Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 interface in SEL-849

UCA International Users Group
Testing Sub Committee

Date: January 16, 2013

Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in SEL-849 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	7
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 AP Title N AE Qualifier N
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 12000 bytes Min MMS PDU size 512 bytes
As8	What is the maximum start up time after a power supply interrupt	Approximately 15 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: Y Process Y Substituted Y 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: Y Process Y Substituted Y Test N OperatorBlocked
Sr3	What is the maximum number of data values in one GetDataValues request	256
Sr4	What is the maximum number of data values in one SetDataValues request	256
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	Dynamic data set creation is not supported
Ds3	How many non-persistent data sets can be created by one or more clients	Dynamic data set creation is not supported

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 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 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 client has its own copy of URCB.
Rp6	What is the format of EntryID	Fixed-size octet string of 8 octets that is sequentially incremented for each generated report as if it were an unsigned 64-bit integer.
Rp7	What is the buffer size for each BRCB or how many reports can be buffered	120k bytes or 200 reports, whichever limit is reached first.
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	0.5 seconds Fixed
Rp11	Does the device support to pre-assign a RCB to a specific client in the SCL	N

ID	Description	Value / Clarification
	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 and there are pending reports on that BRCB, then the current client will not be allowed to enable the BRCB.

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 APPID Y Ethertype = 0x88B8 Y gocbRef = length must be as configured in the CID file. N timeAllowedtoLive Y datSet = length must be as configured in the CID file. Y If goID is present in the message then length must be as configured in the CID file. N t Y stNum Y sqNum Y test = false Y confRev = as configured in the CID Y ndsCom allData accepted if false Y numDatSetEntries as configured in the CID file
Go2	Can the test flag in the published GOOSE be turned on / off	N
Go3	What is the behaviour when the GOOSE publish configuration is incorrect	The whole 61850 configuration fails and no GOOSE messages are transmitted.
Go4	When is a subscribed GOOSE marked as lost? (TAL = time allowed to live value from the last received GOOSE message)	A message does not arrive prior to expiry of 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, the GOOSE subscriber will issue an out-of-sequence error and wait for the next message to update the status. For syntax errors, the GOOSE subscriber will issue message-corrupted error and wait for the next message to update the status.
Go6	What is the behaviour when a subscribed GOOSE message is out-of-order	The GOOSE subscriber will issue an out-of-sequence error and process the received GOOSE message.

ID	Description	Value / Clarification
Go7	What is the behaviour when a subscribed GOOSE message is duplicated	The GOOSE subscriber will issue an out-of-sequence error and process the received GOOSE message.
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?	4000 mseconds 60000 mseconds Both are configurable in the CID file.
Go14	Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	N GOOSE can only be enabled or disabled via IED (command line) settings.
	What is the stNum and sqNum of the initial GOOSE message?	stNum = 1 and sqNum = 0

TAL = Time Allowed to Live

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 in the CID file
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 DUT accepts the control command but does not actually execute it to cause a status change
Ct6	What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	DUT ignores the time value in processing the request.
Ct7	Is pulse configuration supported	N

ID	Description	Value / Clarification
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 conditions in processing the request. This behavior is 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?	Send the SelectWithValue request with an orCat value greater than 8.
Ct11	How to force a “test-not-ok” respond with Select request?	The control service Select is not supported.
Ct12	How to force a “test-not-ok” respond with Operate request?	DOns: SBOns: not supported DOes: SBOes: Send the Operate request with an orCat value greater than 8.
Ct13	Which origin categories are supported?	All
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 and a LastApplError.
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

ID	Description	Value / Clarification
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?	Both 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 (always set) 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
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)