



Relion® 615 series

Line Differential Protection and Control RED615 DNP3 Point List Manual



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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

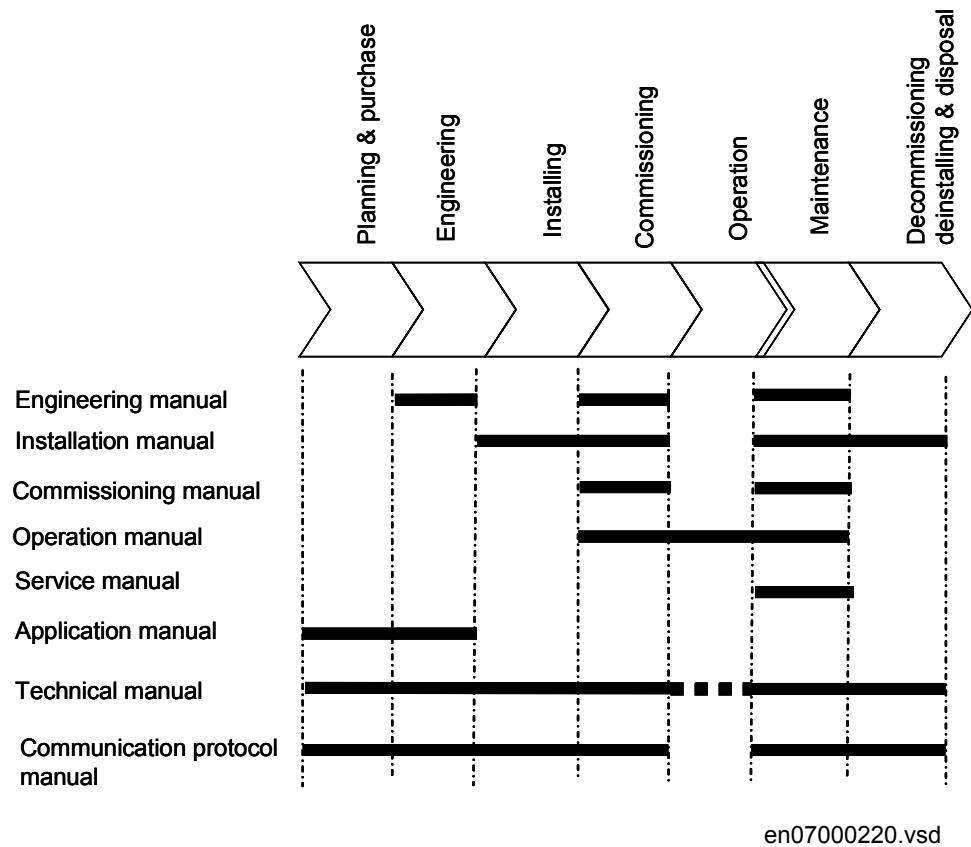


Figure 1: The intended use of manuals in different lifecycles

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/2009-07-03	2.0	First release
B/2010-06-11	3.0	Content updated to correspond to the product version



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: *RED615 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, high stage, instance 2	PHHPTOC2	3I>> (2)	51P-2 (2)
Three-phase non-directional overcurrent protection, instantaneous stage, instance 1	PHIPTOC1	3I>>> (1)	50P/51P (1)
Non-directional earth-fault protection, low stage, instance 1	EFLPTOC1	Io> (1)	51N-1 (1)
Non-directional earth-fault protection, low stage, instance 2	EFLPTOC2	Io> (2)	51N-1 (2)
Non-directional earth-fault protection, high stage, instance 1	EFHPTOC1	Io>> (1)	51N-2 (1)
Non-directional earth-fault protection, instantaneous stage	EFIPTOC1	Io>>>	50N/51N
Directional earth-fault protection, low stage, instance 1	DEFLPDEF1	Io> -> (1)	67N-1 (1)
Directional earth-fault protection, low stage, instance 2	DEFLPDEF2	Io> -> (2)	67N-1 (2)
Directional earth-fault protection, high stage	DEFHPDEF1	Io>> ->	67N-2
Admittance based earth-fault protection, instance 1	EFPADM1	Yo> -> (1)	21YN (1)
Admittance based earth-fault protection, instance 2	EFPADM2	Yo> -> (2)	21YN (2)
Admittance based earth-fault protection, instance 3	EFPADM3	Yo> -> (3)	21YN (3)
Transient / intermittent earth-fault protection	INTRPTEF1	Io> -> IEF	67NIEF
Non-directional (cross-country) earth fault protection, using calculated Io	EFHPTOC1	Io>> (1)	51N-2 (1)
Negative-sequence overcurrent protection, instance 1	NSPTOC1	I2> (1)	46 (1)
Negative-sequence overcurrent protection, instance 2	NSPTOC2	I2> (2)	46 (2)
Phase discontinuity protection	PDNSPTOC1	I2/I1>	46PD
Table continues on next page			

Function	IEC 61850	IEC 60617	IEC-ANSI
Residual overvoltage protection, instance 1	ROVPTOV1	U ₀ > (1)	59G (1)
Residual overvoltage protection, instance 2	ROVPTOV2	U ₀ > (2)	59G (2)
Residual overvoltage protection, instance 3	ROVPTOV3	U ₀ > (3)	59G (3)
Three-phase thermal protection for feeders, cables and distribution transformers	T1PTTR1	3I _{th} >F	49F
Binary signal transfer	BSTGGIO1	BST	BST
Line differential protection and related measurements, stabilized and instantaneous stages	LNPLDF1	3dI>L	87L
Circuit breaker failure protection	CCBRBRF1	3I>/I ₀ >BF	51BF/51NBF
Three-phase inrush detector	INRPHAR1	3I2f>	68
Master trip, instance 1	TRPPTRC1	Master Trip (1)	94/86 (1)
Master trip, instance 2	TRPPTRC2	Master Trip (2)	94/86 (2)
Control			
Circuit-breaker control	CBXCBR1	I <-> O CB	I <-> O CB
Disconnecter position indication, instance 1	DCSXSUW1	I <-> O DC (1)	I <-> O DC (1)
Disconnecter position indication, instance 2	DCSXSUW2	I <-> O DC (2)	I <-> O DC (2)
Disconnecter position indication, instance 3	DCSXSUW3	I <-> O DC (3)	I <-> O DC (3)
Earthing switch indication	ESSXSUW1	I <-> O ES	I <-> O ES
Auto-reclosing	DARREC1	O -> I	79
Condition monitoring			
Circuit-breaker condition monitoring	SSCBR1	CBCM	CBCM
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
Protection communication supervision	PCSRTPC1	PCS	PCS
Measurement			
Disturbance recorder	RDRE1	-	-
Three-phase current measurement, instance 1	CMMXU1	3I	3I
Sequence current measurement	CSMSQ1	I ₁ , I ₂ , I ₀	I ₁ , I ₂ , I ₀
Residual current measurement, instance 1	RESCMMXU1	I ₀	I _n
Residual voltage measurement	RESVMMXU1	U ₀	V _n

Section 2 DNP3 data mappings

2.1 Overview

This document describes the DNP3 data points and structures available in RED615 Ver. 3.0. The data points are unmapped as a default. The point lists describe a superset of all data available through the standard configurations A, B and C including the optional functionalities. The names of the standard configurations are DE01, DE02 and DE03 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 RED615 Ver.3.0 DE01-03

Table 2: Binary inputs

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
Binary signal transfer supervision			
LD0.BSTGGIO1.Alm1.stVal	BSTGGIO1.SEND_SIG_A	Send signal alarm, stVal	1=Send alarm
LD0.BSTGGIO1.Alm2.stVal	BSTGGIO1.RECV_SIG_A	Receive signal alarm, stVal	1=Receive alarm
Circuit breaker related signals (CB pos is found in AI)			
CTRL.CBCILO1.EnaCls.stVal	CBXCBBR1.ENA_OPEN	CBXCBBR1, ENA_CLOSE, stVal	1 = Close enabled
CTRL.CBCILO1.EnaOpn.stVal	CBXCBBR1.ENA_CLOSE	CBXCBBR1, ENA_OPEN, stVal	1 = Open enabled
CTRL.CBCILO1.ItlByPss.stVal	CBXCBBR1.ITL_BYPASS	CBXCBBR1, ITL_BYPASS, stVal	1 = Interlocking bypassed
CTRL.CBCSW1.Pos.stSeld	CBXCBBR1.SELECTED	CBXCBBR1, Switch, general, stSeld	1 = CB control selected
CTRL.CBXCBBR1.BlkCls.stVal	CBXCBBR1.BLK_CLOSE	CBXCBBR1, Block closing, stVal	1 = Close blocked
CTRL.CBXCBBR1.BlkOpn.stVal	CBXCBBR1.BLK_OPEN	CBXCBBR1, Block opening, stVal	1 = Open blocked
Circuit breaker condition monitoring			
CTRL.CCBBRBF1.OpEx.general	CCBBRBF1.TRBU	CCBBRBF1, Breaker failure trip (external trip), general	1 = Breaker failure trip
CTRL.CCBBRBF1.OpIn.general	CCBBRBF1.TRRET	CCBBRBF1, Operate, retrip (internal trip), general	1 = Operate, re-trip
CTRL.CCBBRBF1.Str.general	CCBBRBF1.CB_FAULT_AL	CCBBRBF1, 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
Autorecloser signals			
LD0.DARREC1.ActRec.stVal	DAAREC1.ACTIVE	DARREC1, Active reclose status, stVal	1=Reclose active
LD0.DARREC1.AROn.stVal	DARREC1.AR_ON	DARREC1, AR switched On, stVal	1=AR switched On
LD0.DARREC1.CBManCls.stVal	DARREC1.MAN_CB_CL	DARREC1, CB manually closed, stVal	1=CB manually closed
LD0.DARREC1.FrqOpAlm.stVal	DARREC1.FRQ_OP_ALM	DARREC1, Frequent operation counter alarm, stVal	1=Frequent operation alarm
LD0.DARREC1.LO.stVal	DARREC1.LOCKED	DARREC1, Lockout status, stVal	1=Lockout
LD0.DARREC1.Op.general	DARREC1.CLOSE_CB	DARREC1, Operate (close command to XCBR), general	1=Close command to CB
LD0.DARREC1.OpOpn.general	DARREC1.OPEN_CB	DARREC1, Operate (open command to XCBR), general	1=Open command to CB
LD0.DARREC1.PrgCutOut.stVal	DARREC1.CUTOUT_INPRO	DARREC1, Cutout time in progress, stVal	1=Cutout time in progress
LD0.DARREC1.PrgDsr.stVal	DARREC1.DISCR_INPRO	DARREC1, Discrimination time in progress, stVal	1=Discr. time in progress
LD0.DARREC1.PrgRec.stVal	DARREC1.INPRO	DARREC1, In progress status, stVal	1=In progress
LD0.DARREC1.PrgRec1.stVal	DARREC1.INPRO_1	DARREC1, In progress 1st reclose, stVal	1=In progress
LD0.DARREC1.PrgRec2.stVal	DARREC1.INPRO_2	DARREC1, In progress 2nd reclose, stVal	1=In progress
LD0.DARREC1.PrgRec3.stVal	DARREC1.INPRO_3	DARREC1, In progress 3rd reclose, stVal	1=In progress
LD0.DARREC1.PrgRec4.stVal	DARREC1.INPRO_4	DARREC1, In progress 4th reclose, stVal	1=In progress
LD0.DARREC1.PrgRec5.stVal	DARREC1.INPRO_5	DARREC1, In progress 5th reclose, stVal	1=In progress

Table continues on next page

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
LD0.DARREC1.RdyRec.stVal	DARREC1.READY	DARREC1, Ready reclose status, stVal	1=Reclose ready
LD0.DARREC1.SucRec.stVal	DARREC1.SUC_RECL	DARREC1, Successful reclose status, stVal	1=Successful reclose
LD0.DARREC1.UnsCBCIs.stVal	DARREC1.UNSUC_CB	DARREC1, Unsuccessful CB closing status, stVal	1=Unsuccessful CB closing
LD0.DARREC1.UnsRec.stVal	DARREC1.UNSUC_RECL	DARREC1, Unsuccessful reclose status, stVal	1=Unsuccessful reclose
LD0.DARREC1.WMstr.stVal	DARREC1.CMD_WAIT	DARREC1, Master signal to follower, stVal	1=Master signal to follower
Directional earth-fault protection signals (3 stages), variant DE02			
LD0.DEFHPTOC1.Op.general	DEFHPDEF1.OPERATE	DEFHPDEF1, Operate, general	1 = Operate
LD0.DEFHPTOC1.Str.general	DEFHPDEF1.START	DEFHPDEF1, Start, general	1 = Start
LD0.DEFLPTOC1.Op.general	DEFLPDEF1.OPERATE	DEFLPDEF1, Operate, general	1 = Operate
LD0.DEFLPTOC1.Str.general	DEFLPDEF1.START	DEFLPDEF1, Start, general	1 = Start
LD0.DEFLPTOC2.Op.general	DEFLPDEF2.OPERATE	DEFLPDEF2, Operate, general	1 = Operate
LD0.DEFLPTOC2.Str.general	DEFLPDEF2.START	DEFLPDEF2, Start, general	1 = Start
Non-directional earth-fault and sensitive earth-fault protection signals (4 stages), variant DE03. (EFHPTOC1 also in DE02)			
LD0.EFHPTOC1.Op.general	EFHPTOC1.OPERATE	EFHPTOC1, Operate, general	1 = Operate
LD0.EFHPTOC1.Str.general	EFHPTOC1.START	EFHPTOC1, Start, general	1 = Start
LD0.EFIPTOC1.Op.general	EFIPTOC1.OPERATE	EFIPTOC1, Operate, general	1 = Operate
LD0.EFIPTOC1.Str.general	EFIPTOC1.START	EFIPTOC1, Start, general	1 = Start
LD0.EFLPTOC1.Op.general	EFLPTOC1.OPERATE	EFLPTOC1, Operate, general	1 = Operate
LD0.EFLPTOC1.Str.general	EFLPTOC1.START	EFLPTOC1, Start, general	1 = Start
LD0.EFLPTOC2.Op.general	EFLPTOC2.OPERATE	EFLPTOC2, Operate, general	1 = Operate
LD0.EFLPTOC2.Str.general	EFLPTOC2.START	EFLPTOC2, Start, general	1 = Start
Admittance based earth-fault protection (3 stages), variant DE02			
LD0.EFPADM1.Str.general	-	EFPADM1, Stage1 start	1 = Start
LD0.EFPADM1.Op.general	-	EFPADM1, Stage1 operate	1 = Operate
LD0.EFPADM2.Op.general	-	EFPADM1, Stage2 operate	1 = Start
LD0.EFPADM2.Str.general	-	EFPADM1, Stage2 start	1 = Operate
LD0.EFPADM3.Str.general	-	EFPADM1, Stage3 start	1 = Start
LD0.EFPADM3.Op.general	-	EFPADM1, Stage3 operate	1 = Operate
Transient/Intermittent earth-fault protection signals (1 stage), variant DE02			
LD0.INTRPTEF1.Op.general	INTRPTEF1.OPERATE	INTRPTEF1, Operate, general	1 = Operate
LD0.INTRPTEF1.Str.general	INTRPTEF1.START	INTRPTEF1, Start, general	1 = Start
Alarm LED states			
LD0.LEDGGIO1.SPCSO1.stVal	-	Alarm LEDs, LED 1, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO2.stVal	-	Alarm LEDs, LED 2, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO3.stVal	-	Alarm LEDs, LED 3, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO4.stVal	-	Alarm LEDs, LED 4, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO5.stVal	-	Alarm LEDs, LED 5, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO6.stVal	-	Alarm LEDs, LED 6, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO7.stVal	-	Alarm LEDs, LED 7, stVal	1 = LED On, 0 = LED Off

Table continues on next page

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
LD0.LEDGGIO1.SPCSO8.stVal	-	Alarm LEDs, LED 8, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO9.stVal	-	Alarm LEDs, LED 9, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO10.stVal	-	Alarm LEDs, LED 10, stVal	1 = LED On, 0 = LED Off
LD0.LEDGGIO1.SPCSO11.stVal	-	Alarm LEDs, LED 11, stVal 1 = LED On, 0 = LED Off	Global conditioning signals
LD0.LEDPTRC1.Op.general	-	Global conditioning, Operate, general	1 = Operate (general)
LD0.LEDPTRC1.Op.phsA	-	Global conditioning, Operate, phsA	1 = Operate (phsA)
LD0.LEDPTRC1.Op.phsB	-	Global conditioning, Operate, phsB	1 = Operate (phsB)
LD0.LEDPTRC1.Op.phsC	-	Global conditioning, Operate, phsC	1 = Operate (phsC)
LD0.LEDPTRC1.Str.general	-	Global conditioning, Start, general	1 = Start (general)
LD0.LEDPTRC1.Str.phsA	-	Global conditioning, Start, phsA	1 = Start (phsA)
LD0.LEDPTRC1.Str.phsB	-	Global conditioning, Start, phsB	1 = Start (phsB)
LD0.LEDPTRC1.Str.phsC	-	Global conditioning, Start, phsC	1 = Start (phsC)
CTRL.LLN0.Loc.stVal	-	Local/remote (also present in IIN)	1 = Local
CTRL.LLN0.Loc1.stVal	-	Control LLN0, Local / remote, stVal	1 = Off
LD0.LLN0.SetChg.stVal	-	Parameter settings supervision	1 = Settings changed
LD0.LLN0.SetSeld.stVal	-	General, Settings change, stVal	1 = Settings reserved
LD0.LLN0.SetSeld.stVal	-	General, Settings reservation, stVal	1 = Settings reserved
LD0.LNPDIF1.Op.general	-	Line differential protection with stabilized and inst. stages	1 = Operate
LD0.LNPDIF1.Str.general	-	LNPLDF1, Operate, general	1 = Start
LD0.MVGAPC1.Q1.stVal	-	LNPLDF1, Start, general	1 = Start
LD0.MVGAPC1.Q2.stVal	-	Multipurpose inputs (All variants)	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q3.stVal	-	MVGAPC1, Input 1 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q4.stVal	-	MVGAPC1, Input 2 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q5.stVal	-	MVGAPC1, Input 3 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q6.stVal	-	MVGAPC1, Input 4 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q7.stVal	-	MVGAPC1, Input 5 [stVal]	0 = Input OFF, 1 = Input ON
LD0.MVGAPC1.Q8.stVal	-	MVGAPC1, Input 6 [stVal]	0 = Input OFF, 1 = Input ON
	-	MVGAPC1, Input 7 [stVal]	0 = Input OFF, 1 = Input ON
	-	MVGAPC1, Input 8 [stVal]	0 = Input OFF, 1 = Input ON
LD0.NSPTOC1.Op.general	-	Negative-sequence overcurrent protection signals (2 stages)	1 = Operate
LD0.NSPTOC1.Str.general	-	NSPTOC1, Operate, general	1 = Start
LD0.NSPTOC2.Op.general	-	NSPTOC1, Start, general	1 = Operate
LD0.NSPTOC2.Str.general	-	NSPTOC2, Operate, general	1 = Start
	-	NSPTOC2, Start, general	1 = Start
LD0.PCSRTPC1.HealthAlm.stVal	-	Protection communication supervision	1 = Alarm
LD0.PDNSPTOC1.Op.general	-	PCSRTPC1, ALARM, stVal	1 = Alarm
	-	Phase discontinuity protection, variants DE02_03	1 = Operate
	-	PDNSPTOC1, Operate, general	1 = Operate

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
LD0.PDNSPTOC1.Str.general	PDNSPTOC1.START	PDNSPTOC1, Start, general	1 = Start
Phase overcurrent protection signals (3 stages)			
LD0.PHPTOC1.Op.general	PHPTOC1.OPERATE	PHPTOC1, Operate, general	1 = Operate
LD0.PHPTOC1.Str.general	PHPTOC1.START	PHPTOC1, Start, general	1 = Start
LD0.PHPTOC2.Op.general	PHPTOC2.OPERATE	PHPTOC2, Operate, general	1 = Operate
LD0.PHPTOC2.Str.general	PHPTOC2.START	PHPTOC2, 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
Disturbance recorder			
DR.RDRE1.RcdMade.stVal	-	Disturbance recorder, Recording made, stVal	1 = Recording made
Residual current limit supervision, variants DE02,03			
LD0.RESCMMXU1.HiAlm.stVal	RESCMMXU1.HIGH_ALARM	RESCMMXU1, High alarm, stVal	1 = High alarm
LD0.RESCMMXU1.HiWrn.stVal	RESCMMXU1.HIGH_WARN	RESCMMXU1, High warning, stVal	1 = High warning
Residual voltage limit supervision, variant DE02			
LD0.RESVMMXU1.HiAlm.stVal	RESVMMXU1.HIGH_ALARM	RESVMMXU1, High alarm, stVal	1 = High alarm
LD0.RESVMMXU1.HiWrn.stVal	RESVMMXU1.HIGH_WARN	RESVMMXU1, High warning, stVal	1 = High warning
Residual overvoltage protection, 3 stages, variant DE02			
LD0.ROVPTOV1.Op.general	-	ROVPTOV1, Operate, general	1 = Operate
LD0.ROVPTOV1.Str.general	-	ROVPTOV1, Start, general	1 = Start
LD0.ROVPTOV2.Op.general	-	ROVPTOV2, Operate, general	1 = Operate
LD0.ROVPTOV2.Str.general	-	ROVPTOV2, Start, general	1 = Start
LD0.ROVPTOV3.Op.general	-	ROVPTOV3, Operate, general	1 = Operate
LD0.ROVPTOV3.Str.general	-	ROVPTOV3, Start, general	1 = Start
Circuit breaker condition monitoring			
LD0.SSCBR1.APwrAlm.stVal	SSCBR1.IPOW_ALM	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.CBIfAlm.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.OprAlm.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
Thermal overload protection, variants DE02,03			
LD0.T1PTTR1.AlmTm.general	T1PTTR1.ALARM	T1PTTR1, Thermal Alarm, general	1 = Alarm

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
LD0.T1PTR1.Op.general	T1PTR1.OPERATE	T1PTR1, Operate, general	1 = Operate
LD0.T1PTR1.Str.general	T1PTR1.START	T1PTR1, Start, general	1 = Start
Trip circuit supervision			
LD0.TCSSCBR1.CirAlm.stVal	TCSSCBR1.ALARM	TCSSCBR1, Alarm, stVal	1 = Alarm
LD0.TCSSCBR2.CirAlm.stVal	TCSSCBR2.ALARM	TCSSCBR2, 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 = Operate output
LD0.TRPPTRC2.Op.general	-	TRPPTRC2, Operate input signal, general	1 = Operate input
LD0.TRPPTRC2.Tr.general	-	TRPPTRC2, General trip output signal, general	1 = Operate output
Raw I/O signals			
LD0.XGGIO100.SPCSO1.stVal	-	X100 (PSM), X100-Output 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCSO2.stVal	-	X100 (PSM), X100-Output 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCSO3.stVal	-	X100 (PSM), X100-Output 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCSO4.stVal	-	X100 (PSM), X100-Output 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCSO5.stVal	-	X100 (PSM), X100-Output 5, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.SPCSO6.stVal	-	X100 (PSM), X100-Output 6, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd1.stVal	-	X110 (BIO), X110-Input 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd2.stVal	-	X110 (BIO), X110-Input 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd3.stVal	-	X110 (BIO), X110-Input 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd4.stVal	-	X110 (BIO), X110-Input 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd5.stVal	-	X110 (BIO), X110-Input 5, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd6.stVal	-	X110 (BIO), X110-Input 6, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd7.stVal	-	X110 (BIO), X110-Input 7, stVal	1 = ON, 0 = OFF
LD0.XGGIO100.lnd8.stVal	-	X110 (BIO), X110-Input 8, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.SPCSO1.stVal	-	X110 (BIO), X110-Output 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.SPCSO2.stVal	-	X110 (BIO), X110-Output 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.SPCSO3.stVal	-	X110 (BIO), X110-Output 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO110.SPCSO4.stVal	-	X110 (BIO), X110-Output 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO120.lnd1.stVal	-	X120 (AIM), X120-Input 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO120.lnd2.stVal	-	X120 (AIM), X120-Input 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO120.lnd3.stVal	-	X120 (AIM), X120-Input 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd1.stVal	-	X130 (BIO), X130-Input 1, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd2.stVal	-	X130 (BIO), X130-Input 2, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd3.stVal	-	X130 (BIO), X130-Input 3, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd4.stVal	-	X130 (BIO), X130-Input 4, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd5.stVal	-	X130 (BIO), X130-Input 5, stVal	1 = ON, 0 = OFF
LD0.XGGIO130.lnd6.stVal	-	X130 (BIO), X130-Input 6, stVal	1 = ON, 0 = OFF

Table continues on next page

Section 2 DNP3 data mappings

IEC61850 name	AFL-Common SA name	IEC61850 LN desc, DO desc, DA name	Value
LD0.XGGIO130.SPCSO1.sVal	-	X130 (BIO), X130-Output 1, sVal	1 = ON, 0 = OFF
LD0.XGGIO130.SPCSO2.sVal	-	X130 (BIO), X130-Output 2, sVal	1 = ON, 0 = OFF
LD0.XGGIO130.SPCSO3.sVal	-	X130 (BIO), X130-Output 3, sVal	1 = ON, 0 = OFF

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	-	CBXCBR1_CB control
Reset current max. demand values		
LD0.CMSTA1.RecRs.Oper.ctiVal	-	CMMXU1.Reset CMMXU1 max.demands
Autoreclosing reset signals		
LD0.DARREC1.RsCnt.Oper.ctiVal	-	DARREC1.reset counters, Oper.ctiVal
LD0.DARREC1.RsRec.Oper.ctiVal	-	DARREC1.reset, Oper.ctiVal
Active parameter setting group control		
LD0.DNPGGIO1.ActSG1.ctiVal	-	Active parameter setting group 1
LD0.DNPGGIO1.ActSG2.ctiVal	-	Active parameter setting group 2
LD0.DNPGGIO1.ActSG3.ctiVal	-	Active parameter setting group 3
LD0.DNPGGIO1.ActSG4.ctiVal	-	Active parameter setting group 4
LD0.DNPGGIO1.ActSG5.ctiVal	-	Active parameter setting group 5
LD0.DNPGGIO1.ActSG6.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, Oper.ctiVal
Disturbance recorder, clear memory and trig recording		
DR.RDRE1.MemClr.Oper.ctiVal	-	Disturbance recorder, Disturbance records, Oper.ctiVal
DR.RDRE1.RcdTrg.Oper.ctiVal	-	Disturbance recorder, Trig recording, Oper.ctiVal
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
LD0.SRGAPC1.Rs8.ctiVal	-	Reset SRGAPC1 flip-flop 8
Reset signals of circuit breaker condition monitoring		
LD0.SSCBR1.RsAccAPwr.Oper.ctiVal	SSCBR1.RST_IPOW	SSCBR1, Reset accumulation energy
LD0.SSCBR1.RsCBWear.Oper.ctiVal	SSCBR1.RST_CB_WEAR	SSCBR1, Reset CB remaining life and operation counter
LD0.SSCBR1.RsSprChaTm.Oper.ctiVal	SSCBR1.RST_SPR_T	SSCBR1, SSCBR1 Spring charge time alarm
LD0.SSCBR1.RsTrvTm.Oper.ctiVal	SSCBR1.RST_TRV_T	SSCBR1, SSCBR1 Travel time alarm

Table 4: Analog inputs

IEC 61850 name	AFL-Common SA name	Description	Scaling function	Argument 1 (min value)	Argument 2 (max value)	Argument 3	Argument 4
CB position							
CTRL.CBCSWI1.Pos.stVal	CBXCBR1.POSITION	CB Switch position (4-pole), stVal	Ratio	0	3	0	3
Phase current measurements							
LD0.CMMXU1.A.phsA.instCVal.mag.f	CMMXU1.I_INST_A	Phase currents, phsA.instCVal.mag.f	Ratio	0	40	0	4000
LD0.CMMXU1.A.phsB.instCVal.mag.f	CMMXU1.I_INST_B	Phase currents, phsB.instCVal.mag.f	Ratio	0	40	0	4000
LD0.CMMXU1.A.phsC.instCVal.mag.f	CMMXU1.I_INST_C	Phase currents, phsC.instCVal.mag.f	Ratio	0	40	0	4000
Sequence of current measurements							
LD0.CSMSQ11.SeqA.c1.instCVal.mag.f	CMSQ11.I1_INST	Positive Sequence Current, c1.instCVal.mag.f	Ratio	0	40	0	4000
LD0.CSMSQ11.SeqA.c2.instCVal.mag.f	CMSQ11.I2_INST	Negative Sequence Current, c2.instCVal.mag.f	Ratio	0	40	0	4000
LD0.CSMSQ11.SeqA.c3.instCVal.mag.f	CMSQ11.I3_INST	Zero Sequence Current, c3.instCVal.mag.f	Ratio	0	40	0	4000
Autoreclosing							
LD0.DARREC1.AutoRecSt.stVal	DARREC1.STATUS	DARREC1, Auto Reclosing Status, stVal	Ratio	-2	4	-2	4
LD0.DARREC1.ShotPntr.stVal	DARREC1.SHOT_PTR	DARREC1, Shot pointer value, stVal	Ratio	0	65535	0	65535
Active parameter setting group							
LD0.DNPGGIO1.ActSG.stVal	-	Active parameter setting group value	Ratio	1	6	1	6
Disconnecter positions							
CTRL.DCSXSWI1.Pos.stVal	DCSXSXI1.POSITION	Disconnecter 1 position (4-pole), stVal	Ratio	0	3	0	3
CTRL.DCSXSWI2.Pos.stVal	DCSXSXI2.POSITION	Disconnecter 2 position (4-pole), stVal	Ratio	0	3	0	3
CTRL.DCSXSWI3.Pos.stVal	DCSXSXI3.POSITION	Disconnecter 3 position (4-pole), stVal	Ratio	0	3	0	3
CTRL.ESSXSWI1.Pos.stVal	ESSXSXI1.POSITION	Earth switch position (4-pole), stVal	Ratio	0	3	0	3
Device diagnostics							
LD0.LPHD1.NumCmpChg.stVal	-	Number of composition changes, stVal	Ratio	0	65535	0	65535
LD0.LPHD1.NumPwrUp.stVal	-	Number of Power ups, stVal	Ratio	0	65535	0	65535
LD0.LPHD1.PhyHealth1.stVal	-	Latest Warning code, stVal	Ratio	0	65535	0	65535
LD0.LPHD1.PhyHealth2.stVal	-	Latest Fault code, stVal	Ratio	0	65535	0	65535
LD0.LPHD1.WacTrg.stVal	-	Number of watchdog device resets detected, stVal	Ratio	0	65535	0	65535
LD0.LPHD1.WrmStr.stVal	-	Number of warm starts, stVal	Ratio	0	65535	0	65535
Disturbance recorder diagnostic							
DR.RDRE1.FINum.stVal	-	Disturbance recorder, Number of recordings, stVal	Ratio	0	65535	0	65535
DR.RDRE1.MemUsed.stVal	-	Disturbance recorder, Rec. memory used, stVal	Ratio	0	100	0	100
Residual current and voltage measurements							
LD0.RESCMXXU1.A.res.instCVal.mag.f	RESCMXXU1.I0_INST	Residual current, res.instCVal.mag.f	Ratio	0	40	0	4000
LD0.RESVMMXU1.Prv.res.instCVal.mag.f	RESVMMXU1.U0_INST	Residual voltage, res.instCVal.mag.f	Ratio	0	4	0	400
Circuit-breaker condition monitoring values							
LD0.SSCBR1.OpCntr.stVal	SSCBR1.NO_OPR	Number of CB operation cycle	Ratio	0	99999	0	99999

Table continues on next page

IEC 61850 name	AFL-Common SA name	Description	Scaling function	Argument 1 (min value)	Argument 2 (max value)	Argument 3	Argument 4
Thermal protection							
LD0.T1PTTR1.Tmp.mag.f	-	T1PTTR1, Temperature	Ratio	-100	9999.9	-1000	99999
LD0.T1PTTR1.TmpRI.mag.f	-	T1PTTR1, Relative temperature	Ratio	0	99.9	0	999

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:	RED615
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"> <input type="radio"/> Configurable <input type="radio"/> Only certain objects <input type="radio"/> Sometimes (attach explanation) <input type="radio"/> ENABLE/DISABLE UNSOLICITED function codes supported 	<ul style="list-style-type: none"> <input type="radio"/> When device restarts <input type="radio"/> When status flags change <p>No other options are permitted.</p>																					
<p>Default counter object/variation:</p> <ul style="list-style-type: none"> <input checked="" type="radio"/> No counters reported <input type="radio"/> Configurable <input type="radio"/> Default object Default variation: <input type="radio"/> Point-by-point list attached 	<p>Counters roll over at:</p> <ul style="list-style-type: none"> <input checked="" type="radio"/> No counters reported <input type="radio"/> Configurable (attach explanation) <input type="radio"/> 16 bits <input type="radio"/> 32 bits <input type="radio"/> Other value: _____ <input type="radio"/> Point-by-point list attached 																					
<p>Sends multi-fragment responses:</p> <ul style="list-style-type: none"> <input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Configurable 																						
<p>Sequential file transfer support:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">Append file mode</td> <td style="width: 10%;"><input type="radio"/> Yes</td> <td style="width: 10%;"><input checked="" type="radio"/> No</td> </tr> <tr> <td>Custom status code strings</td> <td><input type="radio"/> Yes</td> <td><input checked="" type="radio"/> No</td> </tr> <tr> <td>Permissions field</td> <td><input type="radio"/> Yes</td> <td><input checked="" type="radio"/> No</td> </tr> <tr> <td>File events assigned to class</td> <td><input type="radio"/> Yes</td> <td><input checked="" type="radio"/> No</td> </tr> <tr> <td>File events send immediately</td> <td><input type="radio"/> Yes</td> <td><input checked="" type="radio"/> No</td> </tr> <tr> <td>Multiple blocks in a fragment</td> <td><input type="radio"/> Yes</td> <td><input checked="" type="radio"/> No</td> </tr> <tr> <td>Max number of files open</td> <td colspan="2">0</td> </tr> </table>		Append file mode	<input type="radio"/> Yes	<input checked="" type="radio"/> No	Custom status code strings	<input type="radio"/> Yes	<input checked="" type="radio"/> No	Permissions field	<input type="radio"/> Yes	<input checked="" type="radio"/> No	File events assigned to class	<input type="radio"/> Yes	<input checked="" type="radio"/> No	File events send immediately	<input type="radio"/> Yes	<input checked="" type="radio"/> No	Multiple blocks in a fragment	<input type="radio"/> Yes	<input checked="" type="radio"/> No	Max number of files open	0	
Append file mode	<input type="radio"/> Yes	<input checked="" type="radio"/> No																				
Custom status code strings	<input type="radio"/> Yes	<input checked="" type="radio"/> No																				
Permissions field	<input type="radio"/> Yes	<input checked="" type="radio"/> No																				
File events assigned to class	<input type="radio"/> Yes	<input checked="" type="radio"/> No																				
File events send immediately	<input type="radio"/> Yes	<input checked="" type="radio"/> No																				
Multiple blocks in a fragment	<input type="radio"/> Yes	<input checked="" type="radio"/> 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
AR	Autoreclosing
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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