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Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 Interface in SEL Real-Time Automation Controllers

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UCA International Users Group

Testing Sub Committee

Edition 2

Contents

1 INTRODUCTION

This document specifies the Protocol Implementation eXtra Information for Testing (PIXIT) of the IEC 61850 interface for the SEL Real-Time Automation Controllers (RTAC).

This document applies specifically to the following RTAC models and firmware versions.

Model	Firmware Version
SEL-3530 RTAC	SEL-3530- R139-V1-Z001001-D20170628
SEL-3530-4 RTAC	SEL-3530-4- R139-V1-Z001001- D20170628
SEL-2241 RTAC	SEL-2241- R139-V1-Z001001- D20170628
SEL-3505 RTAC	SEL-3505- R139-V1-Z001001- D20170628
SEL-3505-3 RTAC	SEL-3505-3- R139-V1-Z001001- D20170628
SEL-3532 RTAC	SEL-3532-N- R139-V1-Z001001- D20170628
SEL-3555 RTAC	SEL-3555- R139-V1-Z001001- D20170628
SEL-3560 RTAC	SEL-3560- R139-V1-Z001001- D20170628

Together with the PICS and the MICS, the PIXIT forms the basis for a conformance test according to IEC 61850-10. The PIXIT entries contain information which is not available in the PICS, MICS, or TICS documents, or SCL file.

Each table specifies the PIXIT for applicable ACSI service model as structured in IEC 61850-10. The "Ed" column indicates if the entry is applicable for IEC 61850 Edition 1 and/or Edition 2.

2 SERVER PIXIT FOR ASSOCIATION MODEL

ID	Ed	Description	Value/Clarification
As1	1	Maximum number of clients that can set up an association simultaneously.	10
As2	1,2	TCP_KEEPALIVE value. The recommended range is 1–20 s.	Configurable Range: 1 second to 1 day Default time: 100 seconds
As3	1,2	Lost connection detection time	1–20 seconds
As4	-	Authentication is not yet supported	Deprecated
As5	1,2	What association parameters are necessary for successful association?	Y: Transport selector Y: Session selector Y: Presentation selector N: AP Title N: AE Qualifier

As6	1,2	If association parameters are necessary for association, describe the correct values.	0001 Transport selector 0001 Session selector 00000001 Presentation selector NA AP Title NA AE Qualifier
As7	1,2	What is the maximum and minimum MMS PDU size?	Max MMS PDU size is 65000 bytes Min MMS PDU size is 512 bytes
As8	1,2	What is the maximum start up time after a power supply interrupt?	This is project dependent. Typical start up times are between 2 and 6 minutes.
As9	1,2	Does this device function only as test equipment? (test equipment need not have a nonvolatile configuration; but it cannot be part of the substation automation system)	No

3 SERVER PIXIT FOR SERVER MODEL

ID	Ed	Description	Value/Clarification
Sr1	1,2	Which analog value (MX) quality bits are supported (can be set by server)?	Validity: Y: Good Y: Invalid Y: Reserved Y: Questionable Y: Overflow Y: OutofRange Y: BadReference N: Oscillatory Y: Failure Y: OldData Y: Inconsistent Y: Inaccurate Source: Y: Process Y: Substituted Y: Test Y: OperatorBlocked

Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)?	Validity: Y: Good Y: Invalid Y: Reserved Y: Questionable N: BadReference Y: Oscillatory Y: Failure Y: OldData Y: Inconsistent Y: Inaccurate Source: Y: Process Y: Substituted Y: Test N: OperatorBlocked
Sr3	-	What is the maximum number of data object references in one GetDataValues request?	Deprecated
Sr4	-	What is the maximum number of data object references in one SetDataValues request?	SetDataValues is not supported
Sr5	1	Which Mode values are supported?[1]	On, Off

4 SERVER PIXIT FOR DATA SET MODEL

ID	Ed	Description	Value/Clarification
Ds1	1	What is the maximum number of data elements in one data set (compare ICD setting)?	468
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)?	150: Only predefined datasets are supported
Ds3	1	How many non-persistent data sets can be created by one or more clients?	None

[1] 1 IEC 61850-6:2009 clause 9.5.6 states that if only a subrange of the enumeration value set is supported, this shall be indicated within an ICD file by an enumeration type, where the unsupported values are missing.

5 SERVER PIXIT FOR REPORTING MODEL

ID	Ed	Description	Value/Clarification
Rp1	1	Supported trigger conditions (compare PICS)	Data change Quality change Integrity General interrogation
Rp2	1	Supported optional fields	Sequence number Report time stamp Reason for inclusion Data set name Data reference Buffer overflow entryID conf-revision Segmentation
Rp3	1,2	Can the server send segmented reports?	Y
Rp4	1,2	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	1	Multiclient URCB approach (compare IEC 61850-7-2:2003 $14.2.1)	Indexing is not supported. Each report control block supports one client connection
Rp6	-	What is the format of EntryID?	Deprecated
Rp7	1,2	What is the buffer size for each BRCB or how many reports can be buffered?	At least 250k bytes are reserved for each report control block. The number of buffered reports will depend upon the dataset size.
Rp8	-	Preconfigured RCB attributes that are dynamic. Compare SCL report settings.	Deprecated
Rp9	1	May the reported data set contain: • structured data objects • data attributes	Structured data objects and data attributes
Rp10	1,2	What is the scan cycle for binary events? Is this fixed or configurable?	I/O module contact inputs are 1 ms. The logic engine scan time is configurable.

Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL?	Not supported
Rp12	2	After restart of the server, is the value of ConfRev restored from the original configuration or retained prior to restart?	Restored from original configuration

6 SERVER PIXIT FOR CONTROL MODEL

ID	Ed	Description	Value/Clarification
Ct1	-	What control models are supported (compare PICS)?	Direct operate with normal security Direct operate with enhanced security Select before operate with enhanced security
Ct2	1,2	Is the control model fixed, configurable, and/or dynamic?	Configurable in the CID file
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)?	N
Ct4	1,2	Is “operate-many” supported (compare sboClass)?	N
Ct5	1	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)?	DUT activates control upon successful operate conditions
Ct6	-	What are the conditions for the time (T) attribute in the SelectWithValue and/or operate request?	Deprecated
Ct7	-	Is pulse configuration supported (compare pulseConfig)?	Not supported
Ct8	1	What is the behavior of the DUT when the check conditions are set? Is this behavior fixed, configurable, or online changeable?	DUT accepts controls. This behavior is fixed.
Ct9	1,2	Which additional cause diagnosis are supported?	N: Unknown N: Not supported for Ed1, Y for Ed2 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 Y: Object not selected Y: Object already selected Y: No access authority Y: Inconsistent parameters Y: Locked by other client
Ct10	1,2	How to force a “test-not-ok” response with SelectWithValue request	Send the SelectWithValue request with an orCat value greater than 8.
Ct11	1,2	How to force a “test-not-ok” response with Select request	The control service Select is not supported.
Ct12	1,2	How to force a “test-not-ok” respond with Operate request	SBOns: Not supported DOes: SBOes: Send the Operate request with an orCat value greater than 8.
Ct13	1,2	Which origin categories are supported/accepted?	Y: Bay control Y: Station control Y: Remote control Y: Automatic bay Y: Automatic station Y: Automatic remote Y: Maintenance Y: Process
Ct14	1,2	What happens if the orCat value is not supported or invalid?	DOns: SBOns: NA DOes: SBOes: DUT issues “test-not-ok” response with AddCause value “not-supported”
Ct15	1,2	Does the IED accept a SelectWithValue/Operate with the same control value as the current status value? Is this behaviour configurable?	DOns: Y SBOns: NA DOes: N SBOes: N Not configurable

Ct16	1	Does the IED accept a select/operate on the same control object from two different clients at the same time?	DUT issues response- with addcasue value “command-already-in-execution”
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)?	When an object is already selected, subsequent select operations are rejected by the server, and an information report is sent with addcause “Object-already-selected”.
Ct18	1,2	For SBOes, is the internal validation performed during the SelectWithValue and/or OperateStep?	SelectWithValue and Operate
Ct19	-	Can a control operation be blocked by Mod = Off or [On-]Blocked (Compare PIXIT-Sr5)?	Controls are rejected when Mod = Off
Ct20	1,2	Does the IED support local/remote operation?	Y
Ct21	1,2	Does the IED send an InformationReport with LastApplError as part of the Operate response (for control with normal security)?	SBOns: Not supported DOns: Y
Ct22	2	How to force a “parameter-change-in-execution”	SBOns: Not supported SBOes: Server receives a select request, then the Loc.stVal is asserted, and then the server receives a write request
Ct23	1,2	Can a controllable object be forced to keep its old state, e.g., Internal Controllable Objects may not be accessible to force this, whereas a switch like Circuit Breaker outside the DUT can?	Y
Ct24	1,2	When CDC = DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state (00)?	Y
Ct25	1,2	Do any objects have Operate Timeout > 0?	DOes: Y SBOes: Y

7 SERVER PIXIT FOR FILE TRANSFER MODEL

ID	Ed	Description	Value / Clarification
Ft1	1	What is the structure of files and directories? Where are the comtrade files stored? Are comtrade files zipped, and what files are included in each zip file?	Comtrade files are stored in the directory called “COMTRADE” in the root directory Comtrade files are zipped and will contain the all possible extensions for the

			comtrade file format. The contents are dependent upon the IED in which the file was collected from.
Ft2	1,2	Directory names are separated from the file name by	"/"
Ft3	1	The maximum file name size including path (recommended 64 characters)	255 characters
Ft4	1,2	Are directory/file name case sensitive?	Not case sensitive
Ft5	1,2	Maximum file size for SetFile	Not Supported
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name?	Y
Ft7	1	Is the wild char supported MMS fileDirectory request?	Y
Ft8	1,2	Are two clients allowed to get a file at the same time?	Y: Same file Y: Different files

8 PIXIT FOR TIME AND TIME SYNCHRONIZATION MODEL

NOTE: The RTAC can act as an IEC 61850 Client or Server for purposes of time synchronization.

Description	Value/Clarification
Describe how to view internal time and quality or how to expose the time-stamp value and time-stamp quality via the IEC 61850 interface.	You can view time-stamp value and time-stamp quality information from ACSELERATOR RTAC® SEL-5033 Software when it is online. View the internal time and time quality by examining the state of the System_Time_Control tags.
What time quality bits are supported?	**Yes** LeapSecondsKnown **Yes** ClockFailure **Yes** ClockNotSynchronized
How does the RTAC behave for lost time synchronization signal/messages?	See the following.
When is the quality bit Clock failure set?	The ClockFailure bit is always false.

Description	Value/Clarification
When is the quality bit Clock not synchronized set?	The RTAC supports multiple time sources—IRIG, NTP, IEC 61850, PTP, DNP 3.0, and IEC 60870-5-101/104. The management of the ClockNotSynchronized bit depends on the RTAC time sources. If the RTAC receives time via an IRIG source that does not contain a time accuracy figure, or if the value is undefined, the RTAC sets the ClockNotSynchronized time quality bit to true. If the RTAC receives time via an NTP or IEC 61850 time source, the RTAC assumes this source to be a time-synchronized source. The RTAC therefore sets the ClockNotSynchronized time quality bit to true in the case of lost synchronization. If the RTAC receives time via a DNP time source, the RTAC assumes this source to not be a time-synchronized source. The ClockNotSynchronized time quality bit will therefore always be set to true.

9 CLIENT PIXIT FOR CONFIGURATION

Description	Value/Clarification
Describe how the Client handles nameplate configuration revision mismatches.	When the Client establishes an association, it reads the LPHD.PhyNam.vendor variable of the first logical device and the LLN0.NamPlt.configRev variable from each logical device. If these values do not match the values that the CID file of a Server defines, the Client asserts a tag (per Server) to indicate the configuration mismatch. The Client accesses a Server without regard for the detected configuration mismatch. You can write logic based on the status of the configuration mismatch tag to modify system behavior.
Describe how the Client handles report control block configuration revision mismatches.	Before the Client enables a report, it reads the DatSet and the confRev attributes from the RCB being enabled. If these values do not match the values the CID file of the Server defines, the Client asserts a tag (per Server) to indicate the configuration mismatch and abort the attempt to enable the report. If the Client detects a configuration mismatch, it periodically rereads the DatSet and the confRev attributes until resolution of the configuration mismatch. Once the DatSet and the confRev attributes match the values in the CID file of the server, the Client configures the RCB and enables the report. You can write logic based on the status of the configuration mismatch tag to modify system behavior.

10 CLIENT PIXIT FOR ASSOCIATION MODEL

Description	Value/Clarification
What is the guaranteed number of Servers that can set up an association simultaneously (one association per Server)?	The RTAC is a highly configurable device; support for a given configuration depends mainly on the overall configuration of the RTAC and the associated IEC 61850 system (e.g., complexity and number of the servers, GOOSE publishing and subscriptions, traffic, etc). Tests have demonstrated successful operations in which the Client has been configured to access more than 100 SEL intelligent electronic devices (IEDs).
What is the lost connection detection time range? (default range of TCP_KEEPALIVE is 1–20 seconds)	Configurable Range: 1 second to 1 day Default time: 100 seconds
What is the lost (abort) connection retry time?	Upon connection loss, the Client attempts immediate reconnection to the Server. If the initial reconnect attempt fails, the Client attempts to reconnect approximately every 30 seconds.
Is authentication supported?	Yes
What is the maximum and minimum MMS PDU size?	Max MMS PDU size = 64 KB Min MMS PDU size = 4 KB
What is the typical startup time after a power supply interrupt?	The RTAC is a highly configurable device; the time before the Client first attempts to connect depends on the overall configuration of the RTAC and the associated IEC 61850 system. This includes the number and complexity of GOOSE publishing and subscriptions, number and complexity of the Servers (e.g., number of services and data objects/attributes), and the number of those services and data objects/attributes mapped by the Client.

11 CLIENT PIXIT FOR SERVER MODEL

Description	Value/Clarification
What is the maximum length supported for an object identifier?	129 octets
Does the Client support autodescription?	No

Description	Value/Clarification
What analog value (MX) quality bits are used in the Client?	The RTAC preserves the states of all quality bits from the Server and makes these states available for your use in logic. **Yes** Good* **Yes** Invalid **Yes** Reserved **Yes** Questionable* **Yes** Overflow **Yes** OutofRange* **Yes** BadReference **Yes** Oscillatory **Yes** Failure **Yes** OldData **Yes** Inconsistent **Yes** Inaccurate **Yes** Process **Yes** Substituted **Yes** Test **Yes** OperatorBlocked * Internal range processing can override the state (e.g., if limits set in the Client are more restrictive than limits in the Server).
Which status value (ST) quality bits are used in the Client?	The RTAC preserves the states of all quality bits from the Server and makes these states available for your use in logic. **Yes** Good **Yes** Invalid **Yes** Reserved **Yes** Questionable **Yes** BadReference **Yes** Oscillatory **Yes** Failure **Yes** OldData **Yes** Inconsistent **Yes** Inaccurate **Yes** Process **Yes** Substituted **Yes** Test **Yes** OperatorBlocked
Describe how to view/display quality values.	A tag is an object you can use to represent data in the RTAC; use it to store data (collected from a Server or information about a Server) or trigger an action (e.g., trigger the issuing of a poll request or reset statistics). When the ACSELERATOR RTAC SEL-5033 Software (PC-based software) is online, you can interrogate the attributes of any tag (Status/Value, TimeStamp, Quality, etc.).
Describe how to force a SetDataValues request.	Not supported

Description	Value/Clarification
Describe how to force a GetAllDataValues request.	Not supported
Describe how the Client behaves in the following cases: • GetDataDefinition response • GetLogicalDeviceDirectory response • GetAllDataValues response • GetDataValues response • SetDataValues response	The Client will not issue the corresponding request for any of the listed responses except GetDataValue. The behavior for a GetDataValue- response is to use the existing data value (initialized from CID or last value read) and/or periodically retry issuing the GetDataValue request.

12 CLIENT PIXIT FOR DATA SET MODEL

Description	Value/Clarification
Describe how to force a GetDataSetValues request.	1. Use the ACSELERATOR Architect® SEL-5032 Software (PC-based software) to create a project that contains the Servers and data sets (based on the CID files of the Servers) that you want the Client to access. 2. After you create an ACSELERATOR RTAC project by importing the ACSELERATOR Architect project into the ACSELERATOR RTAC SEL-5033 software, you can modify configurable settings and/or map data to specified tags in the RTAC. 3. Use the ACSELERATOR RTAC software to send the ACSELERATOR RTAC project to the RTAC. Once the RTAC completes initialization, any assertion of the Issue_Poll tag causes polling of the data sets you have selected (i.e., causes generation of a GetDataSetValue request). By default, polling of your selected data sets occurs periodically.
Describe how to force a SetDataSetValues request.	Not supported
Describe how to force a DeleteDataSet request.	Not supported

Description	Value/Clarification
Describe how the Client handles the following data set mismatches between the SCL and the data sets MMS exposes: (1) new data set element (2) missing data set element (3) Reordered data set members in a data set of a different data type (4) Reordered data set members in a data set of the same data type	Configuration of the Client is offline and involves use of ACSELERATOR Architect and ACSELERATOR RTAC software. If the Server does not follow the SCL standard, communication with it may be impossible. For cases (1) and (2), the Client detects a failure of the GetDataSetValues request to return the expected number of dataset entries. The Client responds by asserting the Invalid quality attribute for all tags associated with the data set. For case (3), the Client asserts the Invalid quality attribute of the tags associated with the data set entries whose type changed, if the changed type affects the ASN.1 encoding (e.g., if a data set entry changes from an INT32 to an INT8, the change is undetected). The Client will not detect the condition for case (4). The Client detects configuration mismatches by comparing the configRev with the values of the logical device the Server CID file defines. If the Client detects a mismatch, it asserts a tag (per Server) to indicate a configuration mismatch. You can write logic based on the status of the configuration mismatch tag to modify system behavior.
Describe how the client handles the following responses to a GetDataSetValues request: (1) Response is negative (2) Response contains more/fewer data set elements (3) Response contains reordered members of different types (4) Response contains reordered members of same type	For case (1), the Client detects the negative response to the GetDataSetValues request. The Client responds by asserting the Invalid quality attribute for all tags associated with the data set. For case (2), the Client detects a failure of the GetDataSetValues request to return the expected number of data set entries. The Client responds by asserting the Invalid quality attribute for all tags associated with the data set. For case (3), the Client responds by asserting the Invalid quality attribute of the tags associated with the data set entries whose type changed, if the changed type affects the ASN.1 encoding (e.g., if a dataset entry changed from an INT32 to an INT8, the change would be undetected). The Client will not detect the condition for case (4). The Client detects configuration mismatches by comparing the configRev with values of the logical device the Server CID file defines. If the Client detects a mismatch, it asserts a tag (per Server) to indicate a configuration mismatch. You can write logic based on the status of the configuration mismatch tag to modify system behavior.
Describe how the Client behaves in the following cases: • GetLogicalNodeDirectory response • GetDataSetDirectory response	The Client does not support issuing the corresponding request.

Description	Value/Clarification
Describe how the Client supports creation of the following: • Persistent data sets • Nonpersistent data sets	**Yes** persistent data sets **No** nonpersistent data sets The Client only supports persistent data sets the Server CID file defines.
Describe how the Client behaves in the following cases: • CreateDataSetDirectory response • DeleteDataSet response	The Client does not support issuing the corresponding request.

13 CLIENT PIXIT FOR SUBSTITUTION MODEL

Substitution not supported.

14 CLIENT PIXIT FOR SETTING GROUP CONTROL MODEL

Setting group controls not supported.

15 CLIENT PIXIT FOR REPORTING MODEL

Description	Value/Clarification
Does the Client search for RCB in all logical nodes?	ACSELERATOR Architect uses SCL to perform RTAC IEC 61850 configuration. The RTAC can subscribe to any RCB present in the Server CID file.
Which dynamic RCB attributes are, or can be, configured by the Client?	RptID **Yes** DataSet **No** Optional fields **Yes** Trigger conditions **Yes** Buffer time **Yes** Integrity period **Yes** PurgeBuf **No** The Client can write to the previous RCB attributes (except DataSet and PurgeBuf) depending on the configuration of the Server. You can use the ACSELERATOR RTAC software to redefine the values written to the Buffer Time and Integrity period RCB attributes. The Client assigns a unique RptID to each RCB, if the RptID attribute is writable. You cannot configure the RptID.
Does the Client support IEDs with indexed and non-indexed report control blocks (RCB)?	Buffered RCB indexed **Yes** Buffered RCB not indexed **Yes** Unbuffered RCB indexed **Yes** Unbuffered RCB not indexed **Yes**

Description	Value/Clarification
Supported trigger conditions include the following:	Integrity **Yes** Data change **Yes** Quality change **Yes** Data update **Yes** General interrogation **Yes**
The minimum required optional fields include the following:	sequence-number **No** report-time-stamp **No** reason-for-inclusion **No** data-set-name **No** data-reference **No** buffer-overflow **No** entryID **No** conf-rev **No** The Client does not require a minimum set of optional fields.
Does the Client support segmented reports?	Yes
Does the Client support pre-assigned RCB?	Yes, you can configure the Client via the Server CID file and/or the ACSELERATOR RTAC software to access a pre-assigned instance of a BRCB or URCB (i.e., non-indexed or indexed instance [1–99]).
Does the Client support a reported data set containing structured data objects or data attributes?	Reporting of data objects **Yes** Reporting of data attributes **Yes**
Describe how the Client responds for a reserved URCB.	The Client continues attempting to reserve a URCB(s) periodically (based on the configuration [preconfigured instance or any available instance]), until the reserve request succeeds. If the Client is not configured to use a preconfigured instance, it attempts to locate a URCB by using the name provided in the ReportControl element of the Server CID file together with an index. The Client accesses every URCB (1–99) to find an unreserved instance. If the Client does not find an unreserved URCB, it makes a final attempt to access the URCB without an index appended to the name.
Describe how the Client responds for a reserved BRCB.	The Client continues to read the enable status of the BRCB(s) periodically (based on configuration [use a preconfigured instance or any available instance]), until it finds a BRCB with a disabled status. If the Client is not configured to use a preconfigured instance, it attempts to locate a BRCB by using the name provided in the ReportControl element of the Server CID file together with an index. The Client accesses every BRCB (1–99) to find a disabled instance. If it does not find a disabled BRCB, the Client makes a final attempt to access the BRCB without an index appended to the name.

Description	Value/Clarification
Describe how the Client responds to a SetBRCBValues(EntryID) response.	If writing the EntryID fails, the Client attempts to write 0. If writing 0 fails, the Client continues configuring the report as if writing EntryID succeeded.
Describe how the Client responds when a report has an unknown: data set, RptID, unexpected number of data set entries, and/or unexpected data type format entries.	If the Client receives a report with an unknown RptID, it will not process the report. If the Client receives a report with an unknown/unexpected DatSet or the ConfRev changes (if the attributes are present), it will not process the report. For a data set entry whose type has changed (and if the changed type affects ASN.1 encoding), the Client responds by setting the quality attributes of the associated tags to invalid. If the Client detects an unexpected number of data set entries, it sets the quality attributes of all tags associated with data set entries of the report to invalid.
Describe how the Client detects reporting configuration changes (mismatches). Does it check the configuration revision attributes and/or does it check the data set members?	The Client enables a report only if the DatSet name and ConfRev of the RCB match the values from the Server CID file. When processing a report, the RTAC verifies that the Dataset name and the ConfRev (if included) match the values from the Server CID file. If the Client detects a mismatch, it asserts a tag (per Server) to indicate the configuration mismatch and set the quality attributes of all tags associated with data set entries of the report to invalid.
Describe how to force the Client to change the RCB buffer time.	Use ACSELERATOR RTAC software to modify the buffer time in the project (offline). Once you have saved the project, you can send it to the RTAC.

16 CLIENT PIXIT FOR LOGGING MODEL

Logging is not supported.

17 PIXIT FOR GENERIC SUBSTATION EVENTS MODEL

Description	Value/Clarification
What elements of a subscribed GOOSE header does the RTAC check to decide whether the message is valid and to accept the allData values? Ignored = the RTAC accepts the message without checking the element value. SCL match = The element value must match the configuration, or the RTAC ignores the GOOSE message.	**No** source MAC address = ignored **Yes** dest. MAC address = SCL match **Yes** VLAN id = ignored if absent **Yes** VLAN priority = ignored if absent **Yes** Ethertype = 0x88B8 **Yes** APPID = SCL match **Yes** gocbRef = SCL match **No** timeAllowedtoLive = see below **Yes** datSet = SCL match **Yes** goID = SCL match **No** t = ignored **No** stNum = see below **No** sqNum = see below **No** test = false (true will be ignored) **Yes** confRev = SCL match **No** ndsCom = false (true will be ignored) **Yes** numDatSetEntries = SCL match
Can you obtain more details, as necessary, about the conditions for checked GOOSE header elements?	The RTAC validates the 16-bit APPID value from the header with the value in the SCL. The ACSELERATOR RTAC software permits you to use logic to access any header information (timeAllowedtoLive, stNum, sqNum, test, and ndsCom).
Can you turn the test flag in the published GOOSE on/off?	Yes. You can use logic to set the value of the test flag.

Description	Value/Clarification
How does the RTAC behave when the GOOSE publish configuration is incorrect?	The RTAC refuses to transmit a GOOSE message under the following conditions: • The GOOSE message has the same destination MAC address and APPID pair as another GOOSE message, published or subscribed by the RTAC. • The GOOSE message has the broadcast address (FF-FF-FF-FF-FF-FF) as its destination MAC address. • The GOOSE message has a multicast address that starts with something other than the OUI (01-0C-CD) assigned to the standard. • The GOOSE message lacks a configured data set or contains unsupported data attribute types. • The GOOSE message encoding would exceed the capacity of an Ethernet frame. If the RTAC refuses to transmit a GOOSE message, it asserts an ndsCom tag that is available to custom user logic. The RTAC can transmit a GOOSE message with ndsCom = true under the following additional conditions: • The APPID is set to 0. The standard reserves this value to indicate a lack of configuration. • User logic has set the Force_Needs_Commissioning tag for the message to true. If the RTAC is transmitting a GOOSE message with ndsCom = true, it asserts an ndsCom tag that is available to user logic.
When does the RTAC mark a subscribed GOOSE as lost? (TAL = time allowed to live value from the last received GOOSE message)	The RTAC asserts the Offline tag corresponding to the subscription if the message does not arrive prior to TAL.
How does the RTAC behave when it fails to receive a subscribed GOOSE message or a message that is syntactically incorrect (missing GOOSE)?	If a subscribed GOOSE message does not arrive *AND* the last TAL value indicates that one should have been received, the RTAC asserts the Offline tag corresponding to the subscription. A GOOSE message that can be matched to a subscription, but which fails additional decoding (such as allData), causes the RTAC to assert the ASN_Decode_Failure tag corresponding to the subscription.
What happens when a subscribed GOOSE message is out-of-order?	The RTAC asserts the Sequence_Error tag corresponding to the subscription.
What happens in the case of a duplicate subscribed GOOSE message?	If stNum did not increment, then no new data were expected and allData will be ignored. If sqNum did not change, then the RTAC asserts the Sequence_Error tag corresponding to the subscription.

<table>
<tr><th>Description</th><th>Value/Clarification</th></tr>
<tr><td>Does the device subscribe to GOOSE messages with/without the VLAN tag?</td><td>Yes, the RTAC subscribes to GOOSE messages with AND without the VLAN tag.</td></tr>
<tr><td>Can the GOOSE data set contain the following?
Structured data objects (FCD)
TimeStamp data attributes
Quality data attributes
Note: data attributes (FCDA) are mandatory.</td><td><table><tr><td></td><td>Subscribed</td><td>Published</td></tr><tr><td>FCD</td><td>Yes</td><td>Yes</td></tr><tr><td>TimeStamp</td><td>Yes</td><td>Yes</td></tr><tr><td>Quality</td><td>Yes</td><td>Yes</td></tr></table></td></tr>
<tr><td>Published FCD-supported common data classes and data types include the following:</td><td>Published GOOSE messages may contain any of the following common data classes: INS, CMV, MV, and SPS.
Published GOOSE messages may contain any of the following data attribute types: BOOLEAN, INT32, FLOAT32, TimeStamp, and Quality.</td></tr>
<tr><td>Subscribed FCD-supported common data classes/data types are:</td><td>Subscribed GOOSE messages may contain any common data class.
You can use logic to access common data attributes having one of the following types: BOOLEAN, INT32, FLOAT32, Dbpos, TimeStamp, and Quality.</td></tr>
<tr><td>What is the slow retransmission time, and is it fixed or configurable?</td><td>The value of the MaxTime child of the GSE element within the SCL definition of the GOOSE message determines the maximum retransmit interval.
You can use ACSELERATOR Architect software to configure this value.
The RTAC has a configurable processing interval. You can derive the maximum retransmit interval by rounding the MaxTime value up to the nearest integer multiple of the processing interval.
When the RTAC transmits at this slow rate, the TAL value in the published message will be twice the retransmit interval.</td></tr>
<tr><td>What are the minimum and maximum supported retransmission times, and are these times fixed or configurable?</td><td>You can set MinTime to a minimum of 4 ms.
MaxTime is limited to a 32-bit value.
You can use SCL to configure MinTime and MaxTime.</td></tr>
<tr><td>Can you use SetGoCBValues(GoEna) to turn the GOOSE publish on or off?</td><td>The RTAC does not support the SetGoCBValues service.
However, you can use custom logic to turn GOOSE publish on or off on a per-message basis.</td></tr>
<tr><th colspan="2">Additional Information</th></tr>
<tr><td>How many GOOSE subscriptions does the RTAC allow?</td><td>150</td></tr>
<tr><td>How many GOOSE messages can you publish?</td><td>150</td></tr>
</table>

Description	Value/Clarification
Which quality bits can you set in published data sets?	You can use logic to set the states of all quality bits GOOSE publisher transmits. Validity: **Yes** Good **Yes** Invalid **Yes** Reserved **Yes** Questionable **Yes** Overflow **Yes** OutofRange **Yes** BadReference **Yes** Oscillatory **Yes** Failure **Yes** OldData **Yes** Inconsistent **Yes** Inaccurate Source: **Yes** Process **Yes** Substituted **Yes** Test **Yes** OperatorBlocked
Which quality bits can you access from subscribed GOOSE message datasets?	The states of all quality bits are available to user logic. Validity: **Yes** Good* **Yes** Invalid **Yes** Reserved **Yes** Questionable* **Yes** Overflow **Yes** OutofRange* **Yes** BadReference **Yes** Oscillatory **Yes** Failure **Yes** OldData **Yes** Inconsistent **Yes** Inaccurate Source: **Yes** Process **Yes** Substituted **Yes** Test **Yes** OperatorBlocked * Internal range processing can override the state (i.e., if limits set in the RTAC are more restrictive than limits set in the publisher).

18 CLIENT PIXIT FOR CONTROL MODEL

Description	Value/Clarification
What control models are supported?	**Yes** status-only **Yes** direct-with-normal-security **Yes** sbo-with-normal-security **Yes** direct-with-enhanced-security **Yes** sbo-with-enhanced-security
Is Time activated operate (operTm) supported?	**No**
Is "operate-many" supported?	**No**
Can the Client set the test flag?	**Yes**
What Check conditions can the Client set?	**Yes** synchrocheck **Yes** interlock-check
Which originator categories does the Client support, and what is the originator identification?	When you use the ACSELERATOR RTAC software to configure the Client, you can specify the originator category value you want on a per-control basis. You can use logic during online operation to determine this value. When you configure the Client, you can specify a unique Client identifier for each Client/Server association.
Describe if and how the Client sets/increments the ctlNum.	The first time the Client operates a control, it writes a value of 0 to its ctlNum. With each subsequent operation of that control, the ctlNum value increments to a value one greater than the previous value (rolls over to 0, from 255).
What does the Client do when it receives a LastApplicationError? Describe how to view the additional cause.	The LastApplError tag (per Server) updates with the LastApplError information report, if the Server supports generation of LastApplError information report. You can write logic based on the status of the configuration mismatch tag to modify system behavior. When you work online with ACSELERATOR RTAC you can view the state/value of any tag, which includes the LastApplError tag.
What does the Client do when it receives a Select, SelectWithValue, or Operate respond negative?	The Client increments the Control_Success_Count or Control_Failure_Count tags for each control operation sequence; the tag that increments is based on the resulting control operation sequence. In addition, the Client increments Control_CmdTerm_Success_Count or Control_CmdTerm_Failure_Count; the tag that increments is based on the resulting command termination response. The Client updates the value of the LastApplError tag, if the server supports generation of the LastApplError information report.

Description	Value/Clarification
Can the Client change the control model via online services?	No
What does the Client do when the ctlModel is not initialized in the SCL?	The Client uses a GetDataValues request to attempt reading the ctlModel from the Server.

19 PIXIT FOR TIME AND TIME SYNCHRONIZATION MODEL

NOTE: The RTAC can act as an IEC 61850 Client or Server for purposes of time synchronization.

Description	Value/Clarification
Describe how to view internal time and quality or how to expose the time-stamp value and time-stamp quality via the IEC 61850 interface.	You can view time-stamp value and time-stamp quality information from ACSELERATOR RTAC software, when it is online. View the internal time and time quality by examining the state of the System_Time_Control tags.
What time quality bits are supported?	**Yes** LeapSecondsKnown **Yes** ClockFailure **Yes** ClockNotSynchronized
How does the RTAC behave for lost time synchronization signal/messages?	See the following time model information.
When is the quality bit Clock failure set?	The ClockFailure bit is always false.
When is the quality bit Clock not synchronized set?	The RTAC supports multiple time sources—IRIG, NTP, IEC 61850, PTP, DNP 3.0 and IEC 60870-5-101/104. The management of the ClockNotSynchronized bit depends on the RTAC time sources. If the RTAC receives time via an IRIG source that does not contain a time accuracy figure, or if the value is undefined, the RTAC sets the ClockNotSynchronized time quality bit to true. If the RTAC receives time via an NTP or IEC 61850 time source, the RTAC assumes this source to be a time-synchronized source. The RTAC therefore sets the ClockNotSynchronized time quality bit to true in the case of lost synchronization. If the RTAC receives time via a DNP time source, the RTAC assumes this source to not be a time-synchronized source. The ClockNotSynchronized time quality bit will therefore always be set to true.

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