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HighPROTEC

MCA4

IEC 61850 Edition 2 — PIXIT

Protocol Implementation Extra Information for Testing (PIXIT)

for the IEC 61850 Edition 2 server interface in MCA4

Build 61991

Revision A

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Table of Contents

1 Contents of this document

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in MCA4 with firmware version 3.10.

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, TICS documents or SCL file.

Each table specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10. The “Ed” column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2. A hyphen (“-”) in the Ed column indicates the PIXIT entry is not applicable for any version.

2 PIXIT for Documentation

ID	Ed	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	The firmware version is visible on the HMI and the ICT.

ICT — IED Configuration Tool: For the HighPROTEC IEDs, this is the Windows PC application *Smart view*.

3 PIXIT for Association model

ID	Ed	Description	Value / Clarification
AS1	1	Maximum number of clients that can set-up an association simultaneously	4
AS2	1,2	TCP_KEEPALIVE values	Keep Alive Time: configurable between 1 – 7200s Keep Alive Interval: configurable between 1 – 60s Keep Alive Retry: fix 3
AS3	1,2	Lost connection detection time	A lost connection is detected after: Keep Alive Time + (Keep Alive Retry + 1) * Keep Alive Interval
AS4	–	Is authentication supported?	N
AS5	1,2	What association parameters are necessary for successful association?	Called values: • Transport selector: Y • Session selector: Y • Presentation selector: Y • AP Title: N • AE Qualifier: N Calling values: • Transport selector: Y • Session selector: Y • Presentation selector: Y • AP Title: N • AE Qualifier: N
AS6	1,2	If association parameters are necessary for association, describe the correct values.	Called values: • Transport selector: 0001 • Session selector: 0001 • Presentation selector: 00000001 • AP Title: any • AE Qualifier: any Calling parameters: • Transport selector: 0001 • Session selector: 0001 • Presentation selector: 00000001 • AP Title: any • AE Qualifier: any
AS7	1,2	What is the maximum and minimum MMS PDU size?	Max MMS PDU size: 64kB Min MMS PDU size: 4000
AS8	1,2	What is the maximum start-up time after a power supply interrupt?	Max. 120 seconds until HMI is operable. Max. 10 seconds until protection and IEC 61850 is operable.

ID	Ed	Description	Value / Clarification
AS9	1,2	Does this device function only as test equipment?	N

4 PIXIT for Server model

ID	Ed	Description	Value / Clarification
Sr1	1,2	Which analog value (MX) quality bits are supported (can be set by server)?	Validity: • Y Good, • N Invalid, • N Reserved, • N Questionable Detail Quality: • N Overflow • N OutofRange • N BadReference • N Oscillatory • N Failure • N OldData • N Inconsistent • N Inaccurate Miscellaneous: • N Source • Y Test • N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)?	Validity: • Y Good, • Y Invalid, • N Reserved, • Y Questionable Detail Quality: • N BadReference • N Oscillatory • Y Failure • N OldData • Y Inconsistent • N Inaccurate Miscellaneous: • N Source • Y Test • N OperatorBlocked
Sr3	–	What is the maximum number of data object references in one GetDataValues request?	Deprecated
Sr4	–	What is the maximum number of data object references in one SetDataValues request?	Deprecated
Sr5	1	Which Mode values are supported? (IEC 61850-6:2009 clause 9.5.6 states that if only a subrange of the enumeration value set is supported, this shall be indicated within an ICD file by an enumeration type, where the unsupported values are missing.)	Y On Y (On-)Blocked (*) Y Test (*) Y Test/Blocked (*)

ID	Ed	Description	Value / Clarification
		(*) Some Logical Nodes support only the modes On and Test. (Details can be seen in the MICS document.)	Y Off

5 PIXIT for Data set model

ID	Ed	Description	Value / Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)?	60
Ds2	1	How many persistent data sets can be created by one or more clients? (This number includes predefined datasets.)	35 (If there are datasets defined in the SCL file, only the remaining amount can be created by the clients during run-time.)
Ds3	1	How many non-persistent data sets can be created by one or more clients?	35

6 PIXIT for Setting group control model

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device?	4 setting groups are available for the Logical Device PROT.
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated? (Compare IEC 61850-8-1 §16.2.4.)	N/A
Sg3	1	Can multiple clients edit the same setting group?	The active setting group can be selected via IEC 61850. However, changing setting group values is possible only using the ICT.
Sg4	1	What happens if the association is lost while editing a setting group?	N/A
Sg5	1	Is EditSG value 0 allowed?	EditSG value is always 0.
Sg6	2	When ResvTms is not present how long is an edit setting group locked?	N/A

ICT IED Configuration Tool: For the HighPROTEC IEDs, this is the Windows PC application *Smart view*.

7 PIXIT for Reporting model

ID	Ed	Description	Value / Clarification
Rp1	1	The supported trigger conditions are: (Compare PICS.)	integrity: Y data change: Y quality change: Y data update: Y general interrogation: Y
Rp2	1	The supported optional fields are:	sequence-number: Y report-time-stamp: Y reason-for-inclusion: Y data-set-name: Y data-reference: Y buffer-overflow: Y entryID: Y conf-rev: Y segmentation: Y
Rp3	1,2	Can the server send segmented reports?	Y
Rp4	1,2	Mechanism on second internal data change notification of the same analogue data value within buffer period: (Compare IEC 61850-7-2 Ed2 §17.2.2.9.)	Send report immediately.
Rp5	1	Multi client URCB approach: (Compare IEC 61850-7-2:2003 §14.2.1.)	Each URCB is visible to all clients
Rp6	–	What is the format of EntryID?	Deprecated
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered?	10000 bytes for each BRCB
Rp8	–	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated
Rp9	1	May the reported data set contain: • structured data objects? • data attributes? • timestamp data attributes?	 • Y • Y • Y
Rp10	1,2	What is the scan cycle for binary events?	There is no scan cycle for binary events. Reporting works event driven.
		Is this fixed, configurable?	Fixed
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL?	N
Rp12	2	After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart?	Restored from original configuration

ID	Ed	Description	Value / Clarification
Rp13	1,2	Does the server accept any client to configure / enable a BRCB with ResvTms=−1? What fields are used to do the identification?	N ResvTms N AP-Title N AE-Qualifier
Rp14	1,2	When BRCB.ResvTms is exposed, what is the default value for BRCB.ResvTms if client does not write (must be > 0)? or	N/A
		When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0)?	N/A
Rp15	2	Is data model db=0 supported?	Y

8 PIXIT for GOOSE publish model

ID	Ed	Description	Value / Clarification
Gp1	1,2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set?	Y
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect?	NdsCom=T DUT keeps GoEna=F
Gp3	1,2	Published FCD supported common data classes are:	Only Data Attributes can be published.
Gp4	1,2	What is the maximum value of TAL (maxTime)?	60000 ms
		Is it fixed or configurable?	Configured by SCL
Gp5	1,2	What is the fastest retransmission time?	2 ms
Gp6	–	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)?	Deprecated. See PICS – SetGoCBValues
Gp7	1,2	What is the initial GOOSE sqNum after restart?	sqNum = 1
Gp8	1	May the GOOSE data set contain: • structured data objects (FCD) • timestamp data attributes	 • N • N
Gp9	1,2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	N

9 PIXIT for GOOSE subscribe model

ID	Ed	Description	Value / Clarification
Gs1	1,2	What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions. Notes: • the VLAN tag may be removed by an Ethernet switch and shall not be checked • the simulation flag shall always be checked (Ed2)	Y destination MAC address N APPID Y gocbRef Y timeAllowedtoLive Y datSet Y goID N T Y stNum Y sqNum Y simulation / test Y confRev Y ndsCom Y numDatSetEntries N out-of-order dataset members
Gs2	1,2	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive by 2× TAL.
Gs3	1,2	What is the behaviour when one or more subscribed GOOSE messages is not received or syntactically incorrect (missing GOOSE)?	The behaviour is as if the messages have not been received. The Quality bit is changed from questionable to invalid.
Gs4	1,2	What is the behaviour when a subscribed GOOSE message is out-of-order?	must be ignored
Gs5	1,2	What is the behaviour when a subscribed GOOSE message is duplicated?	must be ignored
Gs6	1	Does the device subscribe to GOOSE messages with/ without the VLAN tag?	Y, with the VLAN tag Y, without the VLAN tag
Gs7	1	May the GOOSE data set contain: • structured data objects (FCD) • timestamp data attributes	• N • N
Gs8	1,2	Subscribed FCD supported common data classes are:	Only Boolean Data Attributes are supported.
Gs9	1	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode?	Y
Gs10	1,2	Max number of dataset members	Unlimited
Gs11	1	Is Fixed-length encoded GOOSE supported?	N/A Note: Ed2 Am1 requires support
Gs12	2	Is IEC 62351-6 security supported?	N

10 PIXIT for GOOSE performance

ID	Ed	Description	Value / Clarification
Gf1	1,2	Performance class:	P1 = 3 ms
Gf2	1,2	GOOSE ping-pong processing method:	Event driven based
Gf3	1,2	Application logic scan cycle (ms):	Min.: 2.25 ms Max.: typ. 10 ms
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes):	60

11 PIXIT for Control model

ID	Ed	Description	Value / Clarification
Ct1	1	What control models are supported? (Compare ICD file enums for Ed2.)	DOns: Y SBOns: N DOes: N SBOes: Y
Ct2	1,2	Is the control model fixed, configurable and/or dynamic?	Fixed
Ct3	–	Is TimeActivatedOperate supported (compare PICS or SCL)?	N – Deprecated
Ct4	–	Is “operate-many” supported (compare sboClass)?	Deprecated, see sboClass in datamodel (ICD)
Ct5	1	Will the DUT activate the control output when the test attribute is set in the SelectWithValue and/or Operate request (when N test procedure Ctl2 is applicable)?	Only if the device works in simulation mode
Ct6	–	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request?	Deprecated
Ct7	–	Is pulse configuration supported?	Y
Ct8	1,2	What is the behaviour of the DUT when the check conditions are not set?	DUT refuses to bypass the check with “Not supported”.
		This behaviour is:	Fixed
Ct9	1,2	Which additional cause diagnosis are supported?	Y Unknown Y Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Parameter-change-in-execution N Step-limit Y Blocked-by-Mode Y Blocked-by-process Y Blocked-by-interlocking Y Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health Y 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected Y Object-already-selected

ID	Ed	Description	Value / Clarification
			N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command Y None Y Inconsistent-parameters Y Locked-by-other-client
Ct10	1,2	How to force a “test-not-ok” respond with SelectWithValue request:	invalid orCat value
Ct11	1,2	How to force a “test-not-ok” respond with Select request:	N/A
Ct12	1,2	How to force a “test-not-ok” respond with Operate request:	DOns: Not available SBOns: N/A DOes: N/A SBOes: invalid orCat value
Ct13	1,2	Which origin categories are supported / accepted?	Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process
Ct14	1,2	What happens if the orCat value is not supported or invalid?	DOns: Command is rejected. SBOns: N/A DOes: N/A SBOes: Command is rejected with AddCause.
Ct15	1,2	Does the IED accept a SelectWithValue / Operate with the same control value as the current status value? Is this behaviour configurable?	DOns: N SBOns: N/A DOes: N/A SBOes: N Configurable: N
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	DOns: Y SBOns: N/A DOes: N/A SBOes: N

ID	Ed	Description	Value / Clarification
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected? (Tissue #334)	SBOns: N/A SBOes: Y
Ct18	1	Deprecated	
Ct19	–	Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)?	Deprecated
Ct20	1,2	Does the IED support local / remote operation?	SBOes: Y DOns: N
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOns: N/A DOns: N/A
Ct22	2	How to force a “parameter-change-in-execution”?	SBOns: N/A SBOes: N/A
Ct23	1,2	How many SBOns/SBOes control objects can be selected at the same time?	SBOns: n = N/A SBOes: n = 1
Ct24	1,2	Can a controllable object be forced to keep its old state e.g. Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y
Ct25	1,2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	DPC: Y intermediate state: Y
Ct26	1,2	Name an enhanced security control point (if any) with a finite operate timeout:	DOes: N/A SBOes: CSWI
		Specify the operate timeout (in milliseconds):	DOes: N/A SBOes: configurable via ICT
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: N DOes: N SBOes: Y
Ct28		Deprecated, kept as placeholder.	

ICT IED Configuration Tool: For the HighPROTEC IEDs, this is the Windows PC application *Smart view*.

12 PIXIT for Time synchronisation model

ID	Ed	Description	Value / Clarification
Tm1	1	What quality bits are supported?	Y LeapSecondsKnown N ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the behaviour when all time server(s) cease to respond:	The quality bit “ClockNotSynchronized” is set to TRUE after a fixed time period.
		What is the time server lost detection time?	~90 seconds
Tm3	1,2	How long does it take to take over the new time from time server?	~15 seconds
Tm4	1,2	When is the time quality bit "Clock failure" set?	Not supported
Tm5	1,2	When is the time quality bit "Clock not synchronised” set?	90 seconds after receiving the last synchronization signal/messages. (Note: For Ed2 and up, CNS is set according to PIXIT Tm2.)
Tm6	–	Is the timestamp of a binary event adjusted to the configured scan cycle?	Deprecated
Tm7	1	Does the device support time zone and daylight saving?	Y
Tm8	1,2	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3? Y Mode is equal to SERVER N OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp N RX/TX timestamp fields are checked for reasonableness Y SNTP version (3 and 4 accepted)
Tm9	1,2	Do the COMTRADE files have local time or UTC time and is this configurable?	N/A – The IED uses a proprietary “HptDr” format. However, this can be exported to COMTRADE using the Windows PC application *DataVisualizer*. N Configurable

13 PIXIT for File transfer model

ID	Ed	Description	Value / Clarification
Ft1	1	What is the structure of files and directories?	Flat file system
		Where are the COMTRADE files stored?	The IED uses a proprietary “HptDr” format. However, this can be exported to COMTRADE using the Windows PC application *DataVisualizer*.
		Are COMTRADE files zipped and what files are included in each zip file?	Not zipped
Ft2	1,2	Directory names are separated from the file name by:	N/A – No directories
Ft3	1	The maximum file name size including path (recommended 64 chars):	255 chars
Ft4	1,2	Are directory/file name case sensitive?	case sensitive
Ft5	1,2	Maximum file size for SetFile:	N/A
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name?	Y (always complete path)
Ft7	1	Is the wild card supported in the MMS fileDirectory request?	No
Ft8	1,2	Is it allowed that 2 clients get a file at the same time?	Y same file Y different files
Ft9	1,2	Which files can be deleted?	All

14 PIXIT for Service tracking model

ID	Ed	Description	Value / Clarification
Tr1	2	Which ACSI services are tracked by LTRK.GenTrk?	The general tracker LTRK.GenTrk is currently not implemented. However, there are specific trackers available for the following ACSI services: SelectActiveSG, GetSGCBValues, SetBRCBValues, SetGoCBValues, SelectWithValue, Cancel, Operate, CommandTermination

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