



# High **PROTEC**

IEC 61850 | PIXIT

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**MCA4**

Software-Version: 3.4.a

Protocol Implementation Extra Information for Testing (PIXIT)

UCA International Users Group Testing Sub Committee

English

## **Contents of this document**

This document is applicable for MCA4 Version 3.4.a (Firmware-Build 35591).

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	4
TCP_KEEPALIVE value	720 seconds, before keep-alive messages are sent
Lost connection detection time	4 * 15 seconds (a lost connection is detected after 720 sec + 4*15 sec = 780 sec)
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                    any AE Qualifier                any
What is the maximum and minimum MMS PDU size?	Max MMS PDU size      64kB Min MMS PDU size      4000
What is the maximum start-up time after a power supply interrupt?	max 300 seconds until HMI is operable max 30 seconds until protection and IEC61850 is operable

## PIXIT for Server model

Description	Value / Clarification
<p>Which analogue value (MX) quality bits are supported (can be set by server)?</p>	<p>Validity:</p> <ul style="list-style-type: none"> <li>Y Good,</li> <li>N Invalid,</li> <li>N Reserved,</li> <li>N Questionable</li> <li>N Overflow</li> <li>N OutofRange</li> <li>N BadReference</li> <li>N Oscillatory</li> <li>N Failure</li> <li>N OldData</li> <li>N Inconsistent</li> <li>N Inaccurate</li> </ul> <p>Source:</p> <ul style="list-style-type: none"> <li>Y Process</li> <li>N Substituted</li> <li>N Test</li> <li>N OperatorBlocked</li> </ul>
<p>Which status value (ST) quality bits are supported (can be set by server)?</p>	<p>Validity:</p> <ul style="list-style-type: none"> <li>Y Good</li> <li>Y Invalid</li> <li>N Reserved</li> <li>Y Questionable</li> <li>N BadReference</li> <li>N Oscillatory</li> <li>Y Failure</li> <li>N OldData</li> <li>Y Inconsistent</li> <li>N Inaccurate</li> </ul> <p>Source:</p> <ul style="list-style-type: none"> <li>Y Process</li> <li>N Substituted</li> <li>N Test</li> <li>N OperatorBlocked</li> </ul>

Description	Value / Clarification
What is the maximum number of data values in one GetDataValues request?	Not restricted; MMS PDU is the limit.
What is the maximum number of data values in one SetDataValues request?	Not restricted; MMS PDU is the limit.
Deadband calculation for measurement	0 – Deadbanding disabled. Measurements follow the instantaneous value. 1 – 100000 - The delta sum up from the last updated value every second. If the sum is bigger than the deadband measurement value will be updated.

## PIXIT for Data set model

Description	Value / Clarification
What is the maximum number of data elements in one data set (compare ICD setting)?	60
How many persistent data sets can be created by one or more clients?	15 (If there are datasets defined in the SCL file, only the remaining amount can be created by the clients during run-time.)
How many non-persistent data sets can be created by one or more clients?	15

## PIXIT for Reporting model

Description	Value / Clarification																		
The supported trigger conditions are (compare PICS)	<table> <tr><td>integrity</td><td>Y</td></tr> <tr><td>data change</td><td>Y</td></tr> <tr><td>quality change</td><td>Y</td></tr> <tr><td>data update</td><td>N</td></tr> <tr><td>general interrogation</td><td>Y</td></tr> </table>	integrity	Y	data change	Y	quality change	Y	data update	N	general interrogation	Y								
integrity	Y																		
data change	Y																		
quality change	Y																		
data update	N																		
general interrogation	Y																		
The supported optional fields are	<table> <tr><td>sequence-number</td><td>Y</td></tr> <tr><td>report-time-stamp</td><td>Y</td></tr> <tr><td>reason-for-inclusion</td><td>Y</td></tr> <tr><td>data-set-name</td><td>Y</td></tr> <tr><td>data-reference</td><td>Y</td></tr> <tr><td>buffer-overflow</td><td>Y</td></tr> <tr><td>entryID</td><td>Y</td></tr> <tr><td>conf-rev</td><td>Y</td></tr> <tr><td>segmentation</td><td>Y</td></tr> </table>	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
sequence-number	Y																		
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data-set-name	Y																		
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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)	The last data value within buffer period will be reported.																		
Multi client URCB approach (compare IEC 61850-7-2 §14.2.1)	Each URCB is visible to all clients																		
What is the format of EntryID?	Octet string, the last 4 bytes are used as counter.																		
What is the buffer size for each BRCB or how many reports can be buffered?	10000 bytes for each BRCB																		
Pre-configured RCB attributes that cannot be changed online when RptEna = FALSE (see also the ICD report settings)	All RCB attributes can be changed online.																		
May the reported data set contain: - structured data objects? - data attributes? - timestamp data attributes?	<table> <tr><td>Y</td></tr> <tr><td>Y</td></tr> <tr><td>Y</td></tr> </table>	Y	Y	Y															
Y																			
Y																			
Y																			
What is the scan cycle for binary events?  Is this fixed, configurable?	<p>There is no scan cycle for binary events. Reporting works event driven</p> <p>Fixed</p>																		

## PIXIT for Generic substation events model

Description	Value / Clarification
<p>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.</p> <p>Note: the VLAN tag may be removed by a ethernet switch and should not be checked</p>	<p>N source MAC address</p> <p>Y destination MAC address</p> <p>Y Ethertype = 0x88B8</p> <p>N APPID</p> <p>Y gocbRef</p> <p>Y timeAllowedtoLive</p> <p>Y datSet</p> <p>Y goID</p> <p>N t</p> <p>Y stNum</p> <p>Y sqNum</p> <p>Y test</p> <p>Y confRev</p> <p>Y ndsCom</p> <p>Y numDatSetEntries</p>
<p>What is the behavior when one or more subscribed GOOSE messages aren't received or are syntactically incorrect (missing GOOSE)?</p> <p>device reaction:</p> <ol style="list-style-type: none"> <li>1. Messages will be ignored.</li> <li>2. Status change will be ignored by the DUT and the quality is set as INVALID</li> <li>3. Status change will be accepted by the DUT and the quality is set as QUESTIONABLE</li> <li>4. Status change will be accepted by the DUT and the quality is set as GOOD</li> </ol>	<p>Reaction to received incorrect or missing GOOSE message:</p> <ul style="list-style-type: none"> <li>• wrong destination MAC address (1)</li> <li>• Ethertype != 0x88B8 (1)</li> <li>• wrong gocbRef (1)</li> <li>• timeAllowedtoLive exceeded: <ul style="list-style-type: none"> <li>- by factor 1: (3)</li> <li>- by factor 2: (2)</li> </ul> </li> <li>• wrong datSet (2)</li> <li>• wrong goID (2)</li> <li>• unexpected stNum (3)</li> <li>• unexpected sqNum (3)</li> <li>• test flag set (1)</li> <li>• wrong confRev (2)</li> <li>• ndsCom flag set (2)</li> <li>• numDatSetEntries != data entries in received message (1)</li> <li>• unexpected datatype in received message (2)</li> <li>• numDatSetEntries &lt; expected (2)</li> <li>• numDatSetEntries &gt; expected (4)</li> </ul>



Description	Value / Clarification																					
Can the test flag in the published GOOSE be turned on / off ?	N																					
What is the behavior when the GOOSE publish configuration is incorrect?	Wrong GOOSE configuration in SCD-File is not possible, because it is checked when downloading it to the device.  Changing the GOOSE configuration during runtime is not supported.																					
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																					
What is the behavior when a subscribed GOOSE message is out-of-order?	This means that the DUT receives unexpected sqNum and/ or stNum. DUT reaction see item above.																					
What is the behavior when a subscribed GOOSE message is duplicated?	This means that the DUT receives unexpected sqNum and stNum. DUT reaction see item above.																					
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?	<table border="1"> <thead> <tr> <th>Subscribed</th> <th>Published</th> </tr> </thead> <tbody> <tr> <td>N</td> <td>N</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> <tr> <td>Y</td> <td>Y</td> </tr> </tbody> </table>	Subscribed	Published	N	N	Y	Y	Y	Y													
Subscribed	Published																					
N	N																					
Y	Y																					
Y	Y																					
What is the slow retransmission time? Is it fixed or configurable?	33 sec with TAL = 66 sec  Fixed																					
What is the fast retransmission scheme? Is it fixed or configurable?	<p>Fixed scheme retrans: retrans time <b>before next</b> message</p> <table border="1"> <thead> <tr> <th>sqNum</th> <th>retrans</th> <th>TAL</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>32 msec</td> <td>64 msec</td> </tr> <tr> <td>1</td> <td>32 msec</td> <td>64 msec</td> </tr> <tr> <td>2</td> <td>64 msec</td> <td>128 msec</td> </tr> <tr> <td>3</td> <td>128 msec</td> <td>256 msec</td> </tr> <tr> <td>4</td> <td>256 msec</td> <td>512 msec</td> </tr> <tr> <td>... until</td> <td>33 sec</td> <td>66 sec</td> </tr> </tbody> </table>	sqNum	retrans	TAL	0	32 msec	64 msec	1	32 msec	64 msec	2	64 msec	128 msec	3	128 msec	256 msec	4	256 msec	512 msec	... until	33 sec	66 sec
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3	128 msec	256 msec																				
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... until	33 sec	66 sec																				
Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)?	N																					

TAL = Time Allowed to Live

## PIXIT for Control model

Description	Value / Clarification
What control modes are supported (compare PICS)?	N status-only Y direct-with-normal-security N sbo-with-normal-security N direct-with-enhanced-security Y sbo-with-enhanced-security
Is the control model fixed, configurable and/or online changeable?	Fixed
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 ignores the test value and execute the command as usual
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
What is the behavior of the DUT when the check conditions are set Is this behavior fixed, configurable, online changeable?	DUT ignores the check value transmitted by IEC61850 and performs the check depending on the device settings. Behavior is fixed
What additional cause diagnosis are supported?	Y Blocked-by-switching-hierarchy Y Select-failed N Invalid-position Y Position-reached Y Parameter-change-in-execution N Step-limit N Blocked-by-Mode N Blocked-by-process Y Blocked-by-interlocking Y Blocked-by-synchrocheck Y Command-already-in-execution N Blocked-by-health Y 1-of-n-control N Abortion-by-cancel Y Time-limit-over N Abortion-by-trip
How to force a "test-not-ok" respond with SelectWithValue request?	Double select of the same object.
How to force a "test-not-ok" respond with Select request?	n.a.

Description	Value / Clarification
How to force a "test-not-ok" respond with Operate request?	DOns: n.a. SBOns: n.a. DOes: n.a. SBOes: Send an Operate with actual value to an unselected SBOes object.
Which origin categories are supported?	Values 0 – 8 are supported
What happens if the orCat is not supported?  Does the IED accept an selectwithvalue/operate with the same ctVal as the current status value?  Does the IED accept a select/operate on the same control object from 2 different clients at the same time?  Does the IED accept a select/selectwithvalue from the same client when the control object is already selected (tissue 334)?  Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?  Can a control operation be blocked by Mod=Off or Blocked?  Does the IED support local / remote operation?  Is it possible to select more than one switch at the same time?	DOns: Error message "not supported" SBOns: n.a. DOes: n.a. SBOes: Error message "not supported"  DOns: Y SBOns: n.a. DOes: n.a. SBOes: N The DUT performs the check during the SelectWithValue phase.  DOns: N SBOns: n.a. DOes: n.a. SBOes: N  SBOns: n.a. SBOes: N  SelectWithValue or Operate It depends on the performed validation step.  N  Y  N The DUT allows to select only one switch at a time

## PIXIT for Time and time synchronisation model

Description	Value / Clarification
What quality bits are supported?	N LeapSecondsKnown N ClockFailure Y ClockNotSynchronized
Describe the behavior when the time synchronization signal/messages are lost	The quality bit "ClockNotSynchronized" is set to TRUE after a fixed time period.
When is the time quality bit "Clock failure" set?	Not supported
When is the time quality bit "Clock not synchronised" set?	90 seconds after receiving the last synchronization signal/messages
Is the timestamp of a binary event adjusted to the configured scan cycle?	N (Timestamps of binary events lying in the past are not adjusted when the system clock is updated.)
Does the device support time zone and daylight saving?	Y
Which attributes of the SNTP response packet are validated?	N Leap indicator not equal to 3? Y Mode is equal to SERVER N 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 4 accepted)