

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

UCA International Users Group  
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-710-5 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 N AE Qualifier N  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 12000 bytes Min MMS PDU size
As8	What is the maximum start up time after a power supply interrupt	Approximately 1.5 minutes

**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	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– This trigger condition is supported, but no data objects exist with this trigger option. 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 URCB is visible to one client only.
Rp6	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	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, that client will not be able 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 The value must be the same as configured in the CID file. Y Ethertype Must be 0x88B8 N APPID Y gocbRef The value must be the same as configured in the CID file. N timeAllowedtoLive Y datSet The value must be the same as configured in the CID file. Y gold The value must be the same as configured in the CID file. N t Y stNum Y sqNum Y test The value must be FALSE. Y confRev The value must be the same as configured in the CID file. Y ndsCom The value must be FALSE. Y numDatSetEntries The value must be the same 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)	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.

ID	Description	Value / Clarification						
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.						
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	<table border="0"> <tr> <td>Subscribed</td> <td>Published</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> </table>	Subscribed	Published	Y	Y	Y	Y
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

<b>ID</b>	<b>Description</b>	<b>Value / Clarification</b>
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
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?	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?	DOs: SBOs: 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 ctIVal as the current status value?	DOns: Y SBOs: 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 SBOs: 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)	SBOs: 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?	SBOs: 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



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)