Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 interface in SEL-787

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: February 25, 2013

Schweitzer Engineering Laboratories, Inc.

Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in SEL-787 with firmware version R100.

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	6
As2	TCP_KEEPALIVE value	1-20 seconds
As3	Lost connection detection time	1-20 seconds
As4	Is authentication supported	N
As5	What association parameters are necessary for successful association	Transport selector Y Session selector Y Presentation selector Y These parameters must be 00 01, 00 01, and 00 00 00 01, respectively, for successful association. AP Title Y AE Qualifier Y These parameters may exist, but they are not validated to allow successful association.
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 NA AE Qualifier NA
As7	What is the maximum and minimum MMS PDU size	Max MMS PDU size 12kbytes Min MMS PDU size
As8	What is the maximum start up time after a power supply interrupt	Approximately 180 seconds

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 Y 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 Y 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	Not restricted; depends on the maximum PDU size of 12K bytes.
Sr4	What is the maximum number of data values in one SetDataValues request	Not restricted; depends on the maximum PDU size of 12k bytes.
Sr5	Which Mode / Behaviour values are supported	On Y Blocked N Test N Test/Blocked N Off Y

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)	500 FCDAs
Ds2	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	Clients cannot create data sets. There is no dynamic data set creation.
Ds3	How many non-persistent data sets can be created by one or more clients	Clients cannot create data sets. There is no dynamic data set creation.

PIXIT for Substitution model
This service is not supported.

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

PIXIT for Setting group control model
This service is not supported.

ID	Description	Value / Clarification
Sg1	What is the number of supported setting groups for each logical device (compare NumSG in the SGCB)	
Sg2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	
Sg3	Can multiple clients edit the same setting group	Y/N
Sg4	What happens if the association is lost while editing a setting group	Y/N
Sg5	Is EditSG value 0 allowed?	Y/N
	<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 N—This trigger condition is supported, but no data objects exist with this trigger option. general interrogation Y

ID	Description	Value / Clarification
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 Y
Rp3	Can the server send segmented reports	Y
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 one client only.
~~Rp6~~	(unused), was “What is the format of EntryID”	Octetstring8
Rp7	What is the buffer size for each BRCB or how many reports can be buffered	120k bytes
Rp8	Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also the ICD report settings)	cbName datSet
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	500 Mseconds Fixed
Rp11	Does the device support to pre-assign a RCB to a specific client in the SCL	N
	BRCB enable behavior with respect to negotiated PDU size.	If a client negotiated a smaller PDU size than the last client that enabled a BRCB, that client will not be able to enable the BRCB.

PIXIT for Logging model
This service is not supported.

ID	Description	Value / Clarification
Lg1	What is the default value of LogEna (Compare IEC 61850-8-1 $17.3.3.2.1, the default value should be FALSE)	TRUE/FALSE
Lg2	What is the format of EntryID (Compare IEC 61850-8-1 $17.3.3.3.1)	
Lg3	If there are multiple Log Control Blocks that specify the Journaling of the same MMS NamedVariable and TrgOps and the Event Condition (Compare IEC 61850-8-1 $17.3.3.3.2)	Single Journal Entry (specify the event condition) or Multiple Journal Entries
Lg4	Pre-configured LCB attributes that cannot be changed online	
	<additional items>	

PIXIT for Generic substation events model

ID	Description	Value / Clarification
Go1	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. Note: the VLAN tag may be removed by a ethernet switch and should not be checked	N source MAC address Y destination MAC address= as configured in the CID file. Y Ethertype = 0x88B8 N APPID Y gocbRef = as configured in the CID file. N timeAllowedtoLive Y datSet Y goID N t Y stNum Y sqNum Y test Y ConfRev = as configured in the CID file. Y ndsCom Y numDatSetEntries = as configured in the CID file.
Go2	Can the test flag in the published GOOSE be turned on / off	N
Go3	Does the DUT accept a configuration with a Goose control block with empty data set or too large data set?	No, the GoCB must be removed from the configuration
Go3	What is the behaviour when the GOOSE publish configuration is incorrect	The whole 61850 configuration fails and no GOOSE messages are transmitted.

ID	Description	Value / Clarification
Go4	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	Message does not arrive prior to TAL. If a GOOSE message exceeds the TAL, the GOOSE subscriber will issue a TAL error and wait for the next message.
Go5	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	If GOOSE messages are skipped for any reason, the GOOSE subscriber will issue an error message and wait for the next message. For syntax errors, the GOOSE subscriber sets the appropriate error and waits for the next message.
Go6	What is the behaviour when a subscribed GOOSE message is out-of-order	Treated as an insignificant error. The GOOSE subscriber sends an out-of-sequence error, and processes the received GOOSE message as normal.
Go7	What is the behaviour when a subscribed GOOSE message is duplicated	Treated as an insignificant error. The GOOSE subscriber sends an out of sequence error, and processes the received GOOSE message as normal.
Go8	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Y, with the VLAN tag Y, without the VLAN tag
Go9	May the GOOSE data set contain: - structured data objects (FCD)? - timestamp data attributes? Note: data attributes (FCDA) is mandatory	Subscribed Published Y Y Y Y
Go10	Published FCD supported common data classes / data types are	ACD, ACT, CMV, DEL, DPC, DPL, INC, INS, LPL, MV, SEQ, SPC, SPS, and WYE
Go11	Subscribed FCD supported common data classes / data types are	All CDCs except these: HMV, HWYE, HDEL, and CSD
Go12	What is the slow retransmission time? Is it fixed or configurable?	1000 mseconds with TAL = 2000 Configurable in CID file.
Go13	What is the minimum supported retransmission time? What is the maximum supported retransmission time? Is it fixed or configurable?	10 mseconds with TAL = 30 The TAL is twice the retransmission time at the maximum retransmission interval. Configurable
Go14	Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	Y/N
	<additional items>	

TAL = Time Allowed to Live

PIXIT for GOOSE performance

ID	Description		Value / Clarification
Gp1	Performance class		P1 or P2/P3
Gp2	GOOSE ping-pong processing method		Event driven based or Scan cycle based
Gp3	Application logic scan cycle(ms)	Max.	Boolean 103 ms / DP 200ms
		Min.	Boolean 0 ms / DP 0 ms
Gp4	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)		50
Gp5	Maximum number of GOOSE to be published		5
Gp6	Maximum number of GOOSE to be subscribed		50
Gp7	Data types in GOOSE dataset for published GOOSEs According to 7-2 Table 2		Boolean / Double Point / Int. 64
Gp8	Data types in GOOSE dataset for subscribed GOOSEs According to 7-2 Table 2		Boolean / Double Point / Int. 64

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 Y direct-with-enhanced-security Y sbo-with-enhanced-security
Ct2	Is the control model fixed, configurable and/or online changeable?	Configurable = as defined in the CID
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	DUT ignores the time value and executes the command as usual.

ID	Description	Value / Clarification
Ct7	Is pulse configuration supported	N
Ct8	What is the behaviour of the DUT when the check conditions are set Is this behaviour fixed, configurable, online changeable?	N synchrocheck N interlock-check DUT ignores the check value and always perform the check Fixed
Ct9	What additional cause diagnosis are supported	Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached Y Parameter-change-in-execution N Step-limit Y Blocked-by-Mode Y Blocked-by-process N Blocked-by-interlocking N Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health N 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip Y Object-not-selected
Ct10	How to force a “test-not-ok” respond with SelectWithValue request?	Operate a single attribute instead of the entire SBOw structure
Ct11	How to force a “test-not-ok” respond with Select request?	Operate a single attribute instead of the entire SBOw structure
Ct12	How to force a “test-not-ok” respond with Operate request?	DOns: SBOns: not supported DOes: SBOes: Operate a single attribute instead of the entire Oper structure.
Ct13	Which origin categories are supported?	All

ID	Description	Value / Clarification
Ct14	What happens if the orCat value is not supported?	All originator categories are supported by default. However, if an orCat is unsupported by configuration, the IED will respond with an MMS write failure.
Ct15	Does the IED accept a SelectWithValue/Operate with the same ctlVal as the current status value?	DOns: Y SBOns: NA DOes: N SBOes: N
Ct16	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	DOns: Y SBOns: NA DOes: N SBOes: N
Ct17	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (tissue 334)	SBOns: NA SBOes: Y
Ct18	For SBOes, is 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, Mod is limited to ON and OFF.
Ct20	Does the IED support local / remote operation?	Y
Ct21	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	SBOns: NA DOns: Y

PIXIT for Time and time synchronisation model

ID	Description	Value / Clarification
Tm1	What quality bits are supported (may be set by the IED)	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	Describe the behaviour when the time synchronization signal/messages are lost	The IED sets ClockNotSynchronized.
Tm3	When is the time quality bit "ClockFailure" set?	The IED sets ClockFailure when the relay is in a “Disabled” state.
Tm4	When is the time quality bit "Clock not synchronised” set?	The IED sets ClockNotSynchronized when there is a loss of IRIG or SNTP time synchronization.
Tm5	Is the timestamp of a binary event adjusted to the configured scan cycle?	Y
Tm6	Does the device support time zone and daylight saving?	Y

ID	Description	Value / Clarification
Tm7	Which attributes of the SNTP response packet are validated?	Y Leap indicator not equal to 3? Y Mode is equal to SERVER Y 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/or 4 N other (describe)
	<additional items>	

PIXIT for File transfer model

ID	Description	Value / Clarification
Ft1	What is structure of files and directories? Where are the COMTRADE files stored? Are comtrade files zipped and what files are included in each zip file?	File system with folders NA NA
Ft2	Directory names are separated from the file name by	"/"
Ft3	The maximum file name size including path (recommended 64 chars)	64 chars
Ft4	Are directory/file name case sensitive	Not case sensitive
Ft5	Maximum file size	Not limited. Depends on available memory.
Ft6	Is the requested file path included in the MMS fileDirectory respond file name?	NA
Ft7	Is the wild char supported MMS fileDirectory request?	NA
Ft8	Is it allowed that 2 clients get a file at the same time?	NA
	File Compression	The SEL-700 series devices use the ZLIB compression format to compress the CID (Configured IED Description) files for transmission and storage. Internally, the SEL-700 series devices inflate (decompress) and read the CID file with ZLIB as needed. You must use ZLIB to decompress a CID file transferred via FTP from an SEL-700series device in order to read it. For more information about ZLIB, see

ID	Description	Value / Clarification
		http://www.zlib.net by Greg Roelofs.