

Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 Edition 2 server interface in AQ-300 series

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1 Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface server interface in **AQ-300 series** with firmware version **2.10**.

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, TICS documents or SCL file.

Each chapter 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. A hyphen ("-") in the Ed column indicates the PIXIT entry is not applicable for any version. ACSI basic conformance statement

1.1 PIXIT for Documentation

ID	Ed	Description	Value / Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	Press I button on the front touch screen and check the "System version: 2.10"

1.2 PIXIT for Association model

ID	Ed	Description	Value / Clarification																										
As1	1	Maximum number of clients that can set-up an association simultaneously	4																										
As2	1,2	TCP_KEEPALIVE value. The recommended range is 1..20s	max. 20 seconds																										
As3	1,2	Lost connection detection time	30 seconds																										
As4	-	Authentication is not supported yet																											
As5	1,2	What association parameters are necessary for successful association: Called value: Calling values:	<table border="0"> <tr><td>Transport selector</td><td>N</td></tr> <tr><td>Session selector</td><td>N</td></tr> <tr><td>Presentation selector</td><td>N</td></tr> <tr><td>AP Title</td><td>N</td></tr> <tr><td>AE Qualifier</td><td>N</td></tr> <tr><td>other</td><td></td></tr> <tr><td colspan="2"> </td></tr> <tr><td>Transport selector</td><td>N</td></tr> <tr><td>Session selector</td><td>N</td></tr> <tr><td>Presentation selector</td><td>N</td></tr> <tr><td>AP Title</td><td>N</td></tr> <tr><td>AE Qualifier</td><td>N</td></tr> <tr><td>other</td><td></td></tr> </table>	Transport selector	N	Session selector	N	Presentation selector	N	AP Title	N	AE Qualifier	N	other				Transport selector	N	Session selector	N	Presentation selector	N	AP Title	N	AE Qualifier	N	other	
Transport selector	N																												
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other																													
As6	1,2	If association parameters are necessary for association, describe the correct Called values: e.g.	<table border="0"> <tr><td>Transport selector</td><td>N/A</td></tr> <tr><td>Session selector</td><td>N/A</td></tr> <tr><td>Presentation selector</td><td>N/A</td></tr> <tr><td>AP Title</td><td>N/A</td></tr> <tr><td>AE Qualifier</td><td>N/A</td></tr> <tr><td>other</td><td></td></tr> </table>	Transport selector	N/A	Session selector	N/A	Presentation selector	N/A	AP Title	N/A	AE Qualifier	N/A	other															
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ID	Ed	Description	Value / Clarification
		Calling parameters: e.g.	Transport selector N/A Session selector N/A Presentation selector N/A AP Title N/A AE Qualifier N/A other
As7	1,2	What is the maximum and minimum MMS PDU size	Max MMS PDU size 65000 bytes Min MMS PDU size 1000 bytes
As8	1,2	What is the maximum start up time after a power supply interrupt	< 30 seconds
As9	1,2	Does this device function only as test equipment? (test equipment need not have a non-volatile configuration; but it cannot be part of the substation automation system)	N

1.3 PIXIT for Server model

ID	Ed	Description	Value / Clarification
Sr1	1,2	Which analogue value (MX) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, Y Questionable Detail Quality N Overflow Y OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent Y Inaccurate Miscellaneous: Y Source Y Test N OperatorBlocked
Sr2	1,2	Which status value (ST) quality bits are supported (can be set by server)	Validity: Y Good, Y Invalid, N Reserved, N Questionable Detail Quality N BadReference N Oscillatory Y Failure

ID	Ed	Description	Value / Clarification
			NOldData NInconsistent NInaccurate Miscellaneous: YSource YTest NOperatorBlocked
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	Deprecated
Sr5	1	Which Mode values are supported ¹	On Y [On-]Blocked Y Test Y Test/Blocked Y Off Y

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

1.4 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)	Datasets are only configurable
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)	N/A
Ds3	1	How many non-persistent data sets can be created by one or more clients	N/A

1.5 PIXIT for Substitution model

ID	Ed	Description	Value / Clarification
		Substitution is not supported	N/A

1.6 PIXIT for Setting group control model

ID	Ed	Description	Value / Clarification
Sg1	1	What is the number of supported setting groups for each logical device	Configurable (max.8)

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

ID	Ed	Description	Value / Clarification
Sg2	1,2	What is the effect of when and how the non-volatile storage is updated (compare IEC 61850-8-1 §16.2.4)	N/A
Sg3	1	Can multiple clients edit the same setting group	N/A
Sg4	1	What happens if the association is lost while editing a setting group	N/A
Sg5	1	Is EditSG value 0 allowed	N/A
Sg6	2	When ResvTms is not present how long is an edit setting group locked	N/A

1.7 PIXIT for Reporting model

ID	Ed	Description	Value / Clarification																		
Rp1	1	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>Y</td></tr> <tr><td>general interrogation</td><td>Y</td></tr> </table>	integrity	Y	data change	Y	quality change	Y	data update	Y	general interrogation	Y								
integrity	Y																				
data change	Y																				
quality change	Y																				
data update	Y																				
general interrogation	Y																				
Rp2	1	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																				
report-time-stamp	Y																				
reason-for-inclusion	Y																				
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data-reference	Y																				
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entryID	Y																				
conf-rev	Y																				
segmentation	Y																				
Rp3	1,2	Can the server send segmented reports (when not supported the device shall refuse an association request with a smaller than minimum PDU size)	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	Multi client URCB approach (compare IEC 61850-7-2:2003 §14.2.1)	Each URCB is visible to all clients																		
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	10 kBytes																		
Rp8	-	Pre-configured RCB attributes that are dynamic, compare SCL report settings	Deprecated																		
Rp9	1	May the reported data set contain: - structured data objects - data attributes	<table> <tr><td>Y</td></tr> <tr><td>Y</td></tr> </table>	Y	Y																
Y																					
Y																					
Rp10	1,2	What is the scan cycle for binary events Is this fixed, configurable	Configurable (default: 4 ms)																		

ID	Ed	Description	Value / Clarification
Rp11	1	Does the device support to pre-assign a RCB to a specific client in the SCL	N
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. No on-line change.
Rp13	1,2	Does the server accept any client to configure / enable a BRCB with ResvTms=-1? What fields are used to do the identification?	N AP-Title N/A AE-Qualifier N/A
Rp14	1,2	When BRCB.ResvTms is exposed, what is the default value for BRCB.ResvTms if client does not write (must be > 0) When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0)	N/A 30 milliseconds
Rp15	2	Is data model db=0 supported	N

1.8 PIXIT for Logging model

ID	Ed	Description	Value / Clarification
		Logging is not supported	N/A

1.9 PIXIT for GOOSE publish model

ID	Ed	Description	Value / Clarification
Gp1	1,2	Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set	N
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect	Not possible. SW tool ensure the correct configuration
Gp3	1,2	Published FCD supported common data classes are	SPS
Gp4	1,2	What is the maximum value of TAL (maxTime) Is it fixed or configurable	15000 ms
Gp5	1,2	What is the fastest retransmission time	10 ms Retransmission strategy is: 10,10,10,5000, ...
Gp6	-	Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)	Deprecated See PICS - SetGoCBValues
Gp7	1,2	What is the initial GOOSE sqNum after restart	sqNum = 0
Gp8	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	Y Y
Gp9	1,2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	Y (ICT refuses)

1.10 PIXIT for GOOSE subscribe model

ID	Ed	Description	Value / Clarification
Gs1	1,2	<p>What elements of a subscribed GOOSE message are checked to decide the message is valid and the allData values are accepted? If yes, describe the conditions.</p> <p>Notes:</p> <ul style="list-style-type: none"> the VLAN tag may be removed by an Ethernet switch and shall not be checked the simulation flag shall always be checked (Ed2) 	<p>Y destination MAC address</p> <p>Y APPID</p> <p>Y gocbRef</p> <p>Y timeAllowedtoLive</p> <p>Y datSet</p> <p>Y golD</p> <p>N T</p> <p>Y stNum</p> <p>Y sqNum</p> <p>Y simulation / test</p> <p>Y confRev</p> <p>Y ndsCom</p> <p>N numDatSetEntries</p> <p>N out-of-order dataset members</p>
Gs2	1,2	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 before TAL expires
Gs3	1,2	What is the behaviour when one or more subscribed GOOSE messages is not received or syntactically incorrect (missing GOOSE)	If TAL expires invalid status of the receiver channel is set.
Gs4	1,2	What is the behaviour when a subscribed GOOSE message is out-of-order	Internal error log entry is created.
Gs5	1,2	What is the behaviour when a subscribed GOOSE message is duplicated	Internal error log entry is created.
Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag	Y, with and without the VLAN tag
Gs7	1	May the GOOSE data set contain: - structured data objects (FCD) - timestamp data attributes	Y Y
Gs8	1,2	Subscribed FCD supported common data classes are	SPS
Gs9	1,2	Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode	Y
Gs10	1,2	Max number of dataset members	100
Gs11	1	Is Fixed-length encoded GOOSE supported	N
Gs12	2	Is IEC 62351-6 security supported	N

1.11 PIXIT for Control model

ID	Ed	Description	Value / Clarification
Ct1	1	What control models are supported (compare PICSICD file enums for Ed2)	Dons: Y SBOs: N DOes: Y SBOes: Y
Ct2	1,2	Is the control model fixed, configurable and/or dynamic	Configurable
Ct3	-	Is TimeActivatedOperate supported (compare PICS or SCL)	Deprecated
Ct4	-	Is "operate-many" supported (compare sboClass)	Deprecated, see sboClass in datamodel (ICD)
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 Ct12 is applicable)	N
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)	Deprecated
Ct8	1	What is the behaviour of the DUT when the check conditions are set Is this behaviour fixed, configurable, online changeable	Y Synchrocheck Y Interlock-check Configurable if DUT ignores the check value and always perform the check or DUT uses the check value to perform the check

ID	Ed	Description	Value / Clarification
Ct9	1,2	Which additional cause diagnosis are supported	Y Unknown Y Not-supported Y Blocked-by-switching-hierarchy N Select-failed Y Invalid-position Y Position-reached N Step-limit Y Blocked-by-Mode Y Blocked-by-process Y Blocked-by-interlocking Y Blocked-by-synchrocheck N Command-already-in-execution N Blocked-by-health Y 1-of-n-control N Abortion-by-cancel N Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 1 specific values: N/A Edition 2 specific values: Y Object-already-selected N No-access-authority N Ended-with-overshoot N Abortion-due-to-deviation N Abortion-by-communication-loss N Blocked-by-command N None Y Inconsistent-parameters N Locked-by-other-client N Parameter-change-in-execution (Ed2 semantics)
Ct10	1,2	How to force a "test-not-ok" respond with SelectWithValue request	Other client has already selected the object
Ct11	1,2	How to force a "test-not-ok" respond with Select request	N/A
Ct12	1,2	How to force a "test-not-ok" respond with Operate request	DOns: Operate an interlocked object. DOes: Control value is the same as the current status SBOes: Operate without select
Ct13	1,2	Which origin categories are supported / accepted	all accepted

ID	Ed	Description	Value / Clarification
Ct14	1,2	What happens if the orCat value is not supported or invalid	Invalid orCat results in a command termination with „Inconsistent-parameters” addcause
Ct15	1,2	Does the IED accept a SelectWithValue / Operate with the same control value as the current status value Is this behaviour configurable	DOs: Y SBOs: N/A DOes: N SBOes: N Configurable: N
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time	DOs: N SBOs: N/A DOes: N SBOes: N
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)	SBOs: N/A SBOes: N
Ct18	1	Deprecated	
Ct19	-	Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)	Deprecated
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	SBOs: N/A DOs: Y
Ct22	2	How to force a “parameter-change-in-execution”	SBOs: N/A SBOes: N/A
Ct23	1,2	How many SBOs/SBOes control objects can be selected at the same time?	SBOs: N/A SBOes: n = “1”
Ct24	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
Ct25	1,2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	N
Ct26	1,2	Name an enhanced security point (if any) with a finite operate timeout specify the timeout (in milliseconds)	DOes: Configurable SBOes: Configurable
Ct27	2	Does the IED support control objects with external signals?	DOs: Y SBOs: N/A DOes: Y SBOes: Y
Ct28		Deprecated, kept as placeholder	

1.12 PIXIT for Time synchronization model

ID	Ed	Description	Value / Clarification
Tm1	1	What time quality bits are supported (may be set by the IED)	Y LeapSecondsKnown Y ClockFailure Y ClockNotSynchronized
Tm2	1,2	Describe the behaviour when all time server(s) cease to respond What is the time server lost detection time	CF and CNS bits set in the timestamps <50 seconds
Tm3	1,2	How long does it take to take over the new time from time server	<25 seconds
Tm4	1,2	When is the time quality bit "ClockFailure" set	when both NTP1 and NTP2 lost
Tm5	1	When is the time quality bit "Clock not Synchronized" set	when both NTP1 and NTP2 lost
Tm6	-	Is the timestamp of a binary event adjusted to the configured scan cycle	Deprecated
Tm7	1	Does the device support time zone and daylight saving	Y
Tm8	1,2	Which attributes of the SNTP response packet are validated	Leap indicator not equal to 3 Mode is equal to SERVER OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp RX/TX timestamp fields are checked for reasonableness SNTP version 4
Tm9	1,2	Do the COMTRADE files have local time or UTC time and is this configurable	Local Not Configurable

1.13 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	Flat file system with pseudo folders (Ed2) / Not zipped : .cfg, .dat, .inf
Ft2	1,2	Directory names are separated from the file name by	"/"
Ft3	1	The maximum file name size including path (recommended 64 chars)	255 chars
Ft4	1,2	Are directory/file name case sensitive	Case sensitive
Ft5	1,2	Maximum file size for SetFile	SetFile is not supported
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name	Y (Ed2: always complete path)

ID	Ed	Description	Value / Clarification
Ft7	1	Is the wild card supported in the MMS fileDirectory request	Yes, wild card = *
Ft8	1,2	Is it allowed that 2 clients get a file at the same time	Y same file Y different files
Ft9	1,2	Which files can be deleted	All files

1.14 PIXIT for Service tracking model

ID	Ed	Description	Value / Clarification
Tr1	2	Which ACSI services are tracked by LTRK.GenTrk	N/A