general	PHIPTOC1.OPERATE	PHIPTOC1, Operate, general	1 = Operate
LD0.PHIPTOC1.Str.general	PHIPTOC1.START	PHIPTOC1, Start, general	1 = Start
LD0.PHIPTOC1.Op.general	PHIPTOC1.OPERATE	PHIPTOC1, Operate, general	1 = Operate
LD0.PHIPTOC1.Str.general	PHIPTOC1.START	PHIPTOC1, Start, general	1 = Start
LD0.PHLPTOC1.Op.general	PHLPTOC1.OPERATE	PHLPTOC1, Operate, general	1 = Operate
LD0.PHLPTOC1.Str.general	PHLPTOC1.START	PHLPTOC1, Start, general	1 = Start
Phase overvoltage protection (3 stages)			
LD0.PHPTOV1.Op.general	PHPTOV1.OPERATE	PHPTOV1, Operate, general	1 = Operate
LD0.PHPTOV1.Str.general	PHPTOV1.START	PHPTOV1, Start, general	1 = Start
LD0.PHPTOV2.Op.general	PHPTOV2.OPERATE	PHPTOV2, Operate, general	1 = Operate
LD0.PHPTOV2.Str.general	PHPTOV2.START	PHPTOV2, Start, general	1 = Start
LD0.PHPTOV3.Op.general	PHPTOV3.OPERATE	PHPTOV3, Operate, general	1 = Operate
LD0.PHPTOV3.Str.general	PHPTOV3.START	PHPTOV3, Start, general	1 = Start
Phase undervoltage protection (3 stages)			
LD0.PHPTUV1.Op.general	PHPTUV1.OPERATE	PHPTUV1, Operate, general	1 = Operate
LD0.PHPTUV1.Str.general	PHPTUV1.START	PHPTUV1, Start, general	1 = Start
LD0.PHPTUV2.Op.general	PHPTUV2.OPERATE	PHPTUV2, Operate, general	1 = Operate
LD0.PHPTUV2.Str.general	PHPTUV2.START	PHPTUV2, Start, general	1 = Start
LD0.PHPTUV3.Op.general	PHPTUV3.OPERATE	PHPTUV3, Operate, general	1 = Operate
LD0.PHPTUV3.Str.general	PHPTUV3.START	PHPTUV3, Start, general	1 = Start
Positive sequence undervoltage protection (2 stages)			
LD0.PSPTUV1.Op.general	PSPTUV1.OPERATE	PSPTUV1, Operate, general	1 = Operate
LD0.PSPTUV1.Str.general	PSPTUV1.START	PSPTUV1, Start, general	1 = Start

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IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
LD0.PSPTUV2.Op.general	PSPTUV2.OPERATE	PSPTUV2, Operate, general	1 = Operate
LD0.PSPTUV2.Str.general	PSPTUV2.START	PSPTUV2, Start, general	1 = Start
DR.RDRE1.RcdMade.stVal	-	Disturbance recorder Disturbance recorder, recording made, stVal	1 = Recording made
LD0.RESCMMXU1.HiAlm.stVal	-	Residual current limit supervision RESCMMXU1, High alarm, stVal	1 = High alarm
LD0.RESCMMXU1.HiWrm.stVal	-	RESCMMXU1, High warning, stVal	1 = High warning
LD0.RESVMMXU1.HiAlm.stVal	-	Residual voltage limit supervision RESVMMXU1, High alarm, stVal	1 = High alarm
LD0.RESVMMXU1.HiWrm.stVal	-	RESVMMXU1, High warning, stVal	1 = High warning
LD0.ROVPTOV1.Op.general	ROVPTOV1.OPERATE	Residual overvoltage protection (3 stages) ROVPTOV1, Operate, general	1 = Operate
LD0.ROVPTOV1.Str.general	ROVPTOV1.START	ROVPTOV1, Start, general	1 = Start
LD0.ROVPTOV2.Op.general	ROVPTOV2.OPERATE	ROVPTOV2, Operate, general	1 = Operate
LD0.ROVPTOV2.Str.general	ROVPTOV2.START	ROVPTOV2, Start, general	1 = Start
LD0.ROVPTOV3.Op.general	ROVPTOV3.OPERATE	ROVPTOV3, Operate, general	1 = Operate
LD0.ROVPTOV3.Str.general	ROVPTOV3.START	ROVPTOV3, Start, general	1 = Start
LD0.SECRSYN1.SynPrg.stVal	SECRSYN1.SYNC_INPRO	Synchrocheck Synchronization in progress	1 = Synchronization in progress
LD0.SECRSYN1.FailCmd.stVal	SECRSYN1.CMD_FAIL_AL	CB closing request failed	1 = Closing request failed
LD0.SECRSYN1.FailSyn.stVal	SECRSYN1.CL_FAIL_AL	CB closing command failed	1 = Closing command failed
LD0.SEQRUFUF1.Str.general	SEQRUFUF1.FUSEF_U	Fuse failure protection SEQRUFUF1, General start of function, general	1 = Start
LD0.SEQRUFUF1.Str3Ph.general	SEQRUFUF1.FUSEF_3PH	SEQRUFUF1, Three-phase start of function, general	1 = Start
LD0.SSCBR1.APwrAlm.stVal	SSCBR1.IPOW_ALM	Circuit-breaker condition monitoring SSCBR1, Accumulated currents power (lyt),exceeded alarm limit, stVal	1 = Iyt alarm limit
LD0.SSCBR1.APwrLO.stVal	SSCBR1.IPOW_LO	SSCBR1, Accumulated currents power (lyt),exceeded lockout limit, stVal	1 = Iyt lockout limit
LD0.SSCBR1.CB.LifAlm.stVal	SSCBR1.CB_LIFE_ALM	SSCBR1, Remaining life of CB exceeded alarm limit, stVal	1 = Remaining life alarm
LD0.SSCBR1.CisAlm.stVal	SSCBR1.TRV_T_CL_ALM	SSCBR1, CB close travel time exceeded set value, stVal	1 = Close travel time alarm
LD0.SSCBR1.LonTmAlm.stVal	SSCBR1.MON_ALM	SSCBR1, CB 'not operated for long time' alarm, stVal	1 = Not operated alarm
LD0.SSCBR1.OpnAlm.stVal	SSCBR1.TRV_T_OP_ALM	SSCBR1, CB open travel time exceeded set value, stVal	1 = Open travel time alarm
LD0.SSCBR1.OpNumAlm.stVal	SSCBR1.OPR_ALM	SSCBR1, Number of CB operations exceeds alarm limit, stVal	1 = CB operations alarm
LD0.SSCBR1.OpNumLO.stVal	SSCBR1.OPR_LO	SSCBR1, Number of CB operations exceeds lockout limit, stVal	1 = CB operations lockout
LD0.SSCBR1.PresAlm.stVal	SSCBR1.PRES_ALM	SSCBR1, Pressure below alarm level, stVal	1 = Low pressure alarm
LD0.SSCBR1.PresLO.stVal	SSCBR1.PRES_LO	SSCBR1, Pressure below lockout level, stVal	1 = Low pressure lockout
LD0.SSCBR1.SprChaAlm.stVal	SSCBR1.SPR_CHR_ALM	SSCBR1, Spring charging time has crossed the set value, stVal	1 = Spring charge alarm
LD0.T2PTTR1.AlmTm.general	T2PTTR1.ALARM	Thermal protection T2PTTR1, Thermal alarm, general	1 = Alarm
LD0.T2PTTR1.Op.general	T2PTTR1.OPERATE	T2PTTR1, Operate, general	1 = Operate

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IEC 61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Values
LD0.T2PTR1.Str.general	T2PTR1.START	T2PTR1, Start, general	1 = Start
		Trip circuit supervision	
LD0.TCSCCBR1.CirAlm.stVal	TCSCCBR1.ALARM	TCSCCBR1, Alarm, stVal	1 = Alarm
LD0.TCSCCBR2.CirAlm.stVal	TCSCCBR2.ALARM	TCSCCBR2, Alarm, stVal	1 = Alarm
		Global conditioning	
LD0.TRPPTRC1.Op.general	-	TRPPTRC1, Operate input signal, general	1 = Operate, input
LD0.TRPPTRC1.Tr.general	-	TRPPTRC1, General trip output signal, general	1 = Trip, output
LD0.TRPPTRC2.Op.general	-	TRPPTRC2, Operate input signal, general	1 = Operate, input
LD0.TRPPTRC2.Tr.general	-	TRPPTRC2, General trip output signal, general	1 = Trip, output
		Three-phase voltage limit supervision	
LD0.VMMXU1.HiAlm.stVal	VMMXU1.HIGH_ALARM	VMMXU1, High alarm, stVal	1 = High alarm
LD0.VMMXU1.HiWrn.stVal	VMMXU1.HIGH_WARN	VMMXU1, High warning, stVal	1 = High warning
LD0.VMMXU1.LoAlm.stVal	VMMXU1.LOW_ALARM	VMMXU1, Low alarm, stVal	1 = Low alarm
LD0.VMMXU1.LoWrn.stVal	VMMXU1.LOW_WARN	VMMXU1, Low warning, stVal	1 = Low warning
		Raw I/O signals	
LD0.XGGIO100.SPCS01.stVal	-	X100 (PSM), X100-Output 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCS02.stVal	-	X100 (PSM), X100-Output 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCS03.stVal	-	X100 (PSM), X100-Output 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCS04.stVal	-	X100 (PSM), X100-Output 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCS05.stVal	-	X100 (PSM), X100-Output 5, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCS06.stVal	-	X100 (PSM), X100-Output 6, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind1.stVal	-	X110 (BIO), X110-Input 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind2.stVal	-	X110 (BIO), X110-Input 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind3.stVal	-	X110 (BIO), X110-Input 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind4.stVal	-	X110 (BIO), X110-Input 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind5.stVal	-	X110 (BIO), X110-Input 5, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind6.stVal	-	X110 (BIO), X110-Input 6, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind7.stVal	-	X110 (BIO), X110-Input 7, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.Ind8.stVal	-	X110 (BIO), X110-Input 8, stVal	1 = ON, 0 = OFF
		XRGGIO1 alarm/warning	
LD0.XRGGIO130.Alm.stVal	XRGGIO130.ALARM	XRGGIO1, Alarm, stVal	1 = Alarm
LD0.XRGGIO130.Wrn.stVal	XRGGIO130.WARNING	XRGGIO1, Warning, stVal	1 = Warning

Table 3: Binary outputs

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name
		Circuit breaker control
CTRL.CBCSW1H.Pos.Oper.ctiVal	-	CBXCBBR1_CB control
		Reset current max. demand values
LD0.CMSTA1.RecRs.Oper.ctiVal	-	CMMXU1_Reset CMMXU1_max.demands
		Active parameter setting group control
LD0.DNPGGIO1.ActISG1.ctiVal	-	Active parameter setting group 1
LD0.DNPGGIO1.ActISG2.ctiVal	-	Active parameter setting group 2
LD0.DNPGGIO1.ActISG3.ctiVal	-	Active parameter setting group 3
LD0.DNPGGIO1.ActISG4.ctiVal	-	Active parameter setting group 4
LD0.DNPGGIO1.ActISG5.ctiVal	-	Active parameter setting group 5
LD0.DNPGGIO1.ActISG6.ctiVal	-	Active parameter setting group 6
		Clear Indications and LEDs
LD0.LLN0.LEDRs1.Oper.ctiVal	-	General, Reset Indications and LEDs
LD0.LLN0.LEDRs2.Oper.ctiVal	-	General, Reset Alarm
LD0.LLN0.RecRs.Oper.ctiVal	-	General, Reset All data
LD0.LPHD1.RsDev.Oper.ctiVal	-	Physical device. Reset device
		Loadshedding controls
LD0.LSHDPTRC1.ManRest.Oper.ctiVal	LSHDPRQ1.MAN_RESTORE	LSHDPRQ1_Loadshedding 1 manual restore
LD0.LSHDPTRC1.BlkRest.Oper.ctiVal	LSHDPRQ1.BLK_REST	LSHDPRQ1_Loadshedding 1 cancel restore
LD0.LSHDPTRC2.ManRest.Oper.ctiVal	LSHDPRQ2.MAN_RESTORE	LSHDPRQ2_Loadshedding 1 manual restore
LD0.LSHDPTRC2.BlkRest.Oper.ctiVal	LSHDPRQ2.BLK_REST	LSHDPRQ2_Loadshedding 1 cancel restore
LD0.LSHDPTRC3.ManRest.Oper.ctiVal	LSHDPRQ3.MAN_RESTORE	LSHDPRQ3_Loadshedding 1 manual restore
LD0.LSHDPTRC3.BlkRest.Oper.ctiVal	LSHDPRQ3.BLK_REST	LSHDPRQ3_Loadshedding 1 cancel restore
LD0.LSHDPTRC4.ManRest.Oper.ctiVal	LSHDPRQ4.MAN_RESTORE	LSHDPRQ4_Loadshedding 1 manual restore
LD0.LSHDPTRC4.BlkRest.Oper.ctiVal	LSHDPRQ4.BLK_REST	LSHDPRQ4_Loadshedding 1 cancel restore
LD0.LSHDPTRC5.ManRest.Oper.ctiVal	LSHDPRQ5.MAN_RESTORE	LSHDPRQ5_Loadshedding 1 manual restore
LD0.LSHDPTRC5.BlkRest.Oper.ctiVal	LSHDPRQ5.BLK_REST	LSHDPRQ5_Loadshedding 1 cancel restore
		Disturbance recorder, clear memory and trig recording
DR.RDRE1.MemClr.Oper.ctiVal	-	Disturbance recorder, Clear memory
DR.RDRE1.RcdTrg.Oper.ctiVal	-	Disturbance recorder, Trig recording
		SRGAPC1_flip-flop reset control (all variants)
LD0.SRGAPC1.Rs1.ctiVal	-	Reset SRGAPC1_flip-flop 1
LD0.SRGAPC1.Rs2.ctiVal	-	Reset SRGAPC1_flip-flop 2
LD0.SRGAPC1.Rs3.ctiVal	-	Reset SRGAPC1_flip-flop 3
LD0.SRGAPC1.Rs4.ctiVal	-	Reset SRGAPC1_flip-flop 4
LD0.SRGAPC1.Rs5.ctiVal	-	Reset SRGAPC1_flip-flop 5
LD0.SRGAPC1.Rs6.ctiVal	-	Reset SRGAPC1_flip-flop 6
LD0.SRGAPC1.Rs7.ctiVal	-	Reset SRGAPC1_flip-flop 7

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IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name
LD0.SRGAPC1.Rs8.ctiVal	-	Reset SRGAPC1 flip-flop 8
		Reset signals of circuit breaker condition monitoring
LD0.SSCBR1.RsAccAPwr.Oper.ctiVal	-	SSCBR1, Reset accumulation energy
LD0.SSCBR1.RsCBWear.Oper.ctiVal	-	SSCBR1, Reset CB remaining life and operation counter
LD0.SSCBR1.RsSprChaTm.Oper.ctiVal	-	SSCBR1, Reset spring charge time alarm
LD0.SSCBR1.RsTrvTm.Oper.ctiVal	-	SSCBR1, Reset travel time alarm

Table 4: Analog inputs

IEC 61850 name	AFL-Common SA name	Description	Scaling function	Argument 1	Argument 2	Argument 3	Argument 4
Circuit breaker, operation counter and 4-pole (2 bit) position value							
CTRL.CBCSW11.OpCntRs.stVal	CBXCBR1.Operation Counter	Operation counter	Ratio	0	65535	0	65535
CTRL.CBCSW11.Pos.stVal	CBXCBR1.POSITION	CB switch position	Ratio	0	3	0	3
Phase current measurements							
LD0.CMMXU1.A.phsA.instCVal.ma g.f	-	Phase current A	Ratio	0	40	0	4000
LD0.CMMXU1.A.phsB.instCVal.ma g.f	-	Phase current B	Ratio	0	40	0	4000
LD0.CMMXU1.A.phsC.instCVal.ma g.f	-	Phase current C	Ratio	0	40	0	4000
Sequence of current measurement values							
LD0.CSMSQI1.SeqA.c1.instCVal. mag.f	-	Positive Sequence Current	Ratio	0	40	0	4000
LD0.CSMSQI1.SeqA.c2.instCVal. mag.f	-	Negative Sequence Current	Ratio	0	40	0	4000
LD0.CSMSQI1.SeqA.c3.instCVal. mag.f	-	Zero Sequence Current	Ratio	0	40	0	4000
Disconnecter 4-pole (2 bit) position values							
CTRL.DCSXSW11.Pos.stVal	DCSXSW11.POSITION	Disconnecter switch 1 position	Ratio	0	3	0	3
CTRL.DCSXSW12.Pos.stVal	DCSXSW12.POSITION	Disconnecter switch 2 position	Ratio	0	3	0	3
CTRL.DCSXSW13.Pos.stVal	DCSXSW13.POSITION	Disconnecter switch 3 position	Ratio	0	3	0	3
Earth switch 4-pole (2 bit) position value							
CTRL.ESSXSW11.Pos.stVal	ESSXSW11.POSITION	Earth switch 1 position	Ratio	0	3	0	3
Frequency metering							
LD0.FMMXU1.Hz.mag	FMMXU1.F_DB	Frequency metering	Ratio	35	75	3500	7500
System values							
LD0.LPHD1.NumPwrUp.stVal	-	Number of power ups	Ratio	0	65535	0	65535
LD0.LPHD1.PhyHealth1.stVal	Warning	Warning	Ratio	0	65535	0	65535
LD0.LPHD1.PhyHealth2.stVal	Internal Fault	Internal fault	Ratio	0	65535	0	65535
LD0.LPHD1.WacTrg.stVal	-	Number of watchdog device resets	Ratio	0	65535	0	65535
LD0.LPHD1.WrmStr.stVal	-	Number of warm starts	Ratio	0	65535	0	65535
CTRL.LLN0.LocRem.stVal	-	LR state monitoring	Ratio	0	4	0	4
On-Load tap changer controller							
LD0.OLATCC1.CIDIOh.stVal	OLATCC1.TIMER_STS	OLATCC1, Timer T1, T2 or fast lower timer active	Ratio	0	5	0	5
LD0.OLATCC1.CHOpmModSt.stVal	OLATCC1.OPR_MODE_STS	OLATCC1, Acting operation mode	Ratio	0	6	0	6
Power measurement and accumulated power values							
LD0.PEMMTR1.DmdVarh.actVal	PEMMXU1.ER_RV_ACM	Forward reactive energy	Ratio	0	999999999	0	999999999
LD0.PEMMTR1.DmdWh.actVal	PEMMXU1.EA_RV_ACM	Forward active energy	Ratio	0	999999999	0	999999999
LD0.PEMMTR1.SupVarh.actVal	PEMMXU1.ER_FWD_ACM	Reverse reactive energy	Ratio	0	999999999	0	999999999

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IEC 61850 name	AFL-Common SA name	Description	Scaling function	Argument 1	Argument 2	Argument 3	Argument 4
LD0.PEMMTR1.SupWh.actVal	PEMMXU1.EA_FWD_ACM	Reverse active energy	Ratio	0	999999999	0	999999999
LD0.PEMMXU1.TotPF.instMag.f	PEMMXU1.PF_INST	Average power factor (Total PF)	Ratio	-1	1	-100	100
LD0.PEMMXU1.TotW.instMag.f	PEMMXU1.P_INST	Total active power (Total P)	Ratio	0	999999	0	999999
LD0.PEMMXU1.TotVA.instMag.f	PEMMXU1.S_INST	Total apparent power (Total S)	Ratio	0	999999	0	999999
LD0.PEMMXU1.TotVAr.instMag.f	PEMMXU1.Q_INST	Total reactive power (Total Q)	Ratio	0	999999	0	999999
Disturbance recorder values							
DR.RDRE1.FINNum.stVal	-	Number of recordings	Ratio	0	65535	0	65535
DR.RDRE1.MemUsed.stVal	-	Rec. memory used	Ratio	0	100	0	100
Residual current and voltage							
LD0.RESCMMXU1.A.res.instCVal.mag.f	-	Residual current	Ratio	0	40	0	40
LD0.RESVMMXU1.PhV.res.instCVal.mag.f	-	Residual voltage	Ratio	0	4	0	4
Synchrocheck							
LD0.SECRSYN1.EnSt.stVal	SECRSYN1.ENERG_STATE	Energization state of Line and Bus	Ratio	0	4	0	4
Tap changer position value							
LD0.TPOSSLTC1.TapPos.valWTr.posVal	TPOSSLTC1.TAP_POS	Tap changer position, valWTr.posVal	Ratio	-64	63	-64	63
Temperature protection values							
LD0.T2PTTR1.Tmp.mag.f	T2PTTR1.TEMP	Protected object temperature	Ratio	-100	9999.9	-1000	99999
LD0.T2PTTR1.TmpRI.mag.f	T2PTTR1.TEMP_RL	Relative temperature	Ratio	0	99.9	0	999
Voltage measurement phase-to-ground and phase-to-phase values							
LD0.VMMXU1.PhV.phsA.cVal.mag.f	VMMXU1.U_INST_A	Phase to ground voltage A	Ratio	0	4	0	400
LD0.VMMXU1.PhV.phsB.cVal.mag.f	VMMXU1.U_INST_B	Phase to ground voltage B	Ratio	0	4	0	400
LD0.VMMXU1.PhV.phsC.cVal.mag.f	VMMXU1.U_INST_C	Phase to ground voltage B	Ratio	0	4	0	400
LD0.VMMXU1.PPV.phsAB.instCVal.mag.f	VMMXU1.U_DB_AB	Phase to phase voltage AB	Ratio	0	4	0	400
LD0.VMMXU1.PPV.phsBC.instCVal.mag.f	VMMXU1.U_DB_BC	Phase to phase voltage BC	Ratio	0	4	0	400
LD0.VMMXU1.PPV.phsCA.instCVal.mag.f	VMMXU1.U_DB_CA	Phase to phase voltage CA	Ratio	0	4	0	400
Sequence of voltage measurement values							
LD0.VMSMQ1.SeqA.c1.instCVal.mag.f	VMSQ1.I1_DB	Positive Sequence voltage	Ratio	0	4	0	400
LD0.VMSMQ1.SeqA.c2.instCVal.mag.f	VMSQ1.I2_DB	Negative Sequence voltage	Ratio	0	4	0	400
LD0.VMSMQ1.SeqA.c3.instCVal.mag.f	VMSQ1.I3_DB	Zero Sequence voltage	Ratio	0	4	0	400
RTD inputs							

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IEC 61850 name	AFL-Common SA name	Description	Scaling function	Argument 1	Argument 2	Argument 3	Argument 4
LD0.XRGGIO130.AnIn1.instMag	XRGGIO130_AI_VAL1	XRGGIO130, RTD input 1, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn2.instMag	XRGGIO130_AI_VAL2	XRGGIO130, RTD input 2, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn3.instMag	XRGGIO130_AI_VAL3	XRGGIO130, RTD input 3, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn4.instMag	XRGGIO130_AI_VAL4	XRGGIO130, RTD input 4, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn5.instMag	XRGGIO130_AI_VAL5	XRGGIO130, RTD input 5, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn6.instMag	XRGGIO130_AI_VAL6	XRGGIO130, RTD input 6, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn7.instMag	XRGGIO130_AI_VAL7	XRGGIO130, RTD input 7, instMag	Ratio	-10000	10000	-10000	10000
LD0.XRGGIO130.AnIn8.instMag	XRGGIO130_AI_VAL8	XRGGIO130, RTD input 8, instMag	Ratio	-10000	10000	-10000	10000

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 5: *Device profile document*

DNP3 device profile document	
Vendor name:	ABB Oy
Device name:	REU615
Highest DNP level supported: For requests: Level 2+ For responses: Level 2+	Device function: ○ Master ● 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): Transmitted: 292 Received: 292	Maximum application fragment size (octets): Transmitted: Configurable (256...2048) Received: 2048
Maximum data link re-tries: ○ None ○ Fixed ● Configurable (0...65535)	Maximum application layer re-tries: ● None ○ Configurable
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						
	<ul style="list-style-type: none"> ○ Sometimes ● Configurable as: "Only when reporting event data", or "When reporting event data or multi-fragment messages" 					
Timeouts while waiting for:						
Data link confirm:	<ul style="list-style-type: none"> ○ None ○ Fixed at ____ ○ Variable ● Configurable 					
Complete appl. fragment:	<ul style="list-style-type: none"> ● None ○ Fixed at ____ ○ Variable ○ Configurable 					
Application confirm:	<ul style="list-style-type: none"> ○ None ○ Fixed at ____ ○ Variable ● Configurable 					
Complete appl. response:	<ul style="list-style-type: none"> ● None ○ Fixed at ____ ○ Variable ○ Configurable 					
Others:	Select/Operate Arm timeout, configurable in DNP setting parameters. Regardless 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	<ul style="list-style-type: none"> ● Never ○ Always ○ Sometimes ○ Configurable 					
SELECT/ OPERATE	<ul style="list-style-type: none"> ○ Never ○ Always ○ Sometimes ● Configurable 					
DIRECT OPERATE	<ul style="list-style-type: none"> ○ Never ○ Always ○ Sometimes ● Configurable 					
DIRECT OPERATE - NO ACK	<ul style="list-style-type: none"> ○ Never ○ Always ○ Sometimes ● Configurable 					
Count > 1 (Count > 1 is accepted but ignored)	<ul style="list-style-type: none"> ● Never ○ Always ○ Sometimes ○ Configurable 					
Pulse on	<ul style="list-style-type: none"> ● Never ○ Always ○ Sometimes ○ Configurable 					
Pulse off	<ul style="list-style-type: none"> ● Never ○ Always ○ Sometimes ○ Configurable 					
Latch on	<ul style="list-style-type: none"> ○ Never ● Always ○ Sometimes ○ Configurable 					
Latch off	<ul style="list-style-type: none"> ○ Never ● Always ○ Sometimes ○ Configurable 					
Queue	<ul style="list-style-type: none"> ● Never ○ Always ○ Sometimes ○ Configurable 					
Clear queue	<ul style="list-style-type: none"> ● 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:			
<ul style="list-style-type: none"> ○ Never ○ Only when time-tagged ○ Only non-time-tagged ● Configurable to send one or the other 			<ul style="list-style-type: none"> ○ Never ○ Binary input change with time ○ Binary input change with relative time ● Configurable 			
Sends unsolicited responses:			Sends static data in unsolicited responses:			
<ul style="list-style-type: none"> ● Never 			<ul style="list-style-type: none"> ● Never 			
Table continues on next page						

DNP3 device profile document																						
<ul style="list-style-type: none"> ○ Configurable ○ Only certain objects ○ Sometimes (attach explanation) ○ ENABLE/DISABLE UNSOLICITED function codes supported 	<ul style="list-style-type: none"> ○ When device restarts ○ When status flags change <p>No other options are permitted.</p>																					
<p>Default counter object/variation:</p> <ul style="list-style-type: none"> ● No counters reported ○ Configurable ○ Default object <p>Default variation:</p> <ul style="list-style-type: none"> ○ Point-by-point list attached 	<p>Counters roll over at:</p> <ul style="list-style-type: none"> ● No counters reported ○ Configurable (attach explanation) ○ 16 bits ○ 32 bits ○ Other value: _____ ○ Point-by-point list attached 																					
<p>Sends multi-fragment responses:</p> <ul style="list-style-type: none"> ● Yes ○ No ○ Configurable 																						
<p>Sequential file transfer support:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Append file mode</td> <td style="width: 10%; text-align: center;">○ Yes</td> <td style="width: 10%; text-align: center;">● No</td> </tr> <tr> <td>Custom status code strings</td> <td style="text-align: center;">○ Yes</td> <td style="text-align: center;">● No</td> </tr> <tr> <td>Permissions field</td> <td style="text-align: center;">○ Yes</td> <td style="text-align: center;">● No</td> </tr> <tr> <td>File events assigned to class</td> <td style="text-align: center;">○ Yes</td> <td style="text-align: center;">● No</td> </tr> <tr> <td>File events send immediately</td> <td style="text-align: center;">○ Yes</td> <td style="text-align: center;">● No</td> </tr> <tr> <td>Multiple blocks in a fragment</td> <td style="text-align: center;">○ Yes</td> <td style="text-align: center;">● No</td> </tr> <tr> <td>Max number of files open</td> <td style="text-align: center;">0</td> <td></td> </tr> </table>		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	
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																					
<p>● = Selected, ○ = Not selected</p>																						

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.

Section 3 DNP3 protocol implementation

Table 6: 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 = 1) 08 (limited qty)	129 (response)	00, 01 (start-stop) 17, 28 (index) ²⁾
			2 (write)	07 (limited qty = 1)		
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	Unsyncronized time and date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)

Table continues on next page

Section 3 DNP3 protocol implementation

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
CB	Circuit breaker
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.
DA	Data attribute
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.
DO	Data object
EMC	Electromagnetic compatibility
HMI	Human-machine interface
I/O	Input/output
IEC	International Electrotechnical Commission
IEC 61850	International standard for substation communication and modelling
IED	Intelligent electronic device
LED	Light-emitting diode
LHMI	Local human-machine interface
LN	Logical node
PCM600	Protection and Control IED Manager
SBO	Select-before-operate

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