Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 interface in SEL-710

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Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in SEL-710 with firmware version R406.

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

Description	**Value / Clarification**
Maximum number of clients that can set-up an association simultaneously	6
TCP_KEEPALIVE value	1-20 seconds
Lost connection detection time	1-20 seconds
Is authentication supported	N
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.
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
What is the maximum and minimum MMS PDU size	Max MMS PDU size 12kbytes Min MMS PDU size

Description	Value / Clarification
What is the maximum startup time after a power supply interrupt	Approximately 1.5 minutes.

PIXIT for Server model

Description	Value / Clarification
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
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

Description	Value / Clarification
What is the maximum number of data values in one GetDataValues request	Not restricted; depends on the maximum PDU size of 12K bytes.
What is the maximum number of data values in one SetDataValues request	Not restricted; depends on the maximum PDU size of 12k bytes.

PIXIT for Data set model

Description	Value / Clarification
What is the maximum number of data elements in one data set (compare ICD setting)	500 FCDAs
How many persistent data sets can be created by one or more clients	Clients cannot create data sets. There is no dynamic data set creation.
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.

Description	Value / Clarification
<additional items>	

PIXIT for Setting group control model

This service is not supported.

Description	Value / Clarification
What is the number of supported setting groups for each logical device (compare NumSG in the SGCB)	
What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 $16.2.4)	
Can multiple clients edit the same setting group	Y/N
What happens if the association is lost	Y/N

Description	Value / Clarification
while editing a setting group	
Is EditSG value 0 allowed?	Y/N
<additional items>	

PIXIT for Reporting model

Description	Value / Clarification
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
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
Can the server send segmented reports	Y
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.
Multi client URCB approach (compare IEC 61850-7-2 $14.2.1)	Each URCB is visible to one client only.
What is the format of EntryID	Octetstring8
What is the buffer size for each BRCB or how many reports can be buffered	120k bytes
Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also the ICD report settings)	cbName datSet
May the reported data set contain: - structured data objects?	Y

- data attributes? - timestamp data attributes?	Y Y
What is the scan cycle for binary events? Is this fixed, configurable	0.5seconds Fixed
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.

Description	**Value / Clarification**
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
What is the format of EntryID (Compare IEC 61850-8-1 $17.3.3.3.1)	
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
Pre-configured LCB attributes that cannot be changed online	
<additional items>	

PIXIT for Generic substation events model

Description	**Value / Clarification**
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. N APPID Y Ethertype = 0x88B8 Y gocbRef = as configured in the CID file. N timeAllowedtoLive

Description	Value / Clarification
	Y datSet = as configured in the CID file. Y goID = as configured in the CID file N t Y stNum Y sqNum Y test = false Y confRev = as configured in the CID file. Y ndsCom = false Y numDatSetEntries = as configured in CID file.
Can the test flag in the published GOOSE be turned on / off	N
What is the behavior when the GOOSE publish configuration is incorrect	The whole 61850 configuration fails and no GOOSE messages are transmitted.
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.
What is the behavior 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.
What is the behavior 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.
What is the behavior 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.
Does the device subscribe to GOOSE messages with/without the VLAN tag?	Y, with the VLAN tag Y, without the VLAN tag
May the GOOSE data set contain: - structured data objects? - data attributes? - timestamp data attributes?	Subscribed / Published Y / Y Y / Y Y / Y

Description	Value / Clarification
What is the slow retransmission time? Is it fixed or configurable?	1000 mseconds with TAL = 2000 Configurable in CID file.
What is the fast retransmission scheme? Is it fixed or configurable?	1) 10 mseconds with TAL = 30 2) 20 mseconds with TAL = 60 3) 40 mseconds with TAL = 120 4) 80 mseconds with TAL = 240 5) 160 mseconds with TAL = 480 6) 320 mseconds with TAL = 960, etc The TAL is twice the retransmission time at the maximum retransmission interval. Fixed
Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	N Enabling and disabling of GOOSE is done via IED configuration. GoEna cannot be set to TRUE or FALSE by a client.
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

Description	Value / Clarification
What control modes 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
Is the control model fixed, configurable and/or online changeable?	Configurable = as defined in the CID
Is Time activated operate (operTm) supported	N
Is “operate-many” supported	N
What is the behavior of the DUT when the test attribute is set in the SelectWithValue and/or Operate request	DUT accepts the control command but does not actually execute it to cause a status change.
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.
Is pulse configuration supported	N
What is the behavior of the DUT when the check conditions are set	N synchrocheck N interlock-check

Description	Value / Clarification
Is this behavior fixed, configurable, online changeable?	DUT ignores the check conditions. This behavior is fixed.
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
How to force a “test-not-ok” respond with SelectWithValue request?	Operate a single attribute instead of the entire SBOw structure
How to force a “test-not-ok” respond with Select request?	Operate a single attribute instead of the entire SBOw structure
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.
Which origin categories are supported?	All
What happens if the orCat 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.
Does the IED accept an selectwithvalue/operate with the same ctlVal as the current status value?	DOns: Y SBOns: NA DOes: N SBOes: N
Does the IED accept a select/operate on the same control object from 2 different	DOns: Y SBOns: NA

Description	Value / Clarification
clients at the same time?	DOes: N SBOES: N
Does the IED accept a select/selectwithvalue from the same client when the control object is already selected (tissue 334)	SBOns: NA SBOES: Y
For SBOes is the internal validation performed during the SelectWithValue and/or Operate step?	SelectWithValue and Operate
Can a control operation be blocked by Mod=Off or Blocked	Y, Mod is limited to ON and OFF.
Does the IED support local / remote operation?	Y

PIXIT for Time and time synchronisation model

Description	Value / Clarification
What quality bits are supported?	Y LeapSecondsKnown (always set) Y ClockFailure Y ClockNotSynchronized
Describe the behavior of the IED when the time synchronization signal/messages are lost	The IED sets ClockNotSynchronized.
When is the time quality bit "Clock failure" set?	The IED sets ClockFailure when the relay is in a “Disabled” state.
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.
Is the timestamp of a binary event adjusted to the configured scan cycle?	Y
Does the device support time zone and daylight saving?	Y
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)

PIXIT for File transfer model

The SEL-700series IEDs support the FTP protocol, not MMS file services.

Description	**Value / Clarification**
What is structure of files and directories?	Directory tree structure.
Is the IETF FTP protocol also implemented	Y
Directory names are separated from the file name by	“/” or “\”
The maximum file name size including path (recommended 64 chars)	64 chars
Are directory/file name case sensitive	Not case sensitive.
Maximum file size	Not limited. Depends on available memory.
Is the requested file path included in the file name of the MMS fileDirectory respond?	NA
Is the wild char supported MMS fileDirectory request?	NA
Is it allowed that 2 client 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 http://www.zlib.net by Greg Roelofs.