

Protocol Implementation eXtra Information for Testing (PIXIT)  
for the IEC 61850 interface in ENIP-2

UCA International Users Group  
Testing Sub Committee

PIXIT template extracted from server test procedures version 2.3 and  
updated according to TPCL version 1.7

Date: July 8, 2015

## Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in ENIP-2 with firmware version 2.0.0.6.

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10.

## Contents of this document

Each chapter specifies the PIXIT for each applicable ACSI service model as structured in IEC 61850-10.

### PIXIT for Association model

ID	Description	Value / Clarification
As1	Maximum number of clients that can set-up an association simultaneously	4
As2	TCP_KEEPALIVE value	configured
As3	Lost connection detection time	TCP_KEEPALIVE + 8 seconds
As4	Is authentication supported	N
As5	What association parameters are necessary for successful association	Transport selector Y Session selector Y Presentation selector Y AP Title ANY AE Qualifier ANY
As6	If association parameters are necessary for association, describe the correct values e.g.	Transport selector 0001 Session selector 0001 Presentation selector 00000001 AP Title 1,1,999,1,1 AE Qualifier 12
As7	What is the maximum and minimum MMS PDU size	Max MMS PDU size in 1460, out 3072 Min MMS PDU size Dependent on packet size
As8	What is the maximum start up time after a power supply interrupt	8 seconds
	<additional items>	

**PIXIT for Server model**

ID	Description	Value / Clarification
Sr1	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, N Questionable N Overflow N OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: N Process N Substituted N Test N OperatorBlocked
Sr2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, N Questionable N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: N Process N Substituted N Test N OperatorBlocked
Sr3	What is the maximum number of data values in one GetDataValues request	Limit on max MMS PDU size
Sr4	What is the maximum number of data values in one SetDataValues request	Limit on max MMS PDU size
Sr5	Which Mode / Behaviour values are supported	On Y Blocked Y Test Y Test/Blocked Y Off Y
	<additional items>	

**PIXIT for Data set model**

ID	Description	Value / Clarification
Ds1	What is the maximum number of data elements in one data set (compare ICD setting)	20
Ds2	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	8 (Max number of all data sets is 8)
Ds3	How many non-persistent data sets can be created by one or more clients	8 (Max number of all data sets is 8)
	<additional items>	

**PIXIT for Substitution model**

ID	Description	Value / Clarification
Sb1	Are substituted values stored in volatile memory?	NA
	<additional items>	

**PIXIT for Setting group control model**

ID	Description	Value / Clarification
Sg1	What is the number of supported setting groups for each logical device (compare NumSG in the SGCB)	NA
Sg2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 §16.2.4)	NA
Sg3	Can multiple clients edit the same setting group	NA
Sg4	What happens if the association is lost while editing a setting group	NA
Sg5	Is EditSG value 0 allowed?	NA
	<additional items>	

**PIXIT for Reporting model**

ID	Description	Value / Clarification
Rp1	The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update NA general interrogation Y
Rp2	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 N

<b>ID</b>	<b>Description</b>	<b>Value / Clarification</b>
Rp3	Can the server send segmented reports	N
Rp4	Mechanism on second internal data change notification of the same analogue data value within buffer period (Compare IEC 61850-7-2 §14.2.2.9)	Send report immediately
Rp5	Multi client URCB approach (compare IEC 61850-7-2 §14.2.1)	Each URCB is visible to all clients
Rp6	What is the format of EntryID	8 bytes
Rp7	What is the buffer size for each BRCB or how many reports can be buffered	Up to 200 events (Device has a single buffer for all binary events. Buffer size for each BRCB depends on device configuration)
Rp8	Pre-configured RCB attributes that can be changed online when RptEna = FALSE (see also the ICD report settings)	Y
Rp9	May the reported data set contain: - structured data objects? - data attributes?	Y Y
Rp10	What is the scan cycle for binary events? Is this fixed, configurable	< 1 milliseconds Fixed
Rp11	Does the device support to pre-assign a RCB to a specific client in the SCL	N
	BufTm	Always = 0

### PIXIT for Generic substation events model

ID	Description	Value / Clarification						
Go1	<p>What elements of a subscribed GOOSE header are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions.</p> <p>Note: the VLAN tag may be removed by a ethernet switch and should not be checked</p>	<p>Y source MAC address</p> <p>Y destination MAC address</p> <p>Y Ethertype = 0x88B8</p> <p>Y APPID</p> <p>Y gocbRef</p> <p>Y timeAllowedtoLive</p> <p>Y datSet</p> <p>Y gold</p> <p>Y t</p> <p>Y stNum</p> <p>Y sqNum</p> <p>Y test</p> <p>Y confRev</p> <p>Y ndsCom</p> <p>Y numDatSetEntries</p>						
Go2	Can the test flag in the published GOOSE be turned on / off	Y						
Go3	Does the DUT accept a configuration with a Goose control block with empty data set or too large data set?	No, the GoCB need to be removed from the configuration						
Go4	What is the behaviour when the GOOSE publish configuration is incorrect	DUT will send GOOSE with NdsCom=T						
Go5	<p>When is a subscribed GOOSE marked as lost?</p> <p>(TAL = time allowed to live value from the last received GOOSE message)</p>	message does not arrive prior to TAL						
Go6	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	After TAL set Quality of GOOSE data as invalid						
Go7	What is the behaviour when a subscribed GOOSE message is out-of-order	message is ignored						
Go8	What is the behaviour when a subscribed GOOSE message is duplicated	message is ignored						
Go9	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Configured						
Go10	<p>May the GOOSE data set contain:</p> <ul style="list-style-type: none"> <li>- structured data objects (FCD)?</li> <li>- timestamp data attributes?</li> </ul> <p>Note: data attributes (FCDA) is mandatory</p>	<table border="0"> <tr> <td>Subscribed</td> <td>Published</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> </table>	Subscribed	Published	Y	Y	Y	Y
Subscribed	Published							
Y	Y							
Y	Y							
Go11	Published FCD supported common data classes / data types are	Any from Model						
Go12	Subscribed FCD supported common data classes / data types are	only SPS, DPC						

ID	Description	Value / Clarification
Go13	What is the slow retransmission time? Is it fixed or configurable?	Configured by EsConfigurator
Go14	What is the minimum supported retransmission time? What is the maximum supported retransmission time?  Is it fixed or configurable?	1 ms  65535 ms  Both are configurable
Go15	Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	Y
	<additional items>	

TAL = Time Allowed to Live

### PIXIT for GOOSE performance

ID	Description	Value / Clarification
Gp1	Performance class	P2/P3
Gp2	GOOSE ping-pong processing method	Event driven based
Gp3	Application logic scan cycle(ms)	Max.
		Min.
Gp4	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	20
Gp5	Maximum number of GOOSE to be published	8
Gp6	Maximum number of GOOSE to be subscribed	32
Gp7	Data types in GOOSE dataset for published GOOSEs According to 7-2 Table 2	Any from Model
Gp8	Data types in GOOSE dataset for subscribed GOOSEs According to 7-2 Table 2	Boolean, Quality, Timestamp, SPS, DPC Arrays are [not] supported

### PIXIT for Control model

ID	Description	Value / Clarification
Ct1	What control models are supported (compare PICS)	Y status-only Y direct-with-normal-security N sbo-with-normal-security N direct-with-enhanced-security Y sbo-with-enhanced-security

ID	Description	Value / Clarification
Ct2	Is the control model fixed, configurable and/or online changeable?	Fixed
Ct3	Is TimeActivatedOperate supported	N
Ct4	Is “operate-many” supported	N
Ct5	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)	N
Ct6	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	e.g. DUT ignores the time value and execute the command as usual
Ct7	Is pulse configuration supported	N
Ct8	<p>What is the behaviour of the DUT when the check conditions are set</p> <p>Is this behaviour fixed, configurable, online changeable?</p>	<p>N synchrocheck  Y interlock-check  DUT uses the check value to perform the check  Online changeable</p>
Ct9	What additional cause diagnosis are supported	<p>Y Blocked-by-switching-hierarchy  Y Select-failed  Y Invalid-position  N Position-reached  Y Parameter-change-in-execution  N Step-limit  Y Blocked-by-Mode  Y Blocked-by-process  Y Blocked-by-interlocking  N Blocked-by-synchrocheck  Y Command-already-in-execution  Y Blocked-by-health  N 1-of-n-control  N Abortion-by-cancel  Y Time-limit-over  N Abortion-by-trip</p>
Ct10	How to force a “test-not-ok” respond with SelectWithValue request?	Send SelectWithValue request twice



<b>ID</b>	<b>Description</b>	<b>Value / Clarification</b>
Ct11	How to force a “test-not-ok” respond with Select request?	NA
Ct12	How to force a “test-not-ok” respond with Operate request?	Dons: N SBOs: NA Does: NA SBOes: Send Operate request without SelectWithValue request
Ct13	Which origin categories are supported?	Categories 1-8
Ct14	What happens if the orCat value is not supported?	Dons: Error SBOs: NA Does: NA SBOes: Error
Ct15	Does the IED accept a SelectWithValue/Operate with the same ctIVal as the current status value?	Dons: Y SBOs: NA Does: NA SBOes: Y
Ct16	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	Dons: Y (default Y) SBOs: NA (default N) Does: NA (default Y) SBOes: N (default N)
Ct17	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)	SBOs: NA SBOes: N
Ct18	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	SelectWithValue and Operate
Ct19	Can a control operation be blocked by Mod=Off or Blocked	Y
Ct20	Does the IED support local / remote operation?	Only specific LN (XCBR, XSWI)
Ct21	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOs: NA Dons: N
	<additional items>	

#### **PIXIT for Time and time synchronization model**

<b>ID</b>	<b>Description</b>	<b>Value / Clarification</b>
Tm1	What quality bits are supported (may be set by the IED)	N LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	Describe the behavior when the time synchronization signal/messages are lost	Quality bit in timestamp is “ClockNotSynchronized”
Tm3	When is the time quality bit “ClockFailure” set?	When DUTs RTC is failure
Tm4	When is the time quality bit “Clock not synchronized” set?	Y
Tm5	Is the timestamp of a binary event adjusted to	Y

ID	Description	Value / Clarification
	the configured scan cycle?	
Tm6	Does the device support time zone and daylight saving?	Y
Tm7	Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3? N Mode is equal to SERVER Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 4 N other (describe)
	<additional items>	