Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 interface in SEL-2411

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Testing Sub Committee

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Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in SEL-2411 with firmware version R310.

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 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 12000 bytes Min MMS PDU size
What is the maximum start up time after a power supply interrupt	Approximately 90 seconds

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
What is the maximum number of data values in one GetDataValues request	Not restricted, depends on the maximum PDU size of 12000 bytes
What is the maximum number of data values in one SetDataValues request	Not restricted, depends on the maximum PDU size of 12000
Which Mode / Behaviour values are supported	On Y Blocked N Test N Test/Blocked N Off Y

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 Reporting model

Description	Value / Clarification
The supported trigger conditions are (compare PICS)	integrity Y data change Y quality change Y data update Y 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	120 Kbytes
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?	 Y Y
What is the scan cycle for binary events? Is this fixed, configurable	0.5 seconds Fixed
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 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 Ethertype = 0x88B8 N APPID Y gocbRef as configured in the CID file N timeAllowedtoLive Y datSet as configured in the CID file Y goID as configured in the CID file N t N stNum N sqNum Y test allData accepted if false Y confRev as configured in the CID file Y ndsCom allData accepted if 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 behaviour 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 IED will set a TAL error and wait for the next message.
What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)	A TAL error will be set for each subscription that no messages have been received
What is the behaviour when a subscribed GOOSE message is out-of-order	An "out-of-sequence" error is set for the subscription but the message is still processed
What is the behaviour when a subscribed GOOSE message is duplicated	An "out-of-sequence" error is set for the subscription but the message is still processed
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 (FCD)? - timestamp data attributes? Note: data attributes (FCDA) is mandatory	Subscribed Published Y Y Y Y
Published FCD supported common data classes / data types are	LPL, DPL, INC, INS, SPS, SPC, MV, CMV, WYE, and DEL
Subscribed FCD supported common data classes / data types are	All CDCs except these: HMV, HWYE, HDEL, and CSD

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 minimum supported retransmission time? What is the maximum supported retransmission time? 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. This retransmission curve is fixed.
Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)	N Enabling and disabling of GOOSE is done via IED configuration.
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 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
Is the control model fixed, configurable and/or online changeable?	Configurable in the CID file
Is TimeActivatedOperate supported	N
Is “operate-many” supported	N
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
What are the conditions for the time (T) attribute in the SelectWithValue and/or Operate request	DUT ignores the time value and execute the command as usual
Is pulse configuration supported	N

Description	Value / Clarification
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. 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?	Write a single attribute instead of the entire SBOw structure
How to force a “test-not-ok” respond with Select request?	NA
How to force a “test-not-ok” respond with Operate request?	DOns: SBOns: not supported DOes: SBOes: Write a single attribute instead of the entire Oper structure
Which origin categories are supported?	0 – 8
What happens if the orCat value is not supported?	If an orCat value is not supported, either because it is disabled in the CID file or is out-of-range, a LastApplError with an AddCause of “Blocked-by-process” is reported
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

Description	Value / Clarification
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
Does the IED support local / remote operation?	Y
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

Description	Value / Clarification
What quality bits are supported (may be set by the IED)	Y LeapSecondsKnown (always set) Y ClockFailure Y ClockNotSynchronized
Describe the behaviour when the time synchronization signal/messages are lost	The IED sets ClockNotSynchronized
When is the time quality bit "ClockFailure" 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 SNTP or IRIG 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)