Relion® 615 series

Voltage Protection and Control
REU615
IEC 60870-5-103 Point List Manual

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Conformity

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

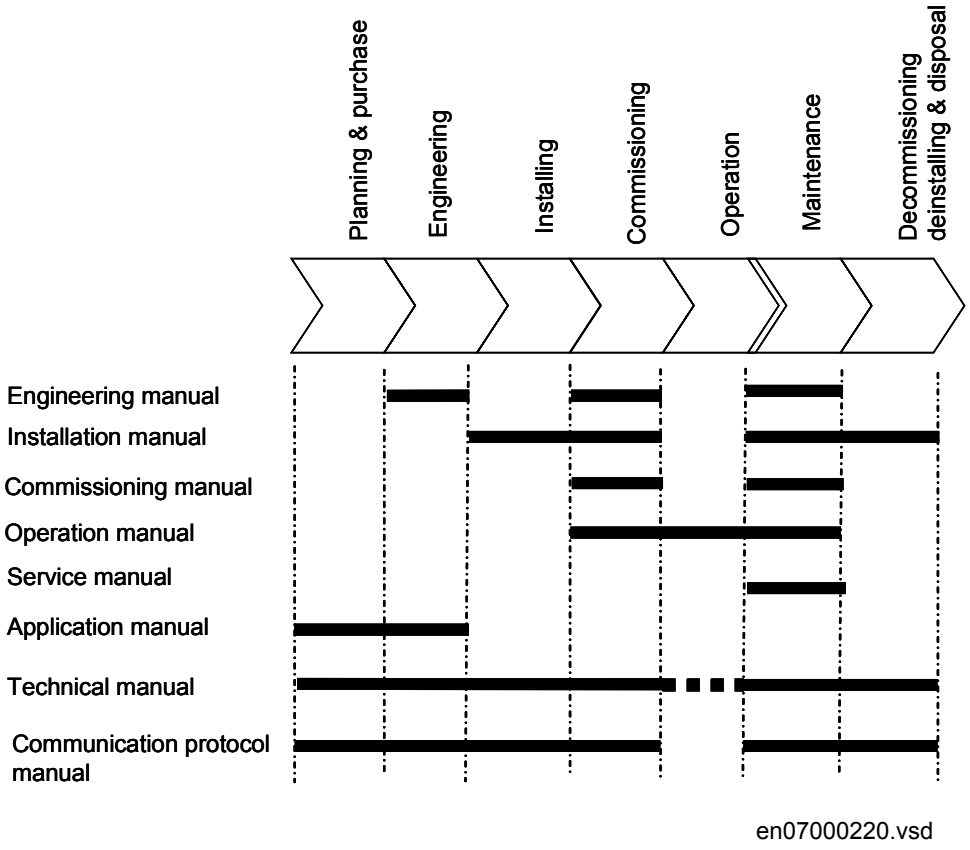

Figure 1: The intended use of manuals in different lifecycles

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
IEC 60870-5-103 Communication Protocol Manual	1MRS756710

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	3Ith>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
Disconnector position indication, instance 1	DCSXSWI1	I <-> O DC (1)	I <-> O DC (1)
Disconnector position indication, instance 2	DCSXSWI2	I <-> O DC (2)	I <-> O DC (2)
Disconnector 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	SEQRFUF1	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 IEC 60870-5-103 data mappings

2.1 Overview

These tables show the default point definitions. The user is able to freely remap all these data. In that case PCM600 can provide an updated point list export of the new outlook.

Indications and controls table columns

IEC 61850 name	Internal signal that is mapped to the IEC 60870-5-103 point. Expressed in the form 'Logical Device.Logical Node.Data Object.Data Attribute'.
AFL-Common SA name	AFL name of the corresponding data signal.
Description	Signal description.
DPI value	Value description. DPI value 10 means ON and value 01 means OFF.
FUN	Default Function Type definition for the point. Observe that Function Type 0 means that FUN in practice contains the given Device Function Type. The user-definable Function Type definition is set to the same FUN value as default.
INF	Default Information Number definition for the point. The user-definable Information Number definition is set to the same INF value as default.
InUse	1 means that the point is taken in use as default, and 0 that the point is not in use as default.
ASDU	ASDU point type. 1 and 2 are indications in monitoring direction. 20 means that the point is controllable.
GI	Default setting for General Interrogation. 1 means ON, 0 means OFF.
Coding	IEC 60870-5-103 DPI value coding. 1 means that the point shows OFF (01) and ON (10) values only. 2 means that the point shows values Intermediate (00), OFF (01), ON (10) and Error (11).

Class 2 data table columns

Index	Value position within the Class2 frame.
IEC 61850 name	Internal signal that is mapped to the IEC 60870-5-103 point.
Description	Signal description.
Default scale	Value that corresponds to the maximum IEC 60870-5-103 measurand value 1.

Table continues on next page

Frame No6	Shows if the value is present in Class2 frame 6.
Frame No7	Shows if the value is present in Class2 frame 7.
Comment	Additional information.

2.2 Point list for REU615 Ver.3.0 UE01-02

Table 2: Indications and controls

IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
Device function type - standard data									
LD0.LLN0.LEDRs1.ctlVal	-	LED reset	10=Reset indications and alarm LEDs	0	19	1	20	0	1
LD0.LLN0.Beh.stVal (Test mode)	-	Test mode	10=Test mode ON, 01=Test mode OFF	0	21	1	1	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 1	10=Setting group 1 in use	0	23	1	1,20	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 2	10=Setting group 2 in use	0	24	1	1,20	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 3	10=Setting group 3 in use	0	25	1	1,20	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 4	10=Setting group 4 in use	0	26	1	1,20	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 5	10=Setting group 5 in use	0	27	1	1,20	1	1
LD0.I3CGGIO1.ActSG.ctlVal	-	Parameter setting group 6	10=Setting group 6 in use	0	28	1	1,20	1	1
LD0.TCSSCBR1.CirAlm.stVal	TCSSCBR1.ALARM	Trip circuit 1 alarm	10=TCS1 alarm	0	36	1	1	1	1
LD0.LEDPTRC1.Op.general	-	Global operate	10=Operate (LEDPTRC)	0	68	1	2	0	1
LD0.LEDPTRC1.Str.general	-	Global start	10=Start (LEDPTRC)	0	84	1	2	1	1
Device function type - private data									
LD0.TRPPTRC1.Op.general	-	TRPTRC1 input signal	10=Input signal ON	10	1	1	2	0	1
LD0.TRPPTRC1.Tr.general	-	TRPTRC1 trip output signal	10=Trip output signal ON	10	2	1	2	0	1
LD0.TRPPTRC2.Op.general	-	TRPTRC2 input signal	10=Input signal ON	10	3	1	2	0	1
LD0.TRPPTRC2.Tr.general	-	TRPTRC2 trip output signal	10=Trip output signal ON	10	4	1	2	0	1
CTRL.LLN0.Loc.stVal	-	Local/Remote state	10=Local, 01=Remote	10	10	1	1	1	1
CTRL.LLN0.LocRem.stVal.Station	-	Station state	10=Station ON, 01=OFF	10	11	1	1	1	1
LD0.LLN0.RecRs.ctlVal	-	Reset all data	10=Reset all data	10	19	1	20	0	1
LD0.LLN0.LEDRs2.ctlVal	-	Reset Alarm LEDs	10=Reset alarm LEDs only	10	21	1	20	0	1
LD0.TCSSCBR2.CirAlm.stVal	TCSSCBR2.ALARM	Trip circuit 2 alarm	10=TCS2 alarm	10	36	1	1	1	1
DR.RDRE1.RcdTrg.ctlVal	-	Trig DR recording	10=External DR trig	10	41	1	20	0	1
DR.RDRE1.MemClr.ctlVal	-	Clear DR memory	10=Clear memory	10	42	1	20	0	1
LD0.CMSTA1.RecRs.ctlVal	-	Reset CMMXU1 max.demands	10=Reset max values	10	45	1	20	0	1
LD0.LEDPTRC1.Str.phsA	-	Global start- phsA	10=Start phsA	10	61	0	2	1	1
LD0.LEDPTRC1.Str.phsB	-	Global start- phsB	10=Start phsB	10	62	0	2	1	1
LD0.LEDPTRC1.Str.phsC	-	Global start- phsC	10=Start phsC	10	63	0	2	1	1
LD0.LEDPTRC1.Op.phsA	-	Global operate -phsA	10=Operate phsA	10	65	0	2	0	1
LD0.LEDPTRC1.Op.phsB	-	Global operate -phsB	10=Operate phsB	10	66	0	2	0	1
LD0.LEDPTRC1.Op.phsC	-	Global operate -phsC	10=Operate phsC	10	67	0	2	0	1
LD0.LLN0.SetSeId.stVal	-	Parameter setting rights reserved	10=Reserved	10	80	1	1	0	1
LD0.LLN0.SetChg.stVal	-	Parameter settings changed	10=Changed	10	81	1	1	0	1
Multipurpose inputs (all variants)									
LD0.MVGAPC1.Q1.stVal	-	MVGAPC1 input 1 signal	10=Input ON, 01=OFF	11	1	0	1	1	1
LD0.MVGAPC1.Q2.stVal	-	MVGAPC1 input 2 signal	10=Input ON, 01=OFF	11	2	0	1	1	1
LD0.MVGAPC1.Q3.stVal	-	MVGAPC1 input 3 signal	10=Input ON, 01=OFF	11	3	0	1	1	1

Table continues on next page

IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.MVGAPC1.Q4.stVal	-	MVGAPC1 input 4 signal	10=Input ON, 01=OFF	11	4	0	1	1	1
LD0.MVGAPC1.Q5.stVal	-	MVGAPC1 input 5 signal	10=Input ON, 01=OFF	11	5	0	1	1	1
LD0.MVGAPC1.Q6.stVal	-	MVGAPC1 input 6 signal	10=Input ON, 01=OFF	11	6	0	1	1	1
LD0.MVGAPC1.Q7.stVal	-	MVGAPC1 input 7 signal	10=Input ON, 01=OFF	11	7	0	1	1	1
LD0.MVGAPC1.Q8.stVal	-	MVGAPC1 input 8 signal	10=Input ON, 01=OFF	11	8	0	1	1	1
SRGAPC1, flip-flop reset control (all variants)									
LD0.SRGAPC1.Rs1.ctlVal	-	Reset SRGAPC1 flip-flop 1	10=Reset	11	101	1	20	0	1
LD0.SRGAPC1.Rs2.ctlVal	-	Reset SRGAPC1 flip-flop 2	10=Reset	11	102	1	20	0	1
LD0.SRGAPC1.Rs3.ctlVal	-	Reset SRGAPC1 flip-flop 3	10=Reset	11	103	1	20	0	1
LD0.SRGAPC1.Rs4.ctlVal	-	Reset SRGAPC1 flip-flop 4	10=Reset	11	104	1	20	0	1
LD0.SRGAPC1.Rs5.ctlVal	-	Reset SRGAPC1 flip-flop 5	10=Reset	11	105	1	20	0	1
LD0.SRGAPC1.Rs6.ctlVal	-	Reset SRGAPC1 flip-flop 6	10=Reset	11	106	1	20	0	1
LD0.SRGAPC1.Rs7.ctlVal	-	Reset SRGAPC1 flip-flop 7	10=Reset	11	107	1	20	0	1
LD0.SRGAPC1.Rs8.ctlVal	-	Reset SRGAPC1 flip-flop 8	10=Reset	11	108	1	20	0	1
Fuse failure protection (1 stage)									
LD0.SEQRFUF1.Str.general	SEQRFUF1.FUSEF_U	General Start	10=General Start	22	84	1	2	1	1
LD0.SEQRFUF1.Str3Ph.general	SEQRFUF1.FUSEF_3PH	3 phase start	10=3 phase start	22	94	1	2	1	1
Current circuit failure protection									
CTRL.CCRDIF1.Alm.stVal	CCRDIF1.FAIL	Current circuit failure alarm	10 = Alarm	23	1	1	1	1	1
CTRL.CCRDIF1.Op.general	CCRDIF1.ALARM	Current circuit failure operate	10 = Operate	23	90	1	2	0	1
Tap position (ASDU 4)									
LD0.TPOSSLTC1.ValWTr.posVal	TPOSSLTC1.TAP_POS	Tap position	-64...63	25	20	1	4	1	-
Frequency protection (FRPFRQ1..6), 6 stages									
LD0.FRPTRC1.Str.general	FRPFRQ1.START	Stage 1 start	1 = Stage1 start	27	11	1	2	1	1
LD0.FRPTOF1.Op.general	FRPFRQ1.OPR_OFRQ	Operate 1 signal for overfrequency	1 = Stage1 overfrequency operate	27	12	1	2	0	1
LD0.FRPTUF1.Op.general	FRPFRQ1.OPR_UFRQ	Operate 1 signal for underfrequency	1 = Stage1 underfrequency operate	27	13	1	2	0	1
LD0.FRPFRC1.Op.general	FRPFRQ1.OPR_FRG	Operate 1 signal for frequency gradient	1 = Stage1 frequency gradient operate	27	14	1	2	0	1
LD0.FRPTRC2.Str.general	FRPFRQ2.START	Stage 2 start	1 = Stage2 start	27	21	1	2	1	1
LD0.FRPTOF2.Op.general	FRPFRQ2.OPR_OFRQ	Operate 2 signal for overfrequency	1 = Stage2 overfrequency operate	27	22	1	2	0	1
LD0.FRPTUF2.Op.general	FRPFRQ2.OPR_UFRQ	Operate 2 signal for underfrequency	1 = Stage2 underfrequency operate	27	23	1	2	0	1
LD0.FRPFRC2.Op.general	FRPFRQ2.OPR_FRG	Operate 2 signal for frequency gradient	1 = Stage2 frequency gradient operate	27	24	1	2	0	1
LD0.FRPTRC3.Str.general	FRPFRQ3.START	Stage 3 start	1 = Stage3 start	27	31	1	2	1	1
LD0.FRPTOF3.Op.general	FRPFRQ3.OPR_OFRQ	Operate 3 signal for overfrequency	1 = Stage3 overfrequency operate	27	32	1	2	0	1
LD0.FRPTUF3.Op.general	FRPFRQ3.OPR_UFRQ	Operate 3 signal for underfrequency	1 = Stage3 underfrequency operate	27	33	1	2	0	1
LD0.FRPFRC3.Op.general	FRPFRQ3.OPR_FRG	Operate 3 signal for frequency gradient	1 = Stage3 frequency gradient operate	27	34	1	2	0	1

Table continues on next page

IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.FRPTRC4.Str.general	FRPFRQ4.START	Stage 4 start	1 = Stage1 start	27	41	1	2	1	1
LD0.FRPTOF4.Op.general	FRPFRQ4.OPR_OFRQ	Operate 4 signal for overfrequency	1 = Stage1 overfrequency operate	27	42	1	2	0	1
LD0.FRPTUF4.Op.general	FRPFRQ4.OPR_UFRQ	Operate 4 signal for underfrequency	1 = Stage1 underfrequency operate	27	43	1	2	0	1
LD0.FRPFRC4.Op.general	FRPFRQ4.OPR_FRG	Operate 4 signal for frequency gradient	1 = Stage1 frequency gradient operate	27	44	1	2	0	1
LD0.FRPTRC5.Str.general	FRPFRQ5.START	Stage 5 start	1 = Stage2 start	27	51	1	2	1	1
LD0.FRPTOF5.Op.general	FRPFRQ5.OPR_OFRQ	Operate 5 signal for overfrequency	1 = Stage2 overfrequency operate	27	52	1	2	0	1
LD0.FRPTUF5.Op.general	FRPFRQ5.OPR_UFRQ	Operate 5 signal for underfrequency	1 = Stage2 underfrequency operate	27	53	1	2	0	1
LD0.FRPFRC5.Op.general	FRPFRQ5.OPR_FRG	Operate 5 signal for frequency gradient	1 = Stage2 frequency gradient operate	27	54	1	2	0	1
LD0.FRPTRC6.Str.general	FRPFRQ6.START	Stage 6 start	1 = Stage3 start	27	61	1	2	1	1
LD0.FRPTOF6.Op.general	FRPFRQ6.OPR_OFRQ	Operate 6 signal for overfrequency	1 = Stage3 overfrequency operate	27	62	1	2	0	1
LD0.FRPTUF6.Op.general	FRPFRQ6.OPR_UFRQ	Operate 6 signal for underfrequency	1 = Stage3 underfrequency operate	27	63	1	2	0	1
LD0.FRPFRC6.Op.general	FRPFRQ6.OPR_FRG	Operate 6 signal for frequency gradient	1 = Stage3 frequency gradient operate	27	64	1	2	0	1
Multipurpose analog protection functions (3 stages)									
LD0.MAPGAPC1.Str.general	MAPGAPC1.START	Stage 1 Start	10 = Stage1 start	27	151	0	1	1	1
LD0.MAPGAPC1.Op.general	MAPGAPC1.OPERATE	Stage 1 Operate	10 = Stage1 operate	27	152	0	1	0	1
LD0.MAPGAPC2.Str.general	MAPGAPC2.START	Stage 2 Start	10 = Stage2 start	27	153	0	1	1	1
LD0.MAPGAPC2.Op.general	MAPGAPC2.OPERATE	Stage 2 Operate	10 = Stage2 operate	27	154	0	1	0	1
LD0.MAPGAPC3.Str.general	MAPGAPC3.START	Stage 3 Start	10 = Stage3 start	27	155	0	1	1	1
LD0.MAPGAPC3.Op.general	MAPGAPC3.OPERATE	Stage 3 Operate	10 = Stage3 operate	27	156	0	1	0	1
XRGGIO130 Alarm/Warning									
LD0.XRGGIO130.Wrn.stVal	XRGGIO130.WARNING	XRGGIO130 Warning	10 = Warning	27	201	0	1	0	1
LD0.XRGGIO130.Alm.stVal	XRGGIO130.ALARM	XRGGIO130 Alarm	10 = Alarm	27	202	0	1	0	1
Phase overvoltage protection (3 stages)									
LD0.PHPTOV3.Str.phsA	-	Stage 3 phsA start	10 = Start phsA	40	44	0	2	1	1
LD0.PHPTOV3.Str.phsB	-	Stage 3 phsB start	10 = Start phsB	40	45	0	2	1	1
LD0.PHPTOV3.Str.phsC	-	Stage 3 phsC start	10 = Start phsC	40	46	0	2	1	1
LD0.PHPTOV2.Str.phsA	-	Stage 2 phsA start	10 = Start phsA	40	54	0	2	1	1
LD0.PHPTOV2.Str.phsB	-	Stage 2 phsB start	10 = Start phsB	40	55	0	2	1	1
LD0.PHPTOV2.Str.phsC	-	Stage 2 phsC start	10 = Start phsC	40	56	0	2	1	1
LD0.PHPTOV1.Str.phsA	-	Stage 1 phsA start	10 = Start phsA	40	64	0	2	1	1
LD0.PHPTOV1.Str.phsB	-	Stage 1 phsB start	10 = Start phsB	40	65	0	2	1	1
LD0.PHPTOV1.Str.phsC	-	Stage 1 phsC start	10 = Start phsC	40	66	0	2	1	1
LD0.PHPTOV1.Str.general	PHPTOV1.START	Stage 1 general start	10 = Start stage 1	40	84	1	2	1	1
LD0.PHPTOV1.Op.general	PHPTOV1.OPERATE	Stage 1 general operate	10 = Operate stage 1	40	90	1	2	0	1
LD0.PHPTOV2.Op.general	PHPTOV2.OPERATE	Stage 2 general operate	10 = Operate stage 2	40	91	1	2	0	1

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IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.PHPTOV2.Str.general	PHPTOV2.START	Stage 2 general start	10 = Start stage 2	40	94	1	2	1	1
LD0.PHPTOV3.Str.general	PHPTOV3.START	Stage 3 general start	10 = Start stage 3	40	96	1	2	1	1
LD0.PHPTOV3.Op.general	PHPTOV3.OPERATE	Stage 3 general operate	10 = Operate stage 3	40	98	1	2	0	1
Phase undervoltage protection (3 stages)									
LD0.PHPTUV3.Str.phsA	-	Stage 3 phsA start	10 = Start phsA	41	44	0	2	1	1
LD0.PHPTUV3.Str.phsB	-	Stage 3 phsB start	10 = Start phsB	41	45	0	2	1	1
LD0.PHPTUV3.Str.phsC	-	Stage 3 phsC start	10 = Start phsC	41	46	0	2	1	1
LD0.PHPTUV2.Str.phsA	-	Stage 2 phsA start	10 = Start phsA	41	54	0	2	1	1
LD0.PHPTUV2.Str.phsB	-	Stage 2 phsB start	10 = Start phsB	41	55	0	2	1	1
LD0.PHPTUV2.Str.phsC	-	Stage 2 phsC start	10 = Start phsC	41	56	0	2	1	1
LD0.PHPTUV1.Str.phsA	-	Stage 1 phsA start	10 = Start phsA	41	64	0	2	1	1
LD0.PHPTUV1.Str.phsB	-	Stage 1 phsB start	10 = Start phsB	41	65	0	2	1	1
LD0.PHPTUV1.Str.phsC	-	Stage 1 phsC start	10 = Start phsC	41	66	0	2	1	1
LD0.PHPTUV1.Str.general	PHPTUV1.START	Stage 1 general start	10 = Start stage 1	41	84	1	2	1	1
LD0.PHPTUV1.Op.general	PHPTUV1.OPERATE	Stage 1 general operate	10 = Operate stage 1	41	90	1	2	0	1
LD0.PHPTUV2.Op.general	PHPTOV2.OPERATE	Stage 2 general operate	10 = Operate stage 2	41	91	1	2	0	1
LD0.PHPTUV2.Str.general	PHPTUV2.START	Stage 2 general start	10 = Start stage 2	41	94	1	2	1	1
LD0.PHPTUV3.Str.general	PHPTUV3.START	Stage 3 general start	10 = Start stage 3	41	96	1	2	1	1
LD0.PHPTUV3.Op.general	PHPTUV3.OPERATE	Stage 3 general operate	10 = Operate stage 3	41	98	1	2	0	1
Positive sequence undervoltage protection (2 stages)									
LD0.PSPTUV2.Str.phsA	-	Stage 2 phsA start	10 = Start phsA	42	54	0	2	1	1
LD0.PSPTUV2.Str.phsB	-	Stage 2 phsB start	10 = Start phsB	42	55	0	2	1	1
LD0.PSPTUV2.Str.phsC	-	Stage 2 phsC start	10 = Start phsC	42	56	0	2	1	1
LD0.PSPTUV1.Str.phsA	-	Stage 1 phsA start	10 = Start phsA	42	64	0	2	1	1
LD0.PSPTUV1.Str.phsB	-	Stage 1 phsB start	10 = Start phsB	42	65	0	2	1	1
LD0.PSPTUV1.Str.phsC	-	Stage 1 phsC start	10 = Start phsC	42	66	0	2	1	1
LD0.PSPTUV1.Str.general	PSPTUV1.START	Stage 1 general start	10 = Start stage 1	42	84	1	2	1	1
LD0.PSPTUV1.Op.general	PSPTUV1.OPERATE	Stage 1 general operate	10 = Operate stage 1	42	90	1	2	0	1
LD0.PSPTUV2.Op.general	PSPTOV2.OPERATE	Stage 2 general operate	10 = Operate stage 2	42	91	1	2	0	1
LD0.PSPTUV2.Str.general	PSPTUV2.START	Stage 2 general start	10 = Start stage 2	42	94	1	2	1	1
Negative sequence overvoltage protection (2 stages)									
LD0.NSPTOV1.Str.general	NSPTOV1.START	Stage 1 general start	10 = Start stage 1	43	84	1	2	1	1
LD0.NSPTOV1.Op.general	NSPTOV1.OPERATE	Stage 1 general operate	10 = Operate stage 1	43	90	1	2	0	1
LD0.NSPTOV2.Op.general	NSPTOV2.OPERATE	Stage 2 general operate	10 = Operate stage 2	43	91	1	2	0	1
LD0.NSPTOV2.Str.general	NSPTOV2.START	Stage 2 general start	10 = Start stage 2	43	94	1	2	1	1
Residual overvoltage protection (3 stages),									
LD0.ROVPTOV1.Str.general	ROVPTOV1.START	Stage 1 general start	10 = Start stage 1	44	84	1	2	1	1
LD0.ROVPTOV1.Op.general	ROVPTOV1.OPERATE	Stage 1 general operate	10 = Operate stage 1	44	90	1	2	0	1
LD0.ROVPTOV2.Op.general	ROVPTOV2.START	Stage 2 general operate	10 = Operate stage 2	44	91	1	2	0	1

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IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.ROVPTOV2.Str.general	ROVPTOV2.OPERATE	Stage 2 general start	10 = Start stage 2	44	94	1	2	1	1
LD0.ROVPTOV3.Str.general	ROVPTOV3.START	Stage 3 general start	10 = Start stage 3	44	96	1	2	1	1
LD0.ROVPTOV3.Op.general	ROVPTOV3.OPERATE	Stage 3 general operate	10 = Operate stage 3	44	98	1	2	0	1
Physical binary I/O signals									
LD0.XGGIO110.Ind1.stVal	-	X110-Input 1	10=ON, 01=OFF	52	1	0	1	1	1
LD0.XGGIO110.Ind2.stVal	-	X110-Input 2	10=ON, 01=OFF	52	2	0	1	1	1
LD0.XGGIO110.Ind3.stVal	-	X110-Input 3	10=ON, 01=OFF	52	3	0	1	1	1
LD0.XGGIO110.Ind4.stVal	-	X110-Input 4	10=ON, 01=OFF	52	4	0	1	1	1
LD0.XGGIO110.Ind5.stVal	-	X110-Input 5	10=ON, 01=OFF	52	5	0	1	1	1
LD0.XGGIO110.Ind6.stVal	-	X110-Input 6	10=ON, 01=OFF	52	6	0	1	1	1
LD0.XGGIO110.Ind7.stVal	-	X110-Input 7	10=ON, 01=OFF	52	7	0	1	1	1
LD0.XGGIO110.Ind8.stVal	-	X110-Input 8	10=ON, 01=OFF	52	8	0	1	1	1
LD0.XGGIO110.SPCSO1.stVal	-	X110-Output 1	10=ON, 01=OFF	52	101	0	1	1	1
LD0.XGGIO110.SPCSO2.stVal	-	X110-Output 2	10=ON, 01=OFF	52	102	0	1	1	1
LD0.XGGIO110.SPCSO3.stVal	-	X110-Output 3	10=ON, 01=OFF	52	103	0	1	1	1
LD0.XGGIO110.SPCSO4.stVal	-	X110-Output 4	10=ON, 01=OFF	52	104	0	1	1	1
LD0.XGGIO100.SPCSO1.stVal	-	X100-Output 1	10=ON, 01=OFF	53	101	0	1	1	1
LD0.XGGIO100.SPCSO2.stVal	-	X100-Output 2	10=ON, 01=OFF	53	102	0	1	1	1
LD0.XGGIO100.SPCSO3.stVal	-	X100-Output 3	10=ON, 01=OFF	53	103	0	1	1	1
LD0.XGGIO100.SPCSO4.stVal	-	X100-Output 4	10=ON, 01=OFF	53	104	0	1	1	1
LD0.XGGIO100.SPCSO5.stVal	-	X100-Output 5	10=ON, 01=OFF	53	105	0	1	1	1
LD0.XGGIO100.SPCSO6.stVal	-	X100-Output 6	10=ON, 01=OFF	53	106	0	1	1	1
On-Load tap changer controller									
LD0.OLATCC1.TapOpErr.stVal	OLATCC1.ALARM	Alarm	10 = Alarm	81	1	1	1	0	1
LD0.OLATCC1.TapOpR.stVal	OLATCC1.RAISE_OWN	Raise command	10 = Raise	81	2	0	1	0	1
LD0.OLATCC1.TapOpL.stVal	OLATCC1.LOWER_OWN	Lower commamd	10 = Lower	81	3	1	1	0	1
LD0.OLATCC1.EndPosR.stVal	-	Block raise	10 = Raise	81	4	1	1	0	1
LD0.OLATCC1.EndPosL.stVal	-	Block lower	10 = Lower	81	5	1	1	0	1
LD0.OLATCC1.LTCBlkAHi.stVal	OLATCC1.BLKD_I_LOD	Over current blocking	10 = Blocking	81	11	1	1	0	1
LD0.OLATCC1.LTCBlkVLo.stVal	OLATCC1.BLKD_U_UN	Under voltage blocking	10 = Blocking	81	12	1	1	0	1
LD0.OLATCC1.LTCRnbk.stVal	OLATCC1.RNBK_U_OV	Raise voltage runback	10 = Blocking	81	13	1	1	0	1
LD0.OLATCC1.LTCBlkCirA.stVal	OLATCC1.BLKD_I_CIR	High circulating current blocking	10 = Blocking	81	14	1	1	0	1
LD0.OLATCC1.LTCBlkSt.stVal	OLATCC1.BLKD_LTCBLK	External blocking	10 = Blocking	81	15	1	1	0	1
LD0.OLATCC1.ErrParTra.stVal	OLATCC1.PAR_FAIL	Parallel failure detected	10 = Failure	81	16	1	1	0	1
LD0.OLATCC1.TapChg.ValWTr.Oper.ctlVal.Lower	-	Tap changer control lower	10 = Lower	81	20	1	20	0	1
LD0.OLATCC1.TapChg.ValWTr.Oper.ctlVal.Higher	-	Tap changer control higher	10 = Higher	81	21	1	20	0	1
Synchrocheck									
LD0.SECRSYN1.SynPrg.stVal	SECRSYN1.SYNC_INPRO	Synchonization in progress	10 = In progress	81	51	1	1	1	1

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IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.SECRSYN1.FailCmd.stVal	SECRSYN1.CMD_FAIL_AL	CB closing request failed	10 = Request failed	81	52	1	1	0	1
LD0.SECRSYN1.FailSyn.stVal	SECRSYN1.CL_FAIL_AL	CB closing command failed	10 = Command failed	81	53	1	1	0	1
LD0.SECRSYN1.EnSt.stVal	SECRSYN1.ENERG_STATE	Energization state of line and bus	0 = Unknown; 1 = Both Live; 2 = Live line Dead bus; 3 = Dead line Live bus; 4 = Both Dead	81	60	1	4	1	-
Load shedding(LSHDPFRQ). 5 stages									
LD0.LSHDPTRC1.Str.general	LSHDPFRQ1.START	Start stage1	10 = Start	82	11	1	1	1	1
LD0.LSHDPTRC1.Op.general	LSHDPFRQ1.OPERATE	Operate stage1	10 = Operate	82	12	1	1	0	1
LD0.LSHDPTRC1.RestLodStr.general	LSHDPFRQ1.ST_REST	Start of restore stage 1	10 = Start	82	13	1	1	1	1
LD0.LSHDPTRC1.RestLodOp.general	LSHDPFRQ1.RESTORE	Restore the load stage 1	10 = Operate	82	14	1	1	0	1
LD0.LSHDPTRC1.ManRest.Oper.ctlVal	LSHDPFRQ1.MAN_RESTORE	Loadshedding 1 manual restore	10 = Restore	82	15	1	20	0	1
LD0.LSHDPTRC1.BlkRest.Oper.ctlVal	LSHDPFRQ1.BLK_REST	Loadshedding 1 cancel restore	10 = Cancel	82	16	1	20	0	1
LD0.LSHDPTRC2.Str.general	LSHDPFRQ2.START	Start stage2	10 = Start	82	21	1	1	1	1
LD0.LSHDPTRC2.Op.general	LSHDPFRQ2.OPERATE	Operate stage2	10 = Operate	82	22	1	1	0	1
LD0.LSHDPTRC2.RestLodStr.general	LSHDPFRQ2.ST_REST	Start of restore stage 2	10 = Start	82	23	1	1	1	1
LD0.LSHDPTRC2.RestLodOp.general	LSHDPFRQ2.RESTORE	Restore the load stage 2	10 = Operate	82	24	1	1	0	1
LD0.LSHDPTRC2.ManRest.Oper.ctlVal	LSHDPFRQ2.MAN_RESTORE	Loadshedding 2 manual restore	10 = Restore	82	25	1	20	0	1
LD0.LSHDPTRC2.BlkRest.Oper.ctlVal	LSHDPFRQ2.BLK_REST	Loadshedding 2 cancel restore	10 = Cancel	82	26	1	20	0	1
LD0.LSHDPTRC3.Str.general	LSHDPFRQ3.START	Start stage3	10 = Start	82	31	1	1	1	1
LD0.LSHDPTRC3.Op.general	LSHDPFRQ3.OPERATE	Operate stage3	10 = Operate	82	32	1	1	0	1
LD0.LSHDPTRC3.RestLodStr.general	LSHDPFRQ3.ST_REST	Start of restore stage 3	10 = Start	82	33	1	1	1	1
LD0.LSHDPTRC3.RestLodOp.general	LSHDPFRQ3.RESTORE	Restore the load stage 3	10 = Operate	82	34	1	1	0	1
LD0.LSHDPTRC3.ManRest.Oper.ctlVal	LSHDPFRQ3.MAN_RESTORE	Loadshedding 3 manual restore	10 = Restore	82	35	1	20	0	1
LD0.LSHDPTRC3.BlkRest.Oper.ctlVal	LSHDPFRQ3.BLK_REST	Loadshedding 3 cancel restore	10 = Cancel	82	36	1	20	0	1
LD0.LSHDPTRC4.Str.general	LSHDPFRQ4.START	Start stage4	10 = Start	82	41	1	1	1	1
LD0.LSHDPTRC4.Op.general	LSHDPFRQ4.OPERATE	Operate stage4	10 = Operate	82	42	1	1	0	1
LD0.LSHDPTRC4.RestLodStr.general	LSHDPFRQ4.ST_REST	Start of restore stage 4	10 = Start	82	43	1	1	1	1
LD0.LSHDPTRC4.RestLodOp.general	LSHDPFRQ4.RESTORE	Restore the load stage 4	10 = Operate	82	44	1	1	0	1
LD0.LSHDPTRC4.ManRest.Oper.ctlVal	LSHDPFRQ4.MAN_RESTORE	Loadshedding 4 manual restore	10 = Restore	82	45	1	20	0	1

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LD0.LSHDPTRC4.BlkRest.Oper.ctlVal	LSHDPFRQ4.BLK_REST	Loadshedding 4 cancel restore	10 = Cancel	82	46	1	20	0	1
LD0.LSHDPTRC5.Str.general	LSHDPFRQ5.START	Start stage5	10 = Start	82	51	1	1	1	1
LD0.LSHDPTRC5.Op.general	LSHDPFRQ5.OPERATE	Operate stage5	10 = Operate	82	52	1	1	0	1
LD0.LSHDPTRC5.RestLodStr.general	LSHDPFRQ5.ST_REST	Start of restore stage 5	10 = Start	82	53	1	1	1	1
LD0.LSHDPTRC5.RestLodOp.general	LSHDPFRQ5.RESTORE	Restore the load stage 5	10 = Operate	82	54	1	1	0	1
LD0.LSHDPTRC5.ManRest.Oper.ctlVal	LSHDPFRQ5.MAN_RESTORE	Loadshedding 5 manual restore	10 = Restore	82	55	1	20	0	1
LD0.LSHDPTRC5.BlkRest.Oper.ctlVal	LSHDPFRQ5.BLK_REST	Loadshedding 5 cancel restore	10 = Cancel	82	56	1	20	0	1
ARC protection									
LD0.ARCSARC11.FADet.stVal	ARCSARC1.ARC_FLT_DET	Stage1 Fault arc detected	10=Stage1 arc detected	156	211	1	1	0	1
LD0.ARCPTRC11.Op.general	ARCSARC1.OPERATE	Stage1 Operate	10=Stage1 operate	156	213	1	2	0	1
LD0.ARCSARC21.FADet.stVal	ARCSARC2.ARC_FLT_DET	Stage2 Fault arc detected	10=Stage2 arc detected	156	221	1	1	0	1
LD0.ARCPTRC21.Op.general	ARCSARC2.OPERATE	Stage2 Operate	10=Stage2 operate	156	223	1	2	0	1
LD0.ARCSARC31.FADet.stVal	ARCSARC3.ARC_FLT_DET	Stage3 Fault arc detected	10=Stage3 arc detected	156	231	1	1	0	1
LD0.ARCPTRC31.Op.general	ARCSARC3.OPERATE	Stage3 Operate	10=Stage3 operate	156	233	1	2	0	1
Phase overcurrent protection (3 stages)									
LD0.PHIPTOC1.Str.phsA	-	Instantaneous stage phsA start	10= phsA start	162	34	0	2	1	1
LD0.PHIPTOC1.Str.phsB	-	Instantaneous stage phsB start	10= phsB start	162	35	0	2	1	1
LD0.PHIPTOC1.Str.phsC	-	Instantaneous stage phsC start	10= phsC start	162	36	0	2	1	1
LD0.PHHPTOC1.Str.phsA	-	High stage phsA start	10= phsA start	162	54	0	2	1	1
LD0.PHHPTOC1.Str.phsB	-	High stage phsB start	10= phsB start	162	55	0	2	1	1
LD0.PHHPTOC1.Str.phsC	-	High stage phsC start	10= phsC start	162	56	0	2	1	1
LD0.PHLPTOC1.Str.phsA	-	Low stage phsA start	10= phsA start	162	64	0	2	1	1
LD0.PHLPTOC1.Str.phsB	-	Low stage phsB start	10= phsB start	162	65	0	2	1	1
LD0.PHLPTOC1.Str.phsC	-	Low stage phsC start	10= phsC start	162	66	0	2	1	1
LD0.PHLPTOC1.Str.general	PHLPTOC1.START	Low stage general start	10= Low stage general start	162	84	1	2	1	1
LD0.PHLPTOC1.Op.general	PHLPTOC1.OPERATE	Low stage general operate	10= Low stage general operate	162	90	1	2	0	1
LD0.PHHPTOC1.Op.general	PHHPTOC1.OPERATE	High stage general operate	10= High stage general operate	162	91	1	2	0	1
LD0.PHHPTOC1.Str.general	PHHPTOC1.START	High stage general start	10= High stage general start	162	94	1	2	1	1
LD0.PHIPTOC1.Str.general	PHIPTOC1.START	Instanteous stage general start	10= Instanteous stage general start	162	97	1	2	1	1
LD0.PHIPTOC1.Op.general	PHIPTOC1.OPERATE	Instantaneous stage general operate	10= Instantaneous stage general operate	162	99	1	2	0	1
Thermal overload protection									
LD0.T2PTTR1.Str.general	T2PTTR1.START	Thermal start	10=Start	168	104	1	2	1	1
LD0.T2PTTR1.AlmThm.general	T2PTTR1.ALARM	Thermal alarm	10=Alarm	168	105	1	2	1	1

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IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.T2PTTR1.Op.general	T2PTTR1.OPERATE	Operate	10=Operate	168	106	1	2	0	1
Phase currents limit supervison									
LD0.CMMXU1.HiAlm.stVal	CMMXU1.HIGH_ALARM	Phase currents High alarm	10=High alarm	210	1	0	1	1	1
LD0.CMMXU1.HiWrn.stVal	CMMXU1.HIGH_WARNING	Phase currents High warning	10=High warning	210	2	0	1	1	1
LD0.CMMXU1.LoWrn.stVal	CMMXU1.LOW_ALARM	Phase currents Low alarm	10=Low alarm	210	3	0	1	1	1
LD0.CMMXU1.LoAlm.stVal	CMMXU1.LOW_WARNING	Phase currents Low warning	10=Low warning	210	4	0	1	1	1
Phase voltage limit supervison									
LD0.VMMXU1.HiAlm.stVal	VMMXU1.HIGH_ALARM	Phase voltage High alarm	10=High alarm	211	1	0	1	1	1
LD0.VMMXU1.HiWrn.stVal	VMMXU1.HIGH_WARNING	Phase voltage High warning	10=High warning	211	2	0	1	1	1
LD0.VMMXU1.LoWrn.stVal	VMMXU1.LOW_ALARM	Phase voltage Low alarm	10=Low alarm	211	3	0	1	1	1
LD0.VMMXU1.LoAlm.stVal	VMMXU1.LOW_WARNING	Phase voltage Low warning	10=Low warning	211	4	0	1	1	1
Residual voltage limit supervision									
LD0.RESVMMXU1.HiAlm.stVal	RESVMMXU1.HIGH_ALAR M	Residual voltage High alarm	10=High alarm	211	11	0	1	1	1
LD0.RESVMMXU1.HiWrn.stVal	RESVMMXU1.HIGH_WAR N	Residual voltage High warning	10=High warning	211	12	0	1	1	1
Circuit breaker position and failure protection									
CTRL.CBCILO1.EnaOpn.stVal	CBXCBR1.ENA_OPEN	CB open enabled	10=Open enabled	240	21	1	1	1	1
CTRL.CBCILO1.EnaCls.stVal	CBXCBR1.ENA_CLOSE	CB close enabled	10=Close enabled	240	22	1	1	1	1
CTRL.CBXCBR1.BlkOpn.stVal	CBXCBR1.BLK_OPEN	CB open blocked	10=Open blocked	240	23	1	1	1	1
CTRL.CBXCBR1.BlkCls.stVal	CBXCBR1.BLK_CLOSE	CB close blocked	10=Close blocked	240	24	1	1	1	1
CTRL.CBCILO1.ItlByPss.stVal	CBXCBR1.ITL_BYPASS	CB interlocking bypass	10=Interlocking bypassed	240	25	1	1	1	1
CTRL.CBCSWI1.Pos.stVal	CBXCBR1.POSITION	Circuit breaker position	10=Close; 01=Open; 00=Intermediate; 11=Error	240	160	1	1.2	1	2
Disconnector positions									
CTRL.DCSXSWI1.Pos.stVal	DCSXSWI1.POSITION	Disconnector 1 position	10=Close;01=Open;00=Intermediate; 11=Error	253	1	1	1	1	2
CTRL.DCSXSWI2.Pos.stVal	DCSXSWI2.POSITION	Disconnector 2 position	10=Close;01=Open;00=Intermediate; 11=Error	253	2	1	1	1	2
CTRL.DCSXSWI3.Pos.stVal	DCSXSWI3.POSITION	Disconnector 3 position	10=Close;01=Open;00=Intermediate; 11=Error	253	3	1	1	1	2
CTRL.ESSXSWI1.Pos.stVal	ESSXSWI1.POSITION	Eart switch position	10=Close;01=Open;00=Intermediate; 11=Error	253	11	1	1	1	2
LHMI alarm LED indications									
LD0.LEDGGIO1.SPCSO1.stVal	-	LED 1 state	10=LED ON, 01=LED OFF	253	89	1	1	1	1
LD0.LEDGGIO1.SPCSO2.stVal	-	LED 2 state	10=LED ON, 01=LED OFF	253	90	1	1	1	1
LD0.LEDGGIO1.SPCSO3.stVal	-	LED 3 state	10=LED ON, 01=LED OFF	253	91	1	1	1	1
LD0.LEDGGIO1.SPCSO4.stVal	-	LED 4 state	10=LED ON, 01=LED OFF	253	92	1	1	1	1
LD0.LEDGGIO1.SPCSO5.stVal	-	LED 5 state	10=LED ON, 01=LED OFF	253	93	1	1	1	1
LD0.LEDGGIO1.SPCSO6.stVal	-	LED 6 state	10=LED ON, 01=LED OFF	253	94	1	1	1	1
LD0.LEDGGIO1.SPCSO7.stVal	-	LED 7 state	10=LED ON, 01=LED OFF	253	95	1	1	1	1

Table continues on next page

IEC 61850 Name	AFL-Common SA Name	Description	DPI value	FUN	INF	In Use	ASDU	GI	Coding
LD0.LEDGGIO1.SPCSO8.stVal	-	LED 8 state	10=LED ON, 01=LED OFF	253	96	1	1	1	1
LD0.LEDGGIO1.SPCSO9.stVal	-	LED 9 state	10=LED ON, 01=LED OFF	253	97	1	1	1	1
LD0.LEDGGIO1.SPCSO10.stVal	-	LED 10 state	10=LED ON, 01=LED OFF	253	98	1	1	1	1
LD0.LEDGGIO1.SPCSO11.stVal	-	LED 11 state	10=LED ON, 01=LED OFF	253	99	1	1	1	1

Table 3: Class 2 PRIVATE measurand frames 6 and 7 for REU615 variants UE01 and UE02

Index	IEC 61850 data	Description	Default scale	Frame 6	Frame 7	Comment
1	LD0.CMMXU1.A.phsA.instCVal.mag	Phase current A	2.4	x	x	n.a in UE01
2	LD0.CMMXU1.A.phsB.instCVal.mag	Phase current B	2.4	x	x	n.a in UE01
3	LD0.CMMXU1.A.phsC.instCVal.mag	Phase current C	2.4	x	x	n.a in UE01
4	LD0.RESVMMXU1.A.res.instCVal.mag	Residual voltage	2.4	x	x	n.a in UE02
5	LD0.CSMSQI1.SeqA.c1.instCVal.mag	Positive sequence current	2.4	x	x	n.a in UE01
6	LD0.CSMSQI1.SeqA.c2.instCVal.mag	Negative sequence current	2.4	x	x	n.a in UE01
7	LD0.CSMSQI1.SeqA.c3.instCVal.mag	Zero sequence current	2.4	x	x	n.a in UE01
8	LD0.T2PTTR1.Tmp.mag	Temperature of protected object	1000	x	x	n.a in UE01
9	LD0.T2PTTR1.TmpRl.mag	Relative temperature of protected object	1000	x	x	n.a in UE01
10	LD0.VMMXU1.phV.phsA.cVal.mag	Phase-to-ground voltage phase A	2.4	x	x	
11	LD0.VMMXU1.phV.phsB.cVal.mag	Phase-to-ground voltage phase B	2.4	x	x	
12	LD0.VMMXU1.phV.phsC.cVal.mag	Phase-to-ground voltage phase C	2.4	x	x	
13	LD0.VMMXU1.PPV.phsAB.cVal.mag	Phase-to-phase voltage phase AB	2.4	x	x	
14	LD0.VMMXU1.PPV.phsBC.cVal.mag	Phase-to-phase voltage phase BC	2.4	x	x	
15	LD0.VMMXU1.PPV.phsCA.cVal.mag	Phase-to-phase voltage phase CA	2.4	x	x	
16	LD0.VSMSQI1.SeqA.c1.instCVal.mag	Positive sequence voltage	2.4	x	x	
17	LD0.VSMSQI1.SeqA.c2.instCVal.mag	Negative sequence voltage	2.4	x	x	
18	LD0.VSMSQI1.SeqA.c3.instCVal.mag	Zero sequence voltage	2.4	x	x	
19	LD0.PEMMXU1.TotW.instMag	Active power P	1000	x	x	n.a in UE01
20	LD0.PEMMXU1.TotVAr.instMag	Reactive power Q	1000	x	x	n.a in UE01
21	LD0.PEMMXU1.TotVA.instMag	Apparent power S	1000	x	x	n.a in UE01
22	LD0.PEMMXU1.TotPF.instMag	Power factor	1	x	x	n.a in UE01
23	LD0.FMMXU1.Hz.mag	Frequency measurement	75.0	x	x	n.a in UE02
24	LD0.CMSTA1.AvAmps1.mag	Phase current A -demand value	2.4		x	n.a in UE01
25	LD0.CMSTA1.AvAmps2.mag	Phase current B -demand value	2.4		x	n.a in UE01
26	LD0.CMSTA1.AvAmps3.mag	Phase current B -demand value	2.4		x	n.a in UE01
unmapped	LD0.XRGGIO130.AnIn1.instMag	RTD input 1	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn2.instMag	RTD input 2	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn3.instMag	RTD input 3	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn4.instMag	RTD input 4	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn5.instMag	RTD input 5	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn6.instMag	RTD input 6	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn7.instMag	RTD input 7	10000	-	-	optional UE01 only
unmapped	LD0.XRGGIO130.AnIn8.instMag	RTD input 8	10000	-	-	optional UE01 only

Section 3 Interoperability profile for 615 series IEC 60870-5-103

3.1 Physical layer

3.1.1 Electrical interface

☒ EIA RS-485

☐ Number of loads ..... for one protection equipment

NOTE - EIA RS-485 standard defines unit loads so that 32 of them can be operated on one line. For detailed information refer to clause 3 of EIA RS-485 standard.

3.1.2 Optical interface

☒ Glass fibre

☐ Plastic fibre

☐ F-SMA type connector

☐ BFOC/2,5 type connector

3.1.3 Transmission speed

☒ 9 600 bit/s

☒ 19 200 bit/s

3.2 Link layer

There are no choices for the link layer.

3.3 Application layer

3.3.1 Transmission mode for application data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

3.3.2 COMMON ADDRESS of ASDU

☒ One COMMON ADDRESS OF ASDU (identical with station address)

☐ More than one COMMON ADDRESS OF ASDU

3.3.3 Selection of standard information numbers in monitor direction

3.3.3.1 System functions in monitor directions

	INF	Semantics
☒	<0>	End of general interrogation
☒	<0>	Time synchronization
☒	<2>	Reset FCB
☒	<3>	Reset CU
☒	<4>	Start/restart
☒	<5>	Power on

3.3.3.2 Status indications in monitor direction

	INF	Semantics
☒	<16>	Auto-recloser active 1
☐	<17>	Teleprotection active
☐	<18>	Protection active
☐	<19>	LED reset
☐	<20>	Monitor direction blocked
☒	<21>	Test mode
☐	<22>	Local parameter setting
☒	<23>	Characteristic 1
☒	<24>	Characteristic 2
☒	<25>	Characteristic 3
☒	<26>	Characteristic 4

Table continues on next page

☐	<27>	Auxiliary input 1
☐	<28>	Auxiliary input 2
☐	<29>	Auxiliary input 3
☐	<30>	Auxiliary input 4

Note <27>...<30>: Depending on Binary I/O options and application usage there may be additional auxiliary inputs available in the IED. As default, all "raw" binary input data are mapped to private data. It is possible for user to re-map these additional inputs into standard <27>...<30> 'Auxiliary Inputs', if wanted.

3.3.3.3 Supervision indications in monitor direction

	INF	Semantics
☐	<32>	Measurand supervision I
☐	<33>	Measurand supervision V
☐	<35>	Phase sequence supervision
☒	<36>	Trip circuit supervision
☐	<37>	I>> back-up operation
☐	<38>	VT fuse failure
☐	<39>	Teleprotection disturbed
☐	<46>	Group warning
☐	<47>	Group alarm

Note <32>, <33> and <38>: IED current and voltage measurement supervision signals and alarms are found in private data definitions. Semantics of these signals are more complex in 615 series than what is defined by the IEC 60870-5-103 standard.

3.3.3.4 Earth fault indications in monitor direction

	INF	Semantics
☐	<48>	Earth fault L_1
☐	<49>	Earth fault L_2
☐	<50>	Earth fault L_3
☐	<51>	Earth fault forward, for example line
☐	<52>	Earth fault reverse, for example busbar

Note: In 615 series there exist different functions (and signals) for non-directional or directional earth fault protection. Function- and stage-dependent start/pickup signals are found in private data locations.

3.3.3.5 Fault indications in monitor direction

	INF	Semantics
☐	<64>	Start /pick-up L_1
☐	<65>	Start /pick-up L_2

Table continues on next page

☐	<66>	Start /pick-up L_3
☐	<67>	Start /pick-up N
☒	<68>	General trip
☐	<69>	Trip L_1
☐	<70>	Trip L_2
☐	<71>	Trip L_3
☐	<72>	Trip I>> (back-up operation)
☐	<73>	Fault location X in ohms
☐	<74>	Fault forward/line
☐	<75>	Fault reverse/busbar
☐	<76>	Teleprotection signal transmitted
☐	<77>	Teleprotection signal received
☐	<78>	Zone 1
☐	<79>	Zone 2
☐	<80>	Zone 3
☐	<81>	Zone 4
☐	<82>	Zone 5
☐	<83>	Zone 6
☐	<84>	General start/pick-up
☒	<85>	Breaker failure
☐	<86>	Trip measuring system L_1
☐	<87>	Trip measuring system L_2
☐	<88>	Trip measuring system L_3
☐	<89>	Trip measuring system E
☐	<90>	Trip I>
☐	<91>	Trip I>>
☐	<92>	Trip IN>
☐	<93>	Trip IN>>

Note: Function-specific fault signals are as default mapped to private data locations in 615 series IEDs.

3.3.3.6 Auto-reclosure indications in monitor direction

	INF	Semantics
☒	<128>	CB ’on’ by AR
☐	<129>	CB ’on’ by long-time AR
☒	<130>	AR blocked

Note <129>: Terms 'short-' or 'long-time' AR are not directly usable in 615 series. The AR functionality in the IED performs AR shots (1..5) that are user configurable. See private AR data definitions. Depending on user AR configuration it is possible to re-map some private data into standard data, if wanted.

3.3.3.7 Measurands in monitor direction

	INF	Semantics
☒	<144>	Measurand I
☒	<145>	Measurands I, V
☒	<146>	Measurands I, V, P, Q
☒	<147>	Measurands I_N, V_{EN}
☒	<148>	Measurands $I_{L1,2,3}$, $V_{L1,2,3}$, P, Q, f

3.3.3.8 Generic functions in monitor direction

	INF	Semantics
☐	<240>	Read headings of all defined groups
☐	<241>	Read values or attributes of all entries of one group
☐	<243>	Read directory of a single entry
☐	<244>	Read value or attribute of a single entry
☐	<245>	End of general interrogation of generic data
☐	<249>	Write entry with confirmation
☐	<250>	Write entry with execution
☐	<251>	Write entry aborted

3.3.4 Selection of standard information numbers in control direction

3.3.4.1 System functions in control direction

	INF	Semantics
☒	<0>	Initiation of general interrogation
☒	<0>	Time synchronization

3.3.4.2 Generic functions in monitor direction

	INF	Semantics
☐	<240>	Read headings of all defined groups
☐	<241>	Read values or attributes of all entries of one group
☐	<243>	Read directory of a single entry
☐	<244>	Read value or attribute of a single entry
☐	<245>	End of general interrogation of generic data
☐	<249>	Write entry with confirmation
☐	<250>	Write entry with execution
☐	<251>	Write entry aborted

3.3.5 Basic application functions

- ☐ Test mode
- ☐ Blocking of monitor direction
- ☒ Disturbance data
- ☐ Generic services
- ☒ Private data

3.3.6 Miscellaneous

Measurands are transmitted as Class2 data using ASDU 3 or ASDU 9. The default MVAL scalings in 615 series devices is 2.4. User can freely reprogram the MVAL for each separate measurand.

Measurand	Max. MVAL = rated value times	
	1.2 or	2.4
Current L_1	☒	☒
Current L_2	☒	☒
Current L_3	☒	☒
Voltage L_{1-E}	☒	☒
Voltage L_{2-E}	☒	☒
Voltage L_{3-E}	☒	☒
Active power P	☒	☒
Reactive power Q	☒	☒
Frequency f	☒	☒
Voltage L_1 - L_2	☒	☒

The IED contains additional private Class2 frames, including private measurands. User can freely select between standard or private Class2 frames.

Section 4 Glossary

AFL	Application function block library
ASDU	Application-layer service data unit
DPI	Double point information
EMC	Electromagnetic compatibility
FUN	Default function type
GI	General interrogation
HMI	Human-machine interface
IEC	International Electrotechnical Commission
IEC 60870-5-103	Communication standard for protective equipment; A serial master/slave protocol for point-to-point communication
IEC 61850	International standard for substation communication and modelling
IED	Intelligent electronic device
INF	Default information number
LHMI	Local human-machine interface
PCM600	Protection and Control IED Manager

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