Relion® Protection and Control

650 series
DNP3 Point List Manual

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

Table of contents

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

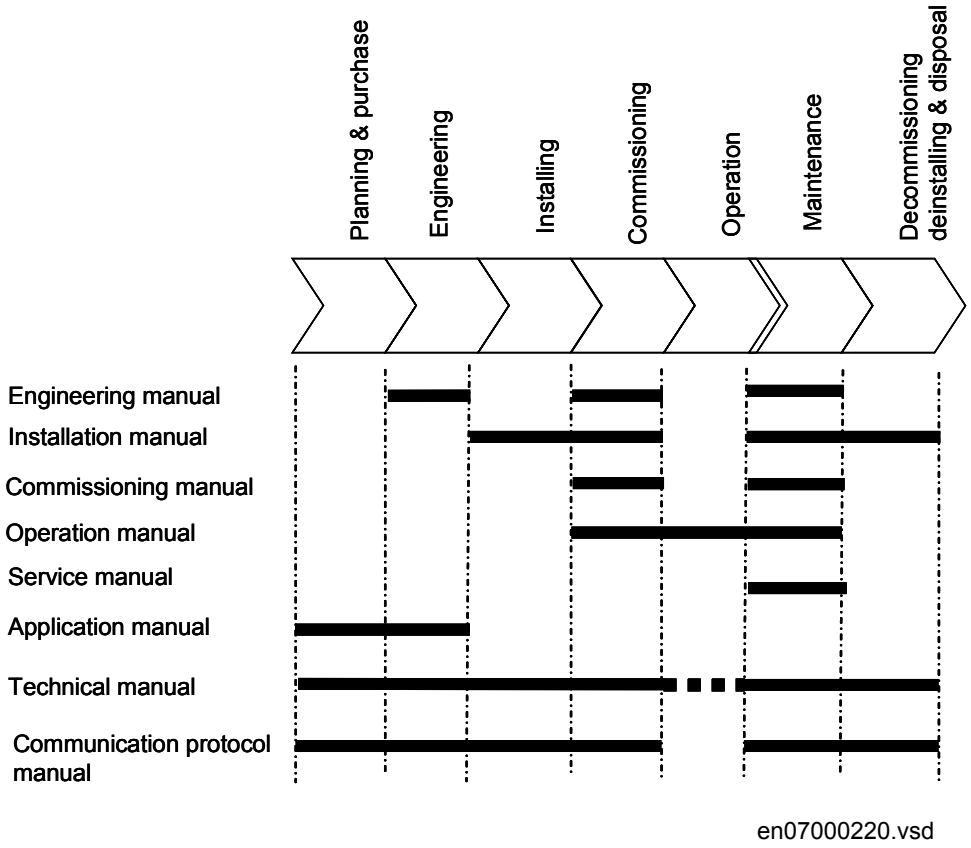

Figure 1: The intended use of manuals in different lifecycles

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 60870-5-103, IEC 61850 and DNP3.

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.

1.3.2 Document revision history

Document revision/date	History
-/June 2012	First release

1.3.3 Related documents

Documents related to REB650	Identity number
Application manual	1MRK 505 276-UEN
Technical manual	1MRK 505 277-UEN
Commissioning manual	1MRK 505 278-UEN
Product Guide, configured	1MRK 505 279-BEN
Type test certificate	1MRK 505 279-TEN
Application notes for Circuit Breaker Control	1MRG006806

Documents related to REL650	Identity number
Application manual	1MRK 506 329-UEN
Technical manual	1MRK 506 330-UEN
Commissioning manual	1MRK 506 331-UEN
Product Guide, configured	1MRK 506 332-BEN
Type test certificate	1MRK 506 332-TEN
Application notes for Circuit Breaker Control	1MRG006806

Documents related to RET650	Identity number
Application manual	1MRK 504 128-UEN
Technical manual	1MRK 504 129-UEN
Commissioning manual	1MRK 504 130-UEN
Product Guide, configured	1MRK 504 131-BEN
Type test certificate	1MRK 504 131-TEN
Application notes for Circuit Breaker Control	1MRG006806

Documents related to REC650	Identity number
Application manual	1MRK 511 262-UEN
Technical manual	1MRK 511 263-UEN
Commissioning manual	1MRK 511 264-UEN
Product Guide	1MRK 511 265-BEN
Type test certificate	1MRK 511 265-TEN

Documents related to REG650	Identity number
Application manual	1MRK 502 042-UEN
Technical manual	1MRK 502 043-UEN
Commissioning manual	1MRK 502 044-UEN
Product Guide	1MRK 502 045-BEN
Type test certificate	1MRK 502 045-TEN
Rotor Earth Fault Protection with Injection Unit RXTTE4 and REG670	1MRG001910
Application notes for Circuit Breaker Control	1MRG006806

Documents related to REQ650	Identity number
Application manual	1MRK 505 280-UEN
Technical manual	1MRK 505 281-UEN
Commissioning manual	1MRK 505 282-UEN
Product Guide	1MRK 505 283-BEN
Type test certificate	1MRK 505 283-TEN
Application notes for Circuit Breaker Control	1MRG006806

650 series manuals	Identity number
Communication protocol manual, DNP3	1MRK 511 257-UEN
Communication protocol manual, IEC 61850–8–1	1MRK 511 258-UEN
Communication protocol manual, IEC 60870-5-103	1MRK 511 259-UEN
Cyber Security deployment guidelines	1MRK 511 268-UEN
Point list manual, DNP3	1MRK 511 260-UEN

Table continues on next page

650 series manuals	Identity number
Engineering manual	1MRK 511 261-UEN
Operation manual	1MRK 500 095-UEN
Installation manual	1MRK 514 015-UEN

1.4 Symbols and conventions

1.4.1 Symbols

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

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

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

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

1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms in this manual are spelled out in the glossary. The glossary also contains definitions of important terms.
- Push button navigation in the LHMI menu structure is presented by using the push button icons.
  To navigate between the options, use ↑ and ↓.
- HMI menu paths are presented in bold.
  Select **Main menu/Settings**.
- LHMI messages are shown in Courier font.
  To save the changes in non-volatile memory, select `Yes` and press ↵.
- Parameter names are shown in italics.

The function can be enabled and disabled with the *Operation* setting.

- The ^ character in front of an input or output signal name in the function block symbol given for a function, indicates that the user can set an own signal name in PCM600.
- The * character after an input or output signal name in the function block symbol given for a function, indicates that the signal must be connected to another function block in the application configuration to achieve a valid application configuration.

1.4.3 Functions included in 650 series IEDs

Table 1: Main protection functions

IEC 61850 / Function block name	ANSI	Function description
Differential protection		
T2WPDIF	87T	Transformer differential protection, two winding
T3WPDIF	87T	Transformer differential protection, three winding
REFPDIF	87N	Restricted earth fault protection, low impedance
HZPDIF	87	1Ph High impedance differential protection
GENPDIF	87G	Generator differential protection
Impedance protection		
ZQMPDIS	21	Five-zone distance protection, Quadrilateral and Mho characteristic
FDPSPDIS	21	Phase selection with load enchroachment, quadrilateral characteristic
FMPSPDIS	21	Faulty phase identification with load enchroachment for mho
ZDARDIR	21	Additional distance protection directional function for earth faults
ZDNRDIR	21	Directional impedance quadrilateral and mho
PPLPHIZ		Phase preference logic
ZMRPSB	68	Power swing detection
ZCVPSOF		Automatic switch onto fault logic, voltage-and current-based
ZGCPDIS	21G	Underimpedance protection for generators and transformers
LEXPDIS	40	Loss of excitation
OOSPPAM	78	Out-of-step protection
LEPDIS		Load enchroachment

Table 2: Backup protection functions

IEC 61850 / Function block name	ANSI	Function description
Current protection		
PHPIOC	50	Instantaneous phase overcurrent protection
SPTPIOC	50	Instantaneous phase overcurrent protection
Table continues on next page		

IEC 61850 / Function block name	ANSI	Function description
OC4PTOC	51/67	Four-step phase overcurrent protection
OC4SPTOC	51/67	Four-step phase overcurrent protection
EFPIOC	50N	Instantaneous residual overcurrent protection
EF4PTOC	51N/67N	Four-step directional residual overcurrent protection
SDEPSDE	67N	Sensitive directional residual overcurrent and power protection
UC2PTUC	37	Time-delayed two-step undercurrent protection
LCPTTR	26	Thermal overload protection, one time constant, Celsius
LFPTTR	26	Thermal overload protection, one time constant, Fahrenheit
TRPTTR	49	Thermal overload protection, two time constants
CCRBRF	50BF	Breaker failure protection
CSPRBRF	50BF	Breaker failure protection
STBPTOC	50STB	Stub protection
CCRPLD	52PD	Pole discordance protection
BRCPTOC	46	Broken conductor check
GUPPDUP	37	Directional underpower protection
GOPPDOP	32	Directional overpower protection
DNSPTOC	46	Negative sequence-based overcurrent function
AEGGAPC	50AE	Accidental energizing protection for synchronous generator
NS2PTOC	46I2	Negative-sequence time overcurrent protection for machines
VR2PVOC	51V	Voltage-restrained time overcurrent protection
Voltage protection		
UV2PTUV	27	Two-step undervoltage protection
OV2PTOV	59	Two-step overvoltage protection
ROV2PTOV	59N	Two-step residual overvoltage protection
OEXPVPH	24	Overexcitation protection
LOVPTUV	27	Loss-of-voltage check
STEFPHIZ	59THD	100% Stator earth fault protection, 3rd harmonic based
Frequency protection		
SAPTUF	81	Underfrequency function
SAPTOF	81	Overfrequency function
SAPFRC	81	Rate-of-change frequency protection

Table 3: Control and monitoring functions

IEC 61850 / Function block name	ANSI	Function description
Control		
SESRSYN	25	Synchrocheck, energizing check and synchronizing
SMBRREC	79	Autorecloser
STBRREC	79	Autorecloser
SCILO	3	Logical node for interlocking
BB_ES	3	Interlocking for busbar earthing switch
A1A2_BS	3	Interlocking for bus-section breaker
A1A2_DC	3	Interlocking for bus-section disconnector
ABC_BC	3	Interlocking for bus-coupler bay
BH_CONN	3	Interlocking for 1 1/2 breaker diameter
BH_LINE_A	3	Interlocking for 1 1/2 breaker diameter
BH_LINE_B	3	Interlocking for 1 1/2 breaker diameter
DB_BUS_A	3	Interlocking for double CB bay
DB_BUS_B	3	Interlocking for double CB bay
DB_LINE	3	Interlocking for double CB bay
ABC_LINE	3	Interlocking for line bay
AB_TRAFO	3	Interlocking for transformer bay
SCSWI		Switch controller
SXCBR		Circuit breaker
SXSWI		Circuit switch
POS_EVAL		Evaluation of position indication
SELGGIO		Select release
QCBAY		Bay control
LOCREM		Handling of LR-switch positions
LOCREMCTRL		LHMI control of PSTO
TR8ATCC	90	Automatic voltage control for tap changer, parallel control
TCMYLTC	84	Tap changer control and supervision, 6 binary inputs
SLGGIO		Logic-rotating Switch for function selection and LHMI presentation
VSGGIO		Selector mini switch extension
DPGGIO		IEC61850 generic communication I/O functions double point
SPC8GGIO		Single-point generic control 8 signals
AUTOBITS		AutomationBits, command function for DNP3.0
I103CMD		Function commands for IEC60870-5-103
I103IEDCMD		IED commands for IEC60870-5-103
I103USRCMD		Function commands user defined for IEC60870-5-103
I103GENCMD		Function commands generic for IEC60870-5-103
I103POSCMD		IED commands with position and select for IEC60870-5-103

Table continues on next page

IEC 61850 / Function block name	ANSI	Function description
Secondary system supervision		
CCSRDIF	87	Current circuit supervision
SDDRFUF		Fuse failure supervision
TCSSCBR		Breaker close/trip circuit monitoring
Logic		
SMPPTRC	94	Tripping logic
SPTPTRC	94	Tripping logic
TMAGGIO		Trip matrix logic
OR		Configurable logic blocks, OR
INVERTER		Configurable logic blocks, Inverter
PULSETIMER		Configurable logic blocks, PULSETIMER
GATE		Configurable logic blocks, Controllable gate
XOR		Configurable logic blocks, exclusive OR
LOOPDELAY		Configurable logic blocks, loop delay
TimerSet		Configurable logic blocks, timer
AND		Configurable logic blocks, AND
SRMEMORY		Configurable logic blocks, set-reset memory
RSMEMORY		Configurable logic blocks, reset-set memory
FXDSIGN		Fixed-signal function block
B16I		Boolean 16 to Integer conversion
B16IFCVI		Boolean 16 to Integer conversion with logic node representation
IB16A		Integer to Boolean 16 conversion
IB16FCVB		Integer to boolean 16 conversion with logic node representation
Monitoring		
CVMMXN		Measurements
CMMXU		Phase current measurement
VMMXU		Phase-phase voltage measurement
CMSQI		Current sequence component measurement
VMSQI		Voltage sequence measurement
VNMMXU		Phase-neutral voltage measurement
AISVBAS		Function block for service values presentation of the analog inputs
TM_P_P2		Function block for service value presentation of primary analog inputs 600TRM
AM_P_P4		Function block for service value presentation of primary analog inputs 600AIM
TM_S_P2		Function block for service value presentation of secondary analog inputs 600TRM
AM_S_P4		Function block for service value presentation of secondary analog inputs 600AIM
CNTGGIO		Event counter
DRPRDRE		Disturbance report
AxRADR		Analog input signals
Table continues on next page		

IEC 61850 / Function block name	ANSI	Function description
BxRBDR		Binary input signals
SPGGIO		IEC61850 generic communication I/O functions
SP16GGIO		IEC61850 generic communication I/O functions 16 inputs
MVGGIO		IEC61850 generic communication I/O functions
MVEXP		Measured value expander block
LMBRFLO		Fault locator
SPVNZBAT		Station battery supervision
SSIMG	63	Insulation gas-monitoring function
SSIML	71	Insulation liquid-monitoring function
SSCBR		Circuit breaker condition monitoring
I103MEAS		Measurands for IEC60870-5-103
I103MEASUSR		Measurands user defined signals for IEC60870-5-103
I103AR		Function status auto-recloser for IEC60870-5-103
I103EF		Function status earth-fault for IEC60870-5-103
I103FLTPROT		Function status fault protection for IEC60870-5-103
I103IED		IED status for IEC60870-5-103
I103SUPERV		Supervision status for IEC60870-5-103
I103USRDEF		Status for user defiend signals for IEC60870-5-103
Metering		
PCGGIO		Pulse counter logic
ETPMMTR		Function for energy calculation and demand handling

Table 4: Designed to communicate

IEC 61850 / Function block name	ANSI	Function description
Station communication		
IEC61850-8-1		IEC61850 communication protocol
DNPSER DNPGEN RS485DNP DNPFREC CH1TCP - CH4TCP OPTICALDNP MSTSERIAL MST1TCP - MST4TCP RS485GEN OPTICALPROT RS485PROT		DNP3.0 for serial communication EIA485 DNP3.0 for TCP/IP communication protocol DNP3.0 for EIA-485 communication protocol DNP3.0 fault records for TCP/IP communication protocol DNP3.0 for TCP/IP communication protocol DNP3.0 for TCP/IP communication protocol DNP3.0 for optical RS-232 communication protocol DNP3.0 for serial communication protocol RS485 Operation selection for optical serial Operation selection for RS485
DNPFREC		DNP3.0 fault records for TCP/IP communication protocol
OPTICAL103		IEC60870-5-103 Optical serial communication
RS485103		IEC60870-5-103 serial communication for RS485
GOOSEINTLKRCV		Horizontal communication via GOOSE for interlocking
Table continues on next page		

IEC 61850 / Function block name	ANSI	Function description
GOOSEBINRCV		GOOSE binary receive
GOOSEVCTRCONF		GOOSE VCTR configuration for send and receive
VCTRSEND		Voltage control sending block for GOOSE
GOOSEVCTRRCV		Voltage control receiving block for GOOSE
ETHFRNT ETHLAN1 GATEWAY		Ethernet configuration of front port, LAN1 port and gateway
GOOSEDPRCV		GOOSE function block to receive a double point value
GOOSEINTRCV		GOOSE function block to receive an integer value
GOOSEMVRCV		GOOSE function block to receive a measurand value
GOOSESPRCV		GOOSE function block to receive a single point value
Scheme communication		
ZCPSCH	85	Scheme communication logic with delta based blocking scheme signal transmit
ZCRWPSCH	85	Current reversal and weak end infeed logic for distance protection
ZCWSPSCH	85	Current reversal and weak end infeed logic for distance protection
ZCLCPLAL		Local acceleration logic
ECPSCH	85	Scheme communication logic for residual overcurrent protection
ECRWPSCH	85	Current reversal and weak end infeed logic for residual overcurrent protection

Table 5: Basic IED functions

IEC 61850 / Function block name	Function description
Basic functions included in all products	
INTERRSIG	Self-supervision with internal event list
SELFSUPEVLST	Self-supervision with internal event list
TIMESYNCHGEN	Time synchronization
SNTP	Time synchronization
DTSBEGIN	Time synchronization
DTSEND	Time synchronization
TIMEZONE	Time synchronization
IRIG-B	Time synchronization
SETGRPS	Setting group handling
ACTVGRP	Parameter setting groups
TESTMODE	Test mode functionality
CHNGLCK	Change lock function
ATHSTAT	Authority status
ATHCHCK	Authority check
TERMINALID	IED identifiers
PRODINF	Product information
Table continues on next page	

IEC 61850 / Function block name	Function description
PRIMVAL	Primary system values
SMAI_20_1 - SMAI_20_12	Signal Matrix for analog inputs
3PHSUM	Summation block 3 phase
GBASVAL	Global base values for settings
DOSFRNT	Denial of service, frame rate control for front port
DOSLAN1	Denial of service, frame rate control for LAN1 port
DOSSCKT	Denial of service, socket flow control

Section 2 DNP3 data mappings

2.1 Overview

This document describes the DNP3 data points and structures available in REC650/REB650/REG650/REL650/REQ650/RET650 Ver. 1.2. The data points are unmapped as a default. The point lists describe a superset of all data available including the optional functionalities.

The point tables show all the available DNP3 data points in these IEDs. The DNP3 points can be freely added, removed, reorganized and reconfigured using PCM600.

As a default, the class assignments are Class 0 and Class 3 for binary inputs and outputs and for double bit indications. The class assignment for analog inputs and for counters are Class 0 and Class 2. Analog values are provided with default scalings. The scalings can be freely modified.

This list represents the superset of DNP3 points. The actual set of available points depends on the product, optional functionalities and configuration.

The point list table only shows the signals of the first instance of each function if more than one instance of a function can be configured.

See the engineering manual and DNP3 communication protocol manual for more information.

2.2 Point list for the 650 series IEDs

Table 6: Signal point list

Function name	Signal type	Signal name	Description
Hardware input and output monitoring			In CMT the 1st input signal for binary input and output card at slot 3 is shown as 'BIO_3;BIO_CPI.BI1"
BIO	Binary inputs	BIO_3; BIO:BI_ERROR	Binary input module error
		BIO_3; BIO:BI1	Binary input 1
		BIO_3; BIO:BI2	Binary input 2
		BIO_3; BIO:BI3	Binary input 3
		BIO_3; BIO:BI4	Binary input 4
Table continues on next page			

Function name	Signal type	Signal name	Description
		BIO_3; BIO:BI5	Binary input 5
		BIO_3; BIO:BI6	Binary input 6
		BIO_3; BIO:BI7	Binary input 7
		BIO_3; BIO:BI8	Binary input 8
		BIO_3; BIO:BI9	Binary input 9
		BIO_3; BIO:BO_ERROR	Binary output module error
		BIO_3; BIO:BO1_PO	Binary output status 1
		BIO_3; BIO:BO2_PO	Binary output status 2
		BIO_3; BIO:BO3_PO	Binary output status 3
		BIO_3; BIO:BO4_SO	Binary output status 4
		BIO_3; BIO:BO5_SO	Binary output status 5
		BIO_3; BIO:BO6_SO	Binary output status 6
		BIO_3; BIO:BO7_SO	Binary output status 7
		BIO_3; BIO:BO8_SO	Binary output status 8
		BIO_3; BIO:BO9_SO	Binary output status 9
COM05	Binary inputs	COM_101:COM05:BI1	Binary input 1
		COM_101:COM05:BI2	Binary input 2
		COM_101:COM05:BI3	Binary input 3
		COM_101:COM05:BI4	Binary input 4
		COM_101:COM05:BI5	Binary input 5
		COM_101:COM05:BI6	Binary input 6
		COM_101:COM05:BI7	Binary input 7
		COM_101:COM05:BI8	Binary input 8
		COM_101:COM05:BI9	Binary input 9
		COM_101:COM05:BI10	Binary input 10
		COM_101:COM05:BI11	Binary input 11
		COM_101:COM05:BI12	Binary input 12
		COM_101:COM05:ERROR	Binary input module error
PSM02	Binary inputs	PSM_102; PSM02:BLOCK	Block binary outputs
		PSM_102; PSM02:BO1_PO_TCS	Binary output 1, power output relay with trip coil supervision
		PSM_102; PSM02:BO2_PO_TCS	Binary output 2, power output relay with trip coil supervision
		PSM_102; PSM02:BO3_PO_TCS	Binary output 3, power output relay with trip coil supervision
		PSM_102; PSM02:BO4_PO	Binary output 4, power output relay
		PSM_102; PSM02:BO5_PO	Binary output 5, power output relay
		PSM_102; PSM02:BO6_PO	Binary output 6, power output relay

Table continues on next page

Function name	Signal type	Signal name	Description
		PSM_102; PSM02:BO7_SO	Binary output 7, signal output relay
		PSM_102; PSM02:BO8_SO	Binary output 8, signal output relay
		PSM_102; PSM02:BO9_SO	Binary output 9, signal output relay
PSM03	Binary inputs	PSM_102; PSM03BLOCK	Block binary outputs
		PSM_102; PSM03:BO1_PO_TCS	Binary output 1, power output relay with trip coil supervision
		PSM_102; PSM03:BO2_PO_TCS	Binary output 2, power output relay with trip coil supervision
		PSM_102; PSM03:BO3_PO_TCS	Binary output 3, power output relay with trip coil supervision
		PSM_102; PSM03:BO4_PO	Binary output 4, power output relay
		PSM_102; PSM03:BO5_PO	Binary output 5, power output relay
		PSM_102; PSM03:BO6_PO	Binary output 6, power output relay
		PSM_102; PSM03:BO7_SO	Binary output 7, signal output relay
		PSM_102; PSM03:BO8_SO	Binary output 8, signal output relay
		PSM_102; PSM03:BO9_SO	Binary output 9, signal output relay
General command handling from DNP master			"In CMT, the 1st binary command signal of instance 1 is shown as 'AUTOBITS: 1.CMDBIT1' The signals can be connected to any binary input signal of any function"
AUTOBITS	Binary outputs	AUTOBITS:CMDBIT1	Command out bit 1
		AUTOBITS:CMDBIT2	Command out bit 2
		AUTOBITS:CMDBIT3	Command out bit 3
		AUTOBITS:CMDBIT4	Command out bit 4
		AUTOBITS:CMDBIT5	Command out bit 5
		AUTOBITS:CMDBIT6	Command out bit 6
		AUTOBITS:CMDBIT7	Command out bit 7
		AUTOBITS:CMDBIT8	Command out bit 8
		AUTOBITS:CMDBIT9	Command out bit 9
		AUTOBITS:CMDBIT10	Command out bit 10
		AUTOBITS:CMDBIT11	Command out bit 11
		AUTOBITS:CMDBIT12	Command out bit 12
		AUTOBITS:CMDBIT13	Command out bit 13
		AUTOBITS:CMDBIT14	Command out bit 14
		AUTOBITS:CMDBIT15	Command out bit 15

Table continues on next page

Function name	Signal type	Signal name	Description
		AUTOBITS:CMDBIT16	Command out bit 16
		AUTOBITS:CMDBIT17	Command out bit 17
		AUTOBITS:CMDBIT18	Command out bit 18
		AUTOBITS:CMDBIT19	Command out bit 19
		AUTOBITS:CMDBIT20	Command out bit 20
		AUTOBITS:CMDBIT21	Command out bit 21
		AUTOBITS:CMDBIT22	Command out bit 22
		AUTOBITS:CMDBIT23	Command out bit 23
		AUTOBITS:CMDBIT24	Command out bit 24
		AUTOBITS:CMDBIT25	Command out bit 25
		AUTOBITS:CMDBIT26	Command out bit 26
		AUTOBITS:CMDBIT27	Command out bit 27
		AUTOBITS:CMDBIT28	Command out bit 28
		AUTOBITS:CMDBIT29	Command out bit 29
		AUTOBITS:CMDBIT30	Command out bit 30
		AUTOBITS:CMDBIT31	Command out bit 31
		AUTOBITS:CMDBIT32	Command out bit 32
General functions for showing signals for DNP master			"In CMT the analog signal of instance 1 of MVGGIO is shown as 'MVGGIO: 1.VALUE' The signals can be connected to any binary respectively analog output signal of any function"
MVGGIO	Analog inputs	MVGGIO:VALUE	Magnitude of deadband value
SP16GGIO	Binary inputs	SP16GGIO:OUT1	Output 1 status
		SP16GGIO:OUT2	Output 2 status
		SP16GGIO:OUT3	Output 3 status
		SP16GGIO:OUT4	Output 4 status
		SP16GGIO:OUT5	Output 5 status
		SP16GGIO:OUT6	Output 6 status
		SP16GGIO:OUT7	Output 7 status
		SP16GGIO:OUT8	Output 8 status
		SP16GGIO:OUT9	Output 9 status
		SP16GGIO:OUT10	Output 10 status
		SP16GGIO:OUT11	Output 11 status
		SP16GGIO:OUT12	Output 12 status
		SP16GGIO:OUT13	Output 13 status
		SP16GGIO:OUT14	Output 14 status
		SP16GGIO:OUT15	Output 15 status
		SP16GGIO:OUT16	Output 16 status

Table continues on next page

Function name	Signal type	Signal name	Description
		SP16GGIO:OUTOR	Output status logic OR gate for input 1 to 16
SPGGIO	Binary inputs	SPGGIO:OUT	Output status
Directly linked signals			In CMT the analog signal of instance 1 of B16I is shown as "B16I: 1.OUT"
AEGGAPC	Binary inputs	AEGGAPC:TRIP	Trip signal from accidental energizing protection
B16I	Analog inputs	B16I:OUT	Output value
B16IFCVI	Analog inputs	B16IFCVI:OUT	Output value
BRCPTOC	Binary inputs	BRCPTOC:TRIP	Operate signal of the protection logic
CCRBRF	Binary inputs	CCRBRF:TRBU	Backup trip by breaker failure protection function
		CCRBRF:TRRET	Retrip by breaker failure protection function
CCRPLD	Binary inputs	CCRPLD:TRIP	Trip signal to CB
CCSRDIF	Binary inputs	CCSRDIF:FAIL	Detection of current circuit failure
CMMXU	Analog inputs	CMMXU:IL1	IL1 Amplitude
		CMMXU:IL1ANGL	IL1 Angle
		CMMXU:IL2	IL2 Amplitude
		CMMXU:IL2ANGL	IL2 Angle
		CMMXU:IL3	IIL3 Amplitude
		CMMXU:IL3ANGL	IL3 Angle
CMSQI	Analog inputs	CMSQI:3I0	3I0 Amplitude
		CMSQI:3I0ANGL	3I0 Angle
		CMSQI:I1	I1 Amplitude
		CMSQI:I1ANGL	I1 Angle
		CMSQI:I2	I2 Amplitude
		CMSQI:I2ANGL	I2Angle
CNTGGIO	Counters	CNTGGIO:VALUE1	Output of counter 1
		CNTGGIO:VALUE2	Output of counter 2
		CNTGGIO:VALUE3	Output of counter 3
		CNTGGIO:VALUE4	Output of counter 4
		CNTGGIO:VALUE5	Output of counter 5
		CNTGGIO:VALUE6	Output of counter 6
CSPRBRF	Binary inputs	CSPRBRF:TRBU	Back-up trip
		CSPRBRF:TRRET	Retrip
CVMMXN	Analog inputs	CVMMXN:F	System frequency magnitude of deadband value
		CVMMXN:I	Calculated current magnitude of deadband value

Table continues on next page

Function name	Signal type	Signal name	Description
		CVMMXN:P	Active power magnitude of deadband value
		CVMMXN:PF	Power factor magnitude of deadband value
		CVMMXN:Q	Reactive power magnitude of deadband value
		CVMMXN:S	Apparent power magnitude of deadband value
		CVMMXN:U	Calculated voltage magnitude of deadband value
	Binary inputs	CVMMXN:ILAG	Current is lagging voltage
		CVMMXN:ILEAD	Current is leading voltage
DNPFREC	Analog inputs	DNPFREC:ActSetGrp	Active setting group
		DNPFREC:Ch1Ang	Prefault Angle
		DNPFREC:Ch1FltAng	Fault Angle
		DNPFREC:Ch1FltMag	Fault Magnitude
		DNPFREC:Ch1Mag	Prefault Magnitude
		DNPFREC:Ch2Ang	Prefault Angle
		DNPFREC:Ch2FltAng	Fault Angle
		DNPFREC:Ch2FltMag	Fault Magnitude
		DNPFREC:Ch2Mag	Prefault Magnitude
		DNPFREC:Ch3Ang	Prefault Angle
		DNPFREC:Ch3FltAng	Fault Angle
		DNPFREC:Ch3FltMag	Fault Magnitude
		DNPFREC:Ch3Mag	Prefault Magnitude
		DNPFREC:Ch4Ang	Prefault Angle
		DNPFREC:Ch4FltAng	Fault Angle
		DNPFREC:Ch4FltMag	Fault Magnitude
		DNPFREC:Ch4Mag	Prefault Magnitude
		DNPFREC:Ch5Ang	Prefault Angle
		DNPFREC:Ch5FltAng	Fault Angle
		DNPFREC:Ch5FltMag	Fault Magnitude
		DNPFREC:Ch5Mag	Prefault Magnitude
		DNPFREC:Ch6Ang	Prefault Angle
		DNPFREC:Ch6FltAng	Fault Angle
		DNPFREC:Ch6FltMag	Fault Magnitude
		DNPFREC:Ch6Mag	Prefault Magnitude
		DNPFREC:Ch7Ang	Prefault Angle
		DNPFREC:Ch7FltAng	Fault Angle
		DNPFREC:Ch7FltMag	Fault Magnitude
		DNPFREC:Ch7Mag	Prefault Magnitude

Table continues on next page

Function name	Signal type	Signal name	Description
		DNPFREC:Ch8Ang	Prefault Angle
		DNPFREC:Ch8FltAng	Fault Angle
		DNPFREC:Ch8FltMag	Fault Magnitude
		DNPFREC:Ch8Mag	Prefault Magnitude
		DNPFREC:Ch9Ang	Prefault Angle
		DNPFREC:Ch9FltAng	Fault Angle
		DNPFREC:Ch9FltMag	Fault Magnitude
		DNPFREC:Ch9Mag	Prefault Magnitude
		DNPFREC:Ch10Ang	Prefault Angle
		DNPFREC:Ch10FltAng	Fault Angle
		DNPFREC:Ch10FltMag	Fault Magnitude
		DNPFREC:Ch10Mag	Prefault Magnitude
		DNPFREC:Ch11Ang	Prefault Angle
		DNPFREC:Ch11FltAng	Fault Angle
		DNPFREC:Ch11FltMag	Fault Magnitude
		DNPFREC:Ch11Mag	Prefault Magnitude
		DNPFREC:Ch12Ang	Prefault Angle
		DNPFREC:Ch12FltAng	Fault Angle
		DNPFREC:Ch12FltMag	Fault Magnitude
		DNPFREC:Ch12Mag	Prefault Magnitude
		DNPFREC:Ch13Ang	Prefault Angle
		DNPFREC:Ch13FltAng	Fault Angle
		DNPFREC:Ch13FltMag	Fault Magnitude
		DNPFREC:Ch13Mag	Prefault Magnitude
		DNPFREC:Ch14Ang	Prefault Angle
		DNPFREC:Ch14FltAng	Fault Angle
		DNPFREC:Ch14FltMag	Fault Magnitude
		DNPFREC:Ch14Mag	Prefault Magnitude
		DNPFREC:Ch15Ang	Prefault Angle
		DNPFREC:Ch15FltAng	Fault Angle
		DNPFREC:Ch15FltMag	Fault Magnitude
		DNPFREC:Ch15Mag	Prefault Magnitude
		DNPFREC:Ch16Ang	Prefault Angle
		DNPFREC:Ch16FltAng	Fault Angle
		DNPFREC:Ch16FltMag	Fault Magnitude
		DNPFREC:Ch16Mag	Prefault Magnitude
		DNPFREC:Ch17Ang	Prefault Angle
		DNPFREC:Ch17FltAng	Fault Angle
		DNPFREC:Ch17FltMag	Fault Magnitude

Table continues on next page

Function name	Signal type	Signal name	Description
		DNPFREC:Ch17Mag	Prefault Magnitude
		DNPFREC:Ch18Ang	Prefault Angle
		DNPFREC:Ch18FltAng	Fault Angle
		DNPFREC:Ch18FltMag	Fault Magnitude
		DNPFREC:Ch18Mag	Prefault Magnitude
		DNPFREC:Ch19Ang	Prefault Angle
		DNPFREC:Ch19FltAng	Fault Angle
		DNPFREC:Ch19FltMag	Fault Magnitude
		DNPFREC:Ch19Mag	Prefault Magnitude
		DNPFREC:Ch20Ang	Prefault Angle
		DNPFREC:Ch20FltAng	Fault Angle
		DNPFREC:Ch20FltMag	Fault Magnitude
		DNPFREC:Ch20Mag	Prefault Magnitude
		DNPFREC:Ch21Ang	Prefault Angle
		DNPFREC:Ch21FltAng	Fault Angle
		DNPFREC:Ch21FltMag	Fault Magnitude
		DNPFREC:Ch21Mag	Prefault Magnitude
		DNPFREC:Ch22Ang	Prefault Angle
		DNPFREC:Ch22FltAng	Fault Angle
		DNPFREC:Ch22FltMag	Fault Magnitude
		DNPFREC:Ch22Mag	Prefault Magnitude
		DNPFREC:Ch23Ang	Prefault Angle
		DNPFREC:Ch23FltAng	Fault Angle
		DNPFREC:Ch23FltMag	Fault Magnitude
		DNPFREC:Ch23Mag	Prefault Magnitude
		DNPFREC:Ch24Ang	Prefault Angle
		DNPFREC:Ch24FltAng	Fault Angle
		DNPFREC:Ch24FltMag	Fault Magnitude
		DNPFREC:Ch24Mag	Prefault Magnitude
		DNPFREC:Ch25Ang	Prefault Angle
		DNPFREC:Ch25FltAng	Fault Angle
		DNPFREC:Ch25FltMag	Fault Magnitude
		DNPFREC:Ch25Mag	Prefault Magnitude
		DNPFREC:Ch26Ang	Prefault Angle
		DNPFREC:Ch26FltAng	Fault Angle
		DNPFREC:Ch26FltMag	Fault Magnitude
		DNPFREC:Ch26Mag	Prefault Magnitude
		DNPFREC:Ch27Ang	Prefault Angle
		DNPFREC:Ch27FltAng	Fault Angle

Table continues on next page

Function name	Signal type	Signal name	Description
		DNPFREC:Ch27FltMag	Fault Magnitude
		DNPFREC:Ch27Mag	Prefault Magnitude
		DNPFREC:Ch28Ang	Prefault Angle
		DNPFREC:Ch28FltAng	Fault Angle
		DNPFREC:Ch28FltMag	Fault Magnitude
		DNPFREC:Ch28Mag	Prefault Magnitude
		DNPFREC:Ch29Ang	Prefault Angle
		DNPFREC:Ch29FltAng	Fault Angle
		DNPFREC:Ch29FltMag	Fault Magnitude
		DNPFREC:Ch29Mag	Prefault Magnitude
		DNPFREC:Ch30Ang	Prefault Angle
		DNPFREC:Ch30FltAng	Fault Angle
		DNPFREC:Ch30FltMag	Fault Magnitude
		DNPFREC:Ch30Mag	Prefault Magnitude
		DNPFREC:Ch31TrigMag	Magnitude at trigger
		DNPFREC:Ch32TrigMag	Magnitude at trigger
		DNPFREC:Ch33TrigMag	Magnitude at trigger
		DNPFREC:Ch34TrigMag	Magnitude at trigger
		DNPFREC:Ch35TrigMag	Magnitude at trigger
		DNPFREC:Ch36TrigMag	Magnitude at trigger
		DNPFREC:Ch37TrigMag	Magnitude at trigger
		DNPFREC:Ch38TrigMag	Magnitude at trigger
		DNPFREC:Ch39TrigMag	Magnitude at trigger
		DNPFREC:Ch40TrigMag	Magnitude at trigger
		DNPFREC:FaultFreq	Fault Freq
		DNPFREC:FaultLoc	Fault Location
		DNPFREC:FaultNumber	Fault Number
		DNPFREC:FaultType	Fault Type
		DNPFREC:NoOfFaultIED	No. of faults in IED
		DNPFREC:TrigDay	Trigger Day
		DNPFREC:TrigHour	Trigger Hour
		DNPFREC:TrigMillisec	Trigger Millisecond
		DNPFREC:TrigMin	Trigger Minute
		DNPFREC:TrigMonth	Trigger Month
		DNPFREC:TrigSec	Trigger Second
		DNPFREC:TrigSigId	Channel number for trigger signal
		DNPFREC:TrigYear	Trigger year
	Binary outputs	DNPFREC:GetFirstRec	Get first disturbance
		DNPFREC:GetNextRec	Get next disturbance

Table continues on next page

Function name	Signal type	Signal name	Description
		DNPFREC:GetPrevRec	Get previous disturbance
DNSPTOC	Binary inputs	DNSPTOC:TRIP	General trip signal
		DNSPTOC:TROC1	Trip signal from step 1 (OC1)
		DNSPTOC:TROC2	Trip signal from step 2 (OC2)
DRPRDRE	Analog inputs	DRPRDRE:FaultNumber	Disturbance fault number
	Binary inputs	DRPRDRE:RECMADE	Disturbance recording made
ECPSCH	Binary inputs	ECPSCH:CS	Carrier sending by Communication Scheme Logic
		ECPSCH:LCG	Loss of carrier guard signal
		ECPSCH:PRORX	Teleprotection signal received for a forward fault
		ECPSCH:TRIP	Trip by Communication Scheme Logic
ECRWPSCH	Binary inputs	ECRWPSCH:CR	POR Carrier signal received from remote end
		ECRWPSCH:ECHO	Carrier send by WEI logic
		ECRWPSCH:TRWEI	Trip of WEI logic
EF4PTOC	Binary inputs	EF4PTOC:STFW	Forward directional start signal
		EF4PTOC:STRV	Reverse directional start signal
		EF4PTOC:TRIP	General trip signal
		EF4PTOC:TR1	Trip signal from step 1
		EF4PTOC:TR2	Trip signal from step 2
		EF4PTOC:TR3	Trip signal from step 3
		EF4PTOC:TR4	Trip signal from step 4
EFPIOC	Binary inputs	EFPIOC:TRIP	Trip signal
ETPMMTR	Binary inputs	ETPMMTR:EAFALM	Alarm for active forward energy exceeding limit in set interval
		ETPMMTR:EARALM	Alarm for active reverse energy exceeding limit in set interval
		ETPMMTR:ERFALM	Alarm for reactive forward energy exceeding limit in set interval
		ETPMMTR:ERRALM	Alarm for reactive reverse energy exceeding limit in set interval
FDPSPDIS	Binary inputs	FDPSPDIS:STFWL1	Fault detected in phase L1-forward direction
		FDPSPDIS:STFWL2	Fault detected in phase L2-forward direction
		FDPSPDIS:STFWL3	Fault detected in phase L3-forward direction

Table continues on next page

Function name	Signal type	Signal name	Description
		FDPSPDIS:STFWPE	Earth fault detected in forward direction
		FDPSPDIS:STNDL1	Non-directional start detected in L1
		FDPSPDIS:STNDL2	Non-directional start detected in L2
		FDPSPDIS:STNDL3	Non-directional start detected in L3
		FDPSPDIS:STNDPE	Non-directional start, Phase-Earth
		FDPSPDIS:STRVL1	Fault detected in phase L1-reverse direction
		FDPSPDIS:STRVL2	Fault detected in phase L2-reverse direction
		FDPSPDIS:STRVL3	Fault detected in phase L3-reverse direction
		FDPSPDIS:STRVPE	Earth fault detected in reverse direction
		FDPSPDIS:TRIP	Trip output
FMPSPDIS	Binary inputs	FMPSPDIS:START	General start signal
		FMPSPDIS:STL1	Fault detected in phase L1
		FMPSPDIS:STL2	Fault detected in phase L2
		FMPSPDIS:STL3	Fault detected in phase L3
		FMPSPDIS:STPE	Earth fault detected
GENPDIF	Binary Inputs	GENPDIF:BLKH	Common harmonic block signal
		GENPDIF:INTDIST	Indication that internal fault has been detected
		GENPDIF:OPENCTAL	Open CT Alarm output signal. Issued after a delay
		GENPDIF:TRIP	General, common trip signal
		GENPDIF:TRIPRES	Trip signal from restrained differential protection
		GENPDIF:TRIPUNRE	Trip signal from unrestrained differential protection
		GENPDIF:TRNSSENS	Trip signal from sensitive neg. seq. diff. protection
		GENPDIF:TRNSUNR	Trip signal from unrestr. neg. seq. diff. protection
GOPPDOP	Binary inputs	GOPPDOP:TRIP	General trip signal
		GOPPDOP:TRIP1	Trip signal from stage 1
		GOPPDOP:TRIP2	Trip signal from stage 2
GUPPDUP	Binary inputs	GUPPDUP:TRIP	General trip signal
		GUPPDUP:TRIP1	Trip signal from stage 1
		GUPPDUP:TRIP2	Trip signal from stage 2
HZPDIF	Binary inputs	HZPDIF:TRIP	Trip signal

Table continues on next page

Function name	Signal type	Signal name	Description
INTERRSIG	Analog inputs	INTERRSIG:TSYNCERR	Time synchronization error
	Binary inputs	INTERRSIG:FAIL	Internal fail
		INTERRSIG:WARNING	Internal warning
LEPDIS	Binary inputs	LEPDIS:START	General start signal
		LEPDIS:STL1	Fault detected in phase L1
		LEPDIS:STL2	Fault detected in phase L2
		LEPDIS:STL3	Fault detected in phase L3
LEXPDIS	Binary inputs	LEXPDIS:TRIP	Common trip signal
		LEXPDIS:TRZ1	Trip signal from impedance zone Z1
		LEXPDIS:TRZ2	Trip signal from impedance zone Z2
LMBRFLO	Binary inputs	LMBRFLO:FltDistLngUnit	Distance to fault in line length unit
LOVPTUV	Binary inputs	LOVPTUV:TRIP	Trip signal
LCPTTR	Binary inputs	LCPTTR:ALARM	Alarm signal
		LCPTTR:LOCKOUT	Lockout signal
		LCPTTR:TRIP	General trip signal
LFPTTR	Binary inputs	LFPTTR:ALARM	Alarm signal
		LFPTTR:LOCKOUT	Lockout signal
		LFPTTR:TRIP	General trip signal
NS2PTOC	Binary inputs	NS2PTOC:ALARM	Alarm signal
		NS2PTOC:TR1	Trip signal for step 1
		NS2PTOC:TR2	Trip signal for step 2
		NS2PTOC:TRIP	Common trip signal
OC4PTOC	Binary inputs	OC4PTOC:TR1	Trip signal from step 1
		OC4PTOC:TR2	Trip signal from step 2
		OC4PTOC:TR3	Trip signal from step 3
		OC4PTOC:TR4	Trip signal from step 4
		OC4PTOC:TRIP	General trip signal
OC4SPTOC	Binary inputs	OC4SPTOC:TR1	Trip signal from step 1
		OC4SPTOC:TR2	Trip signal from step 2
		OC4SPTOC:TR3	Trip signal from step 3
		OC4SPTOC:TR4	Trip signal from step 4
		OC4SPTOC:TRIP	General trip signal
		OC4SPTOC:TRL1	Trip signal from phase L1
		OC4SPTOC:TRL2	Trip signal from phase L2
		OC4SPTOC:TRL3	Trip signal from phase L3
OEXPVPH	Analog inputs	OEXPVPH:VPERHZ	Voltage-to-frequency ratio in per-unit
	Binary inputs	OEXPVPH:.ALARM	Overexcitation alarm signal

Table continues on next page

Function name	Signal type	Signal name	Description
		OEXPVPH:TRIP	General trip signal
OOSPPAM	Binary inputs	OOSPPAM:TRIP	Common trip, issued when either zone 1 or zone 2 give trip
OV2PTOV	Binary inputs	OV2PTOV:TR1	Trip signal from step 1
		OV2PTOV:TR2	Trip signal from step 2
		OV2PTOV:TRIP	General trip signal
PHPIOC	Binary inputs	PHPIOC:TRIP	General trip signal
QCBAY	Binary inputs	QCBAY:CMD_BLKD	Function is blocked for commands
		QCBAY:LOC	Local operation allowed
		QCBAY:REM	Remote operation allowed
		QCBAY:UPD_BLKD	Update of position is blocked
REFPDIF	Binary inputs	REFPDIF:BLK2H	Block due to 2nd harmonic
		REFPDIF:DIROK	Directional criteria have operated for internal fault
		REFPDIF:TRIP	General trip signal
ROV2PTOV	Binary inputs	ROV2PTOV:TR1	Trip signal from step 1
		ROV2PTOV:TR2	Trip signal from step 2
		ROV2PTOV:TRIP	General trip signal
SAPFRC	Binary inputs	SAPFRC:BLKDMAGN	Blocking indication due to low amplitude
		SAPFRC:TRIP	Operating/trip signal for frequency gradient
SAPTOF	Binary inputs	SAPTOF:BLKDMAGN	Measurement blocked due to low amplitude
		SAPTOF:TRIP	General trip signal
SAPTUF	Binary inputs	SAPTUF:BLKDMAGN	Measurement blocked due to low voltage amplitude
		SAPTUF:TRIP	General trip signal
SCILO	Binary inputs	SCILO:EN_CLOSE	Close operation at open or intermediate or bad position is enabled
		SCILO:EN_OPEN	Open operation at closed or intermediate or bad position is enabled
SCSWI	Analog inputs	SCSWI:L_CAUSE	Latest value of the error indication during command
	Binary inputs	SCSWI:CMD_BLK	Commands are blocked
	Binary outputs	SCSWI:CLOSE_CMD	Close command parameter for DNP protocol
		SCSWI:OPEN_CMD	Open command parameter for DNP protocol
	Double bit indications	SCSWI:POSITION	Position indication
SDDRFUF	Binary inputs	SDDRFUF:BLKU	General start of function

Table continues on next page

Function name	Signal type	Signal name	Description
SDEPSDE	Binary inputs	SDEPSDE:TRDIRIN	Trip of the directional residual overcurrent
		SDEPSDE:TRIP	General trip signal
		SDEPSDE:TRNDIN	Trip of non-directional residual overcurrent
		SDEPSDE:TRUN	Trip of non-directional residual overvoltage
SESRSYN	Analog inputs	SESRSYN:FRDIFFME	Calculated difference in frequency
		SESRSYN:PHDIFFME	Calculated difference of phase angle
		SESRSYN:UDIFFME	Calculated difference in voltage
	Binary inputs	SESRSYN:AUTOENOK	Automatic energizing check OK
		SESRSYN:AUTOREL	Automatic release
		SESRSYN:B1SEL	Bus1 selected
		SESRSYN:B2SEL	Bus2 selected
		SESRSYN:LN2SEL	Line2 selected
		SESRSYN:LNSEL	Line selected
		SESRSYN:MANENOK	Manual energizing check OK
		SESRSYN:MANREL	Manual release
		SESRSYN:SYNFAIL	Synchronizing failed
		SESRSYN:SYNOK	Synchronizing OK output
		SESRSYN:SYNPROGR	Synchronizing in progress
SLGGIO	Analog inputs	SLGGIO:SWPOSN	Switch position as integer value
SMBRREC	Binary inputs	SMBRREC:3PT1	Three-phase reclosing in progress, shot 1
		SMBRREC:3PT2	Three-phase reclosing in progress, shot 2
		SMBRREC:3PT3	Three-phase reclosing in progress, shot 3
		SMBRREC:3PT4	Three-phase reclosing in progress, shot 4
		SMBRREC:3PT5	Three-phase reclosing in progress, shot 5
		SMBRREC:ACTIVE	Reclosing sequence in progress
		SMBRREC:BLOCKED	AR is in blocked state
		SMBRREC:CLOSECB	Closing command for CB
		SMBRREC:READY	Indicates that AR is ready for a new sequence
		SMBRREC:SETON	AR operation is switched on

Table continues on next page

Function name	Signal type	Signal name	Description
		SMBRREC:UNSUCCL	Reclosing unsuccessful, signal resets after the reclaim time
	Counters	SMBRREC:COUNT3P1	Counting the number of three-phase reclosing shot 1
		SMBRREC:COUNT3P2	Counting the number of three-phase reclosing shot 2
		SMBRREC:COUNT3P3	Counting the number of three-phase reclosing shot 3
		SMBRREC:COUNT3P4	Counting the number of three-phase reclosing shot 4
		SMBRREC:COUNT3P5	Counting the number of three-phase reclosing shot 5
SMPPTRC	Binary inputs	SMPPTRC:CLLKOUT	Circuit breaker lockout output (set until reset)
		SMPPTRC:TRIP	General trip signal
SPTPIOC	Binary inputs	SPTPIOC:TRIP	General trip signal
		SPTPIOC:TRL1	Trip signal from phase L1
		SPTPIOC:TRL2	Trip signal from phase L2
		SPTPIOC:TRL3	Trip signal from phase L3
SPTPTRC	Binary inputs	SPTPTRC:CLLKOUT	Circuit breaker lockout output (set until reset)
		SPTPTRC:TR1P	Tripping single-pole
		SPTPTRC:TR3P	Tripping three-pole
		SPTPTRC:TRIP	General trip signal
		SPTPTRC:TRL1	Trip signal from phase L1
		SPTPTRC:TRL2	Trip signal from phase L2
		SPTPTRC:TRL3	Trip signal from phase L3
SPVNZBAT	Binary inputs	SPVNZBAT:ST_UHI	Start signal when battery voltage exceeds upper limit
		SPVNZBAT:ST_ULOW	Start signal when battery voltage drops below lower limit
SSCBR	Binary inputs	SSCBR:CBLIFEAL	Remaining life of CB exceeded alarm limit
		SSCBR:NO_OPR	Number of CB operation cycle
		SSCBR:PRESALM	Pressure below alarm level
		SSCBR:PRESLO	Pressure below lockout level
		SSCBR:SPRCHRAL	Spring charging time has crossed the set value
SSIMG	Binary inputs	SSIMG:PRES_ALM	Pressure below alarm level
		SSIMG:PRES_LO	Pressure below lockout level
		SSIMG:TEMP_ALM	Temperature above alarm level
		SSIMG:TEMP_LO	Temperature above lockout level

Table continues on next page

Function name	Signal type	Signal name	Description
SSIML	Binary inputs	SSIML:LVL_ALM	Level below alarm level
		SSIML:LVL_LO	Level below lockout level
		SSIML:TEMP_ALM	Temperature above alarm level
		SSIML:TEMP_LO	Temperature above lockout level
STBPTOC	Binary inputs	STBPTOC:TRIP	General trip signal
STBRREC	Counters	STBRREC:1PT1	Single-phase reclosing in progress, shot 1
		STBRREC:3PT1	Three-phase reclosing in progress, shot 1
		STBRREC:3PT2	Three-phase reclosing in progress, shot 2
		STBRREC:3PT3	Three-phase reclosing in progress, shot 3
		STBRREC:3PT4	Three-phase reclosing in progress, shot 4
		STBRREC:3PT5	Three-phase reclosing in progress, shot 5
		STBRREC:ACTIVE	Reclosing sequence in progress
		STBRREC:BLOCKED	AR is in blocked state
		STBRREC:CLOSECB	Closing command for CB
		STBRREC:READY	Indicates that AR is ready for a new sequence
		STBRREC:SETON	AR operation is switched on
		STBRREC:UNSUCCL	Reclosing unsuccessful, signal resets after the reclaim time
	Binary outputs	STBRREC:COUNT1P	Counting the number of single-phase reclosing shots
		STBRREC:COUNT3P1	Counting the number of three-phase reclosing shot 1
		STBRREC:COUNT3P2	Counting the number of three-phase reclosing shot 2
		STBRREC:COUNT3P3	Counting the number of three-phase reclosing shot 3
		STBRREC:COUNT3P4	Counting the number of three-phase reclosing shot 4
		STBRREC:COUNT3P5	Counting the number of three-phase reclosing shot 5
STEFPHIZ	Binary inputs	STEFPHIZ:TRIP	Main, common trip command
		STEFPHIZ:TRIP3H	Trip by one of two 3rd harmonic voltage-based prot.
		STEFPHIZ:TRIPUN	Trip by fund. freq. neutral over-voltage protection
SXCBR	Binary inputs	SXCBR:CLOSEPOS	Apparatus closed position

Table continues on next page

Function name	Signal type	Signal name	Description
		SXCBR:OPENPOS	Apparatus open position
		SXCBR:UPD_BLKD	Update of position indication is blocked
	Counters	SXCBR:CNT_VAL	Operation counter value
	Double bit indications	SXCBR:POSITION	Apparatus position indication
		SXCBR:TR_POS	Truck position indication
SXSWI	Binary inputs	SXSWI:CLOSEPOS	Apparatus closed position
		SXSWI:OPENPOS	Apparatus open position
		SXSWI:UPD_BLKD	Update of position indication is blocked
	Counters	SXSWI:CNT_VAL	Operation counter value
	Double bit indications	SXSWI:POSITION	Apparatus position indication
T2WPDIF	Binary inputs	T2WPDIF:BLK2H	General second harmonic block signal
		T2WPDIF:BLK5H	General fifth harmonic block signal
		T2WPDIF:INTFAULT	Indication that internal fault has been detected
		T2WPDIF:TRIP	General trip signal
		T2WPDIF:TRIPRES	Trip signal from restrained differential protection
		T2WPDIF:TRIPUNRE	Trip signal from unrestrained differential protection
		T2WPDIF:TRNSSENS	Trip signal from sensitive negative sequence differential protection
		T2WPDIF:TRNSUNR	Trip signal from unrestrained negative-sequence differential protection
T3WPDIF	Binary inputs	T3WPDIF:BLK2H	General second harmonic block signal
		T3WPDIF:BLK5H	General fifth harmonic block signal
		T3WPDIF:INTFAULT	Indication that internal fault has been detected
		T3WPDIF:TRIP	General trip signal
		T3WPDIF:TRIPRES	Trip signal from restrained differential protection
		T3WPDIF:TRIPUNRE	Trip signal from unrestrained differential protection
		T3WPDIF:TRNSSENS	Trip signal from sensitive negative sequence differential protection
		T3WPDIF:TRNSUNR	Trip signal from unrestrained negative sequence differential protection
TCMYLTC	Analog inputs	TCMYLTC:TCPOS	Integer value corresponding to actual tap position

Table continues on next page

Function name	Signal type	Signal name	Description
	Binary inputs	TCMYLTC:CNT_VAL	Number of operations on tap changer
		TCMYLTC:HIPOSAL	Alarm for tap in the highest volt position
		TCMYLTC:LOPOSAL	Alarm for tap in the lowest volt position
		TCMYLTC:POSERRAL	Alarm that indicates a problem with the position indication
TMAGGIO	Binary inputs	TMAGGIO:OUTPUT1	OR function betweeen inputs 1 to 16
		TMAGGIO:OUTPUT2	OR function between inputs 17 to 32
		TMAGGIO:OUTPUT3	OR function between inputs 1 to 32
TR8ATCC	Analog inputs	TR8ATCC:BUSVOLT	Average of measured busbar voltage (service value)
		TR8ATCC:ICIRCUL	Circulating current
		TR8ATCC:ILOAD	Magnitude of measured load current (service value)
		TR8ATCC:TCPOS	Tap position
		TR8ATCC:ULOAD	Calculated compensated voltage (service value)
	Binary inputs	TR8ATCC:AUTO	Automatic control mode is active
		TR8ATCC:AUTOBLK	Block of auto-commands commands
		TR8ATCC:COMMERR	Communication error
		TR8ATCC:DISCONN	Transformer is disconnected
		TR8ATCC:FOLLOWER	This transformer is follower
		TR8ATCC:MAN	Manual control mode is active
		TR8ATCC:MASTER	Transformer is master
		TR8ATCC:MSTRSLV	Master slave is active
		TR8ATCC:OUTOFPOS	Difference in tap positions exceeded the set limit
		TR8ATCC:PARALLEL	Transformer operates in parallel mode
		TR8ATCC:SINGLE	Transformer operates in single mode
		TR8ATCC:TOTBLK	Block of auto-commands and manual commands
TRPTTR	Binary inputs	TRPTTR:ALARM1	First-level alarm signal
		TRPTTR:ALARM2	Second-level alarm signal
		TRPTTR:TRIP	Trip Signal
UC2PTUC	Binary inputs	UC2PTUC:TR1	Operate signal for step 1
		UC2PTUC:TR1L1	Operate signal for step 1 in L1

Table continues on next page

Function name	Signal type	Signal name	Description
		UC2PTUC:TR1L2	Operate signal for step 1 in L2
		UC2PTUC:TR1L3	Operate signal for step 1 in L3
		UC2PTUC:TR2	Operate signal for step 2
		UC2PTUC:TR2L1	Operate signal for step 2 in L1
		UC2PTUC:TR2L2	Operate signal for step 2 in L2
		UC2PTUC:TR2L3	Operate signal for step 2 in L3
		UC2PTUC:TRIP	General trip signal
UV2PTUV	Binary inputs	UV2PTUV:TR1	Trip signal from step 1
		UV2PTUV:TR2	Trip signal from step 2
		UV2PTUV:TRIP	General trip signal
VMMXU	Analog inputs	VMMXU:UL12	UL12 Amplitude
		VMMXU:UL12ANGL	UL12 Angle
		VMMXU:UL23	UL23 Amplitude
		VMMXU:UL23ANGL	UL23 Angle
		VMMXU:UL31	UL31 Amplitude
		VMMXU:UL31ANGL	UL31 Angle
VMSQI	Analog inputs	VMSQI:3U0	3U0
		VMSQI:3U0ANGL	3U0 Angle
		VMSQI:U1	U1 Amplitude
		VMSQI:U1ANGL	U1 Angle
		VMSQI:U2	U2Amplitude
		VMSQI:U2ANGL	U2Angle
VNMMXU	Analog inputs	VNMMXU:UL1	UL1 Amplitude, magnitude of reported value
		VNMMXU:UL1ANGL	UL1 Angle, magnitude of reported value
		VNMMXU:UL2	UL2 Amplitude, magnitude of reported value
		VNMMXU:UL2ANGL	UL2 Angle, magnitude of reported value
		VNMMXU:UL3	UL3 Amplitude, magnitude of reported value
		VNMMXU:UL3ANGL	UL3 Angle, magnitude of reported value
VR2PVOC	Binary inputs	VR2PVOC:TRIP	General trip signal
		VR2PVOC:TROC	Trip signal from voltage restraint overcurrent stage
		VR2PVOC:TROC2	Trip signal from overcurrent function OC2
VSGGIO	Binary inputs	VSGGIO:POS1	Position 1 indication, logical signal
		VSGGIO:POS2	Position 2 indication, logical signal

Table continues on next page

Function name	Signal type	Signal name	Description
	Double bit indications	VSGGIO:POSITION	Position indication, integer
ZCLCPLAL	Binary inputs	ZCLCPLAL:TRLL	Trip by loss of load
		ZCLCPLAL:TRZE	Trip by zone extension
ZCPSCH	Binary inputs	ZCPSCH:CS	Carrier sending signal
		ZCPSCH:LCG	Loss of carrier guard signal
		ZCPSCH:PRORX	Carrier signal received or missing carrier guard signal
		ZCPSCH:TRIP	Trip output
ZCRWPSCH	Binary inputs	ZCRWPSCH:CR	POR Carrier signal received from remote end
		ZCRWPSCH:ECHO	Carrier sending by WEI logic
		ZCRWPSCH:TRWEI	Trip of WEI logic
		ZCRWPSCH:TRWEIL1	Trip of WEI logic in phase L1
		ZCRWPSCH:TRWEIL2	Trip of WEI logic in phase L2
		ZCRWPSCH:TRWEIL3	Trip of WEI logic in phase L3
ZCVPSOF	Binary inputs	ZCVPSOF:TRIP	Trip output
ZCWSPSCH	Binary inputs	ZCWSPSCH:CR	POR Carrier signal received from remote end
		ZCWSPSCH:ECHO	Carrier send by WEI logic
		ZCWSPSCH:TRWEI	Trip of WEI logic
		ZCWSPSCH:TRWEIL1	Trip of WEI logic in phase L1
		ZCWSPSCH:TRWEIL2	Trip of WEI logic in phase L2
		ZCWSPSCH:TRWEIL3	Trip of WEI logic in phase L3
ZDARDIR	Binary inputs	ZDARDIR:STDIRCND	Start condition - binary coded
		ZDARDIR:STRVPE	Reverse start signal from phase-to-earth directional element
ZGCPDIS	Binary inputs	ZGCPDIS:TRIP	General trip
		ZGCPDIS:TRZ1	Trip signal Zone1
		ZGCPDIS:TRZ2	Trip signal Zone2
		ZGCPDIS:TRZ3	Trip signal Zone3
ZMRPSB	Binary inputs	ZMRPSB:START	Power swing detected
ZQMPDIS	Binary inputs	ZQMPDIS:TRIP	General trip signal
		ZQMPDIS:TRL1	Trip signal from phase L1
		ZQMPDIS:TRL2	Trip signal from phase L2
		ZQMPDIS:TRL3	Trip signal from phase L3
		ZQMPDIS:TRZ1	Trip signal Zone1
		ZQMPDIS:TRZ2	Trip signal Zone2
		ZQMPDIS:TRZ3	Trip signal Zone3
		ZQMPDIS:TRZ4	Trip signal Zone4
		ZQMPDIS:TRZ5	Trip signal Zone5

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. While it is referred to in the DNP3 Subset Definitions as a document, 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.

When going down in baudrate, the size of the configuration on DNP must be considered.

Table 7: Device profile document

DNP3 device profile document	
Vendor name:	ABB AB
Device name:	650 series IED
Highest DNP level supported: For requests: Level + For responses: Level +	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 are responded with qualifiers 00 or 01.** 16-bit, 32-bit and Floating point analog change events with time may be requested. Floating point analog output status and output block objects 40 and 41 are not supported. Sequential file transfer, object 70, variations 2 through 7, are not supported. Octet string and string event objects 110 and 111 are not supported. Virtual terminal output and event objects 112 and 113 are not supported. Device attribute object 0 is not supported. Data set objects 85-88 are not supported.	
Maximum data link frame size (octets): Transmitted: 292 Received: 292	Maximum application fragment size (octets): Transmitted: Configurable up to 2048 (ApLayMaxTxSize for each master session) Received: Configurable up to 2048 (ApLayMaxRxSize for each Master session)
Maximum data link retries: ● None ○ Fixed ○ Configurable (0...65535) (DLinkRetries for each channel)	Maximum application layer retries: ● None ○ Configurable
Table continues on next page	

DNP3 device profile document								
Requires data link layer confirmation:								
	○	Never						
	○	Always						
	○	Sometimes						
	●	Configurable as: only when reporting event data (DLinkConfirm for each channel)						
Requires application layer confirmation:								
	○	Never						
	○	Always						
	○	When reporting event data (slave devices only)						
	○	When sending multi-fragment responses (slave devices only)						
	○	Sometimes						
	●	Configurable as: "Only when reporting event data" or "When reporting event data or multi-fragment messages." (ConfMultiFrag for each master session)						
Timeouts while waiting for:								
Data link confirm: (tDLinkTimeout on DNP3Channel in PST)	●	None	○	Fixed at ____	○	Variable	○	Configurable
Complete appl. fragment:	○	None	○	Fixed at ____	○	Variable	○	Configurable
Application confirm: (tApplConfTout on DNP3Master in PST)	○	None	○	Fixed at ____	○	Variable	●	Configurable
Complete appl. response:	●	None	○	Fixed at ____	○	Variable	○	Configurable
Others:	• Transmission delay, configurable (tRxToTxMinDel for each channel). • Selecting/Operating arm timeout, configurable (tSelectTimeout for each master session). • Need time interval, configurable (tSynchTimeout for each master session). • Unsolicited notification delay, configurable (tUREvBufTout1, tUREvBufTout2, tUREvBufTout3 for each master session). • Unsolicited response retry delay, configurable (tURRetryDelay for each master session). • Unsolicited offline iInterval, configurable (tUROfflRtryDel for each master session). **Change events in the IED are generated by the device's internal event system; they are not polled at a protocol-specific scan rate. The periodicity for each point depends on the point's data rate in the IED.** **Binary change event scan period – see above** **Double bit change event scan period – see above** **Analog change event scan period – see above** **Counter change event scan period – see above**							
Sends/Executes Control Operations:								
WRITE binary outputs	●	Never	○	Always	○	Sometimes	○	Configurable
SELECT/ OPERATE	○	Never	●	Always	○	Sometimes	○	Configurable

Table continues on next page

DNP3 device profile document								
DIRECT OPERATE	○	Never	○	Always	○	Sometimes	●	Configurable
DIRECT OPERATE - NO ACK	○	Never	○	Always	○	Sometimes	●	Configurable
Count > 1	○	Never	○	Always	●	Sometimes	○	Configurable
Pulse on	○	Never	○	Always	●	Sometimes	○	Configurable
Pulse off	○	Never	○	Always	●	Sometimes	○	Configurable
Latch on	○	Never	○	Always	●	Sometimes	○	Configurable
Latch off	○	Never	○	Always	●	Sometimes	○	Configurable
Queue	●	Never	○	Always	○	Sometimes	○	Configurable
Clear queue	●	Never	○	Always	○	Sometimes	○	Configurable

Explanation of "Sometimes" above: Supported binary output control operations depend on the type of point. Please consult the binary output point list description.

Reports binary input change events when no specific variation requested: ○ Never ○ Only when time-tagged ○ Only non-time-tagged ● Configurable to send one or the other (Obj2DefVar on DNP3Master)	Reports time-tagged binary input change events when no specific variation requested: ○ Never ○ Binary input change with time ○ Binary input change with relative time ● Configurable (Obj2DefVar on DNP3Master)
Sends unsolicited responses: ○ Never ● Configurable (UREnable on DNP3Master) ○ Only certain objects ○ Sometimes (attach explanation) ● ENABLE/DISABLE UNSOLICITED function codes supported	Sends static data in unsolicited responses: ● Never ○ When device restarts ○ When status flags change No other options are permitted.
Default counter object/variation: ○ No counters reported ● Configurable (obj20DefVar and obj22DefVar in DNP3Master) ○ Default object Default variation: ○ Point-by-point list attached	Counters roll over at: ○ No counters reported ○ Configurable (attach explanation) ○ 16 bits ● 32 bits ○ Other value: _____ ○ Point-by-point list attached

Sends multi-fragment responses:

○ Yes

○ No

Table continues on next page

DNP3 device profile document
• Configurable (ApplMultFrgRes on DNP3Master)
Deadbanding is not performed in the DNP protocol stack. Any deadbanding is a property of the IED's underlying data and is configured through the IED configuration tools. • = Selected, ○ = Not selected

3.2 DNP3 implementation table

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

Table 8: Implementation table

OBJECT			REQUEST (Slave will parse)		RESPONSE (Slave 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, 27, 28 (index)		
1	1 (default) 1)	Binary input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 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, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index)
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	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)
3	0	Double bit input – any variation	1 (read) 22 (assign class)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17 ,27, 28 (index)		
3	1	Double bit output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index)
3	2	Double bit input with status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index)

Table continues on next page

OBJECT			REQUEST (Slave will parse)		RESPONSE (Slave will respond with)	
4	0	Double bit input change - any variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
4	1	Double bit input change without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	2	Double bit input change with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
4	3	Double bit 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, 27, 28 (index)		
10	1	Binary output	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index)
10	2	Binary output status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index)
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
20	0	Binary counter —any variation	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)		
20	1	32–bit binary counter (with flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
20	2	16–bit binary counter (with flag)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
20	5	32–bit binary counter without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
20	6	16–bit binary counter without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
22	0	Counter change event — any variation	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
22	1	32–bit counter change event without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	2	16–bit counter change event without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	3	32–bit delta counter change event without time				

Table continues on next page

OBJECT			REQUEST (Slave will parse)		RESPONSE (Slave will respond with)	
22	4	16–bit delta counter change event without time				
22	5	32–bit counter change event with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
22	6	16–bit counter change event with time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)
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, 27, 28 (index)		
30	1	32–bit analog input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
30	2	16–bit analog input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
30	3	32–bit analog input without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
30	4	16–bit analog input without flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
30	5	Short floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
30	6	Long floating point	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 27, 28 (index)	129 (response)	00,01 (start-stop) 17, 28 (index)
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	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)
32	5	Short floating point 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	6	Long floating point analog change event without time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response) 130 (unsol. resp)	17, 28 (index)

Table continues on next page

OBJECT			REQUEST (Slave will parse)		RESPONSE (Slave will respond with)	
32	7	Short floating point 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	8	Long floating point 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	Time and date	1 (read)	07, (limited qty = 1)	129 (response)	07 (limited qty = 1)
			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	Unsynchronized time and date CTO			129 (response) 130 (unsol. resp)	07 (limited qty) (qty = 1)
52	1	Time delay coarse			129 (response)	07 (limited qty) (qty = 1)
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) 07, 08 (limited qty)		
			20 (enbl. unsol.) 21 (dab.unsol.) 22 (assign class)	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) 20 (enbl. unsol.) 21 (dab.unsol.) 22 (assign class)	06 (no range, or all) 06 (no range, or all) 07, 08 (limited qty)		
80	1	Internal indications	1 (read)	00, 01 (start-stop)	129 (response)	00,01 (start-stop)
			2 (write) [3]	00 (start-stop) index=7		
No object (function code only)			13 (cold restart)			
No object (function code only)			14 (warm restart)			
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. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07 or 08 are responded with qualifiers 00 or 01. (For change event objects, qualifiers 17 or 28 are always responded.)
3) Writings of internal indications are only supported for index 7 (Restart IIn1–7).

Section 4 Glossary

AC	Alternating current
ACT	Application configuration tool within PCM600
A/D converter	Analog-to-digital converter
ADBS	Amplitude deadband supervision
AI	Analog input
ANSI	American National Standards Institute
AR	Autoreclosing
ASCT	Auxiliary summation current transformer
ASD	Adaptive signal detection
AWG	American Wire Gauge standard
BI	Binary input
BOS	Binary outputs status
BR	External bistable relay
BS	British Standards
CAN	Controller Area Network. ISO standard (ISO 11898) for serial communication
CB	Circuit breaker
CCITT	Consultative Committee for International Telegraph and Telephony. A United Nations-sponsored standards body within the International Telecommunications Union.
CCVT	Capacitive Coupled Voltage Transformer
Class C	Protection Current Transformer class as per IEEE/ ANSI
CMPPS	Combined megapulses per second
CMT	Communication Management tool in PCM600
CO cycle	Close-open cycle
Codirectional	Way of transmitting G.703 over a balanced line. Involves two twisted pairs making it possible to transmit information in both directions
COMTRADE	Standard format according to IEC 60255-24
Contra-directional	Way of transmitting G.703 over a balanced line. Involves four twisted pairs, two of which are used for transmitting data in both directions and two for transmitting clock signals

CPU	Central processor unit
CR	Carrier receive
CRC	Cyclic redundancy check
CROB	Control relay output block
CS	Carrier send
CT	Current transformer
CVT	Capacitive voltage transformer
DAR	Delayed autoreclosing
DARPA	Defense Advanced Research Projects Agency (The US developer of the TCP/IP protocol etc.)
DBDL	Dead bus dead line
DBLL	Dead bus live line
DC	Direct current
DFC	Data flow control
DFT	Discrete Fourier transform
DHCP	Dynamic Host Configuration Protocol
DIP-switch	Small switch mounted on a printed circuit board
DI	Digital input
DLLB	Dead line live bus
DNP	Distributed Network Protocol as per IEEE/ANSI Std. 1379-2000
DR	Disturbance recorder
DRAM	Dynamic random access memory
DRH	Disturbance report handler
DSP	Digital signal processor
DTT	Direct transfer trip scheme
EHV network	Extra high voltage network
EIA	Electronic Industries Association
EMC	Electromagnetic compatibility
EMF	(Electric Motive Force)
EMI	Electromagnetic interference
EnFP	End fault protection
EPA	Enhanced performance architecture
ESD	Electrostatic discharge
FCB	Flow control bit; Frame count bit

FOX 20	Modular 20 channel telecommunication system for speech, data and protection signals
FOX 512/515	Access multiplexer
FOX 6Plus	Compact time-division multiplexer for the transmission of up to seven duplex channels of digital data over optical fibers
G.703	Electrical and functional description for digital lines used by local telephone companies. Can be transported over balanced and unbalanced lines
GCM	Communication interface module with carrier of GPS receiver module
GDE	Graphical display editor within PCM600
GI	General interrogation command
GIS	Gas-insulated switchgear
GOOSE	Generic object-oriented substation event
GPS	Global positioning system
HDLC protocol	High-level data link control, protocol based on the HDLC standard
HFBR connector type	Plastic fiber connector
HMI	Human-machine interface
HSAR	High speed autoreclosing
HV	High-voltage
HVDC	High-voltage direct current
IDBS	Integrating deadband supervision
IEC	International Electrical Committee
IEC 60044-6	IEC Standard, Instrument transformers – Part 6: Requirements for protective current transformers for transient performance
IEC 61850	Substation automation communication standard
IEC 61850–8–1	Communication protocol standard
IEEE	Institute of Electrical and Electronics Engineers
IEEE 802.12	A network technology standard that provides 100 Mbits/s on twisted-pair or optical fiber cable
IEEE P1386.1	PCI Mezzanine Card (PMC) standard for local bus modules. References the CMC (IEEE P1386, also known as Common Mezzanine Card) standard for the mechanics and the PCI specifications from the PCI SIG (Special Interest Group) for the electrical EMF (Electromotive force).

IEEE 1686	Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities
IED	Intelligent electronic device
I-GIS	Intelligent gas-insulated switchgear
Instance	When several occurrences of the same function are available in the IED, they are referred to as instances of that function. One instance of a function is identical to another of the same kind but has a different number in the IED user interfaces. The word "instance" is sometimes defined as an item of information that is representative of a type. In the same way an instance of a function in the IED is representative of a type of function.
IP	1. Internet protocol. The network layer for the TCP/IP protocol suite widely used on Ethernet networks. IP is a connectionless, best-effort packet-switching protocol. It provides packet routing, fragmentation and reassembly through the data link layer. 2. Ingression protection, according to IEC standard
IP 20	Ingression protection, according to IEC standard, level 20
IP 40	Ingression protection, according to IEC standard, level 40
IP 54	Ingression protection, according to IEC standard, level 54
IRF	Internal failure signal
IRIG-B:	InterRange Instrumentation Group Time code format B, standard 200
ITU	International Telecommunications Union
LAN	Local area network
LIB 520	High-voltage software module
LCD	Liquid crystal display
LDD	Local detection device
LED	Light-emitting diode
MCB	Miniature circuit breaker
MCM	Mezzanine carrier module
MVB	Multifunction vehicle bus. Standardized serial bus originally developed for use in trains.
NCC	National Control Centre
OCO cycle	Open-close-open cycle
OCP	Overcurrent protection
OLTC	On-load tap changer
OV	Over-voltage

Overreach	A term used to describe how the relay behaves during a fault condition. For example, a distance relay is overreaching when the impedance presented to it is smaller than the apparent impedance to the fault applied to the balance point, that is, the set reach. The relay “sees” the fault but perhaps it should not have seen it.
PCI	Peripheral component interconnect, a local data bus
PCM	Pulse code modulation
PCM600	Protection and control IED manager
PC-MIP	Mezzanine card standard
PMC	PCI Mezzanine card
POR	Permissive overreach
POTT	Permissive overreach transfer trip
Process bus	Bus or LAN used at the process level, that is, in near proximity to the measured and/or controlled components
PSM	Power supply module
PST	Parameter setting tool within PCM600
PT ratio	Potential transformer or voltage transformer ratio
PUTT	Permissive underreach transfer trip
RASC	Synchrocheck relay, COMBIFLEX
RCA	Relay characteristic angle
RFPP	Resistance for phase-to-phase faults
RFPE	Resistance for phase-to-earth faults
RISC	Reduced instruction set computer
RMS value	Root mean square value
RS422	A balanced serial interface for the transmission of digital data in point-to-point connections
RS485	Serial link according to EIA standard RS485
RTC	Real-time clock
RTU	Remote terminal unit
SA	Substation Automation
SBO	Select-before-operate
SC	Switch or push button to close
SCS	Station control system
SCADA	Supervision, control and data acquisition
SCT	System configuration tool according to standard IEC 61850

SDU	Service data unit
SMA connector	Subminiature version A, A threaded connector with constant impedance.
SMT	Signal matrix tool within PCM600
SMS	Station monitoring system
SNTP	Simple network time protocol – is used to synchronize computer clocks on local area networks. This reduces the requirement to have accurate hardware clocks in every embedded system in a network. Each embedded node can instead synchronize with a remote clock, providing the required accuracy.
SRY	Switch for CB ready condition
ST	Switch or push button to trip
Starpoint	Neutral point of transformer or generator
SVC	Static VAr compensation
TC	Trip coil
TCS	Trip circuit supervision
TCP	Transmission control protocol. The most common transport layer protocol used on Ethernet and the Internet.
TCP/IP	Transmission control protocol over Internet Protocol. The de facto standard Ethernet protocols incorporated into 4.2BSD Unix. TCP/IP was developed by DARPA for Internet working and encompasses both network layer and transport layer protocols. While TCP and IP specify two protocols at specific protocol layers, TCP/IP is often used to refer to the entire US Department of Defense protocol suite based upon these, including Telnet, FTP, UDP and RDP.
TNC connector	Threaded Neill-Concelman, a threaded constant impedance version of a BNC connector
TPZ, TPY, TPX, TPS	Current transformer class according to IEC
UMT	User management tool
Underreach	A term used to describe how the relay behaves during a fault condition. For example, a distance relay is underreaching when the impedance presented to it is greater than the apparent impedance to the fault applied to the balance point, that is, the set reach. The relay does not “see” the fault but perhaps it should have seen it. See also Overreach.
UTC	Coordinated Universal Time. A coordinated time scale, maintained by the Bureau International des Poids et Mesures (BIPM), which forms the basis of a coordinated dissemination of standard frequencies and time signals. UTC

	is derived from International Atomic Time (TAI) by the addition of a whole number of "leap seconds" to synchronize it with Universal Time 1 (UT1), thus allowing for the eccentricity of the Earth's orbit, the rotational axis tilt (23.5 degrees), but still showing the Earth's irregular rotation, on which UT1 is based. The Coordinated Universal Time is expressed using a 24-hour clock, and uses the Gregorian calendar. It is used for aeroplane and ship navigation, where it is also sometimes known by the military name, "Zulu time." "Zulu" in the phonetic alphabet stands for "Z", which stands for longitude zero.
UV	Undervoltage
WEI	Weak end infeed logic
VT	Voltage transformer
X.21	A digital signalling interface primarily used for telecom equipment
$3I_O$	Three times zero-sequence current. Often referred to as the residual or the earth-fault current
$3U_O$	Three times the zero sequence voltage. Often referred to as the residual voltage or the neutral point voltage

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