Protocol Implementation eXtra Information for Testing (PIXIT)
for the IEC 61850 interface in SEL-351S

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Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in SEL-351S with firmware version R511.

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 AP Title N AE Qualifier N
If association parameters are necessary for association, describe the correct values	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: 12000 bytes Min MMS PDU size: 512 bytes
What is the maximum startup time after a power supply interrupt	Approximately 15 seconds.

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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: Y Process Y Substituted Y 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: Y Process Y Substituted Y Test N OperatorBlocked
What is the maximum number of data values in one GetDataValues request	256
What is the maximum number of data values in one SetDataValues request	256

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	Dynamic data set creation is not supported.
How many non-persistent data sets can be created by one or more clients	Dynamic data set creation is not supported.

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

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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
	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)	Sends the report immediately.	
Multi client URCB approach (compare IEC 61850-7-2 $14.2.1)	Each client has its own copy of URCB.	
What is the format of EntryID	Fixed-size octet string of 8 octets.	
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.	
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? - data attributes? - timestamp data attributes?	Y Y Y	
What is the scan cycle for binary events? Is this fixed, configurable	0.5 seconds 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 and there are pending reports on that BRCB, then the current client will not be allowed to enable the BRCB.	

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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. 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 goID = 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

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Description	Value / Clarification
	file.
	Y ndsCom = false
	Y numDatSetEntries = as configured in the 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)	A message does not arrive prior to expiry of 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, 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.
What is the behavior 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.
What is the behavior when a subscribed GOOSE message is duplicated	The GOOSE subscriber will issue an out-of-sequence error and process the received GOOSE message.
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
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) MinTime mseconds with TAL = 3*MinTime 2) MinTime mseconds with TAL = 3*MinTime 3) 2*MinTime mseconds with TAL = 2*MaxTime 4) MaxTime mseconds with TAL

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Description	Value / Clarification
	= 2*MaxTime Both MinTime and MaxTime are configurable in the CID file but the number of points and multipliers in the scheme are fixed. Default value for MinTime is 4ms.
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

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 configured in the CID file.
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 in processing the request.
Is pulse configuration supported	N
What is the behavior of the DUT when the check conditions are set Is this behavior fixed, configurable, online changeable?	N synchrocheck N interlock-check DUT ignores the check conditions in processing the request. This behavior is fixed.
What additional cause diagnosis are supported	Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position

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Description	Value / Clarification
	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?	Send the SelectWithValue request with an orCat value greater than 8.
How to force a "test-not-ok" respond with Select request?	The control service Select is not supported.
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.
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 and a LastApplError.
Does the IED accept a 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 clients at the same time?	DOns: Y SBOns: NA DOes: N SBOes: N
Does the IED accept a Select/SelectWithValue from the same client when the control object is already	SBOns: NA SBOes: Y

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Description	Value / Clarification
selected (tissue 334)	
For SBOes, is the internal validation performed during the SelectWithValue and/or Operate step?	Both 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

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Description	Value / Clarification
What is structure of files and directories?	Hierarchical (tree) structure.
Is the IETF FTP protocol also implemented	Y
Directory names are separated from the file name by	"/", but "\" is also acceptable in requests.
The maximum file name size including path (recommended 64 chars)	64 chars
Are directory/file name case sensitive	Case insensitive.
Maximum file size	Depends on the specific file and available memory.
Is the requested file path included in the file name of the MMS fileDirectory response?	Y
Is the wild character supported in MMS fileDirectory request?	Y
Is it allowed that 2 client get a file at the same time?	Y
File organization and format	Files for MMS transfer are stored in the directories EVENTS and REPORTS. The EVENTS directory contains proprietary SEL compressed ASCII event reports, and the REPORTS directory contains a history of events and breaker data.
File compression	The SEL-351S device uses the ZLIB compression format to compress the CID (Configured IED Description) file for transmission and storage. Internally, the SEL-351S device inflates (decompresses) and reads the CID file. You must use ZLIB to decompress a CID file transferred via FTP from a SEL-351S device in order to read it. For more information about ZLIB, see http://www.zlib.net by Greg Roelofs.

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