



GE VERNONA

MiCOM P40 Agile

P44, P54, P64, P84

PIXIT

Protocol Implementation eXtra Information for Testing - IEC 61850 Edition 2

Software Version: AB

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1 INTRODUCTION

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in P44, P54, P64 and P84 with firmware version AB.

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 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. A hyphen ("–") in the Ed column indicates the PIXIT entry is not applicable for any version.

2 PIXIT FOR DOCUMENTATION

ID	Ed	Description	Value/Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	na. Shows in LLN0.NamPlt.ConfigRev for all LD

3 PIXIT FOR CONFIGURATION

ID	Ed	Description	Value/Clarification
Cf1	2	Can IED tool export ICD file or IID file (SICS I12)	ICD: Y IID: Y
		<additional items>	

4 PIXIT FOR ASSOCIATION MODEL

ID	Ed	Description	Value/Clarification	
As1	1	Maximum number of clients that can set-up an association simultaneously	16	
As2	1, 2	TCP_KEEPALIVE value. The recommended range is 1..20s	<p>The default interval for TCP_KEEPALIVE messages transmitted by the relay is five (5) seconds.</p> <p>The TCP_KEEPALIVE messages are transmitted for a fixed period of approximately 20 seconds following the last received keep-alive response, after which time the client association will be dropped.</p>	
As3	1, 2	Lost connection detection time	<p>The time-out period for aborted sockets is approximately sixty (60) seconds.</p> <p>For the duration of this time-out period the socket resources are unavailable for new client association requests.</p> <p>A total of 100 sockets are available.</p>	
As4	-	Authentication is not supported yet		
As5	1, 2	What association parameters are necessary for successful association? Called values:	Transport selector	Y
			Session selector	Y
			Presentation selector	Y
			AP Title	N
			AE Qualifier	N
		Calling values:	Transport selector	N
			Session selector	N
			Presentation selector	N
			AP Title	N
			AE Qualifier	N
As6	1, 2	If association parameters are necessary for association, describe the correct Called values:	Transport selector	0001
			Session selector	0001
			Presentation selector	00000001
			AP Title	na
			AE Qualifier	na
		Calling parameters:	Transport selector	na
			Session selector	na
			Presentation selector	na
			AP Title	na
			AE Qualifier	na
As7	1, 2	What is the maximum and minimum MMS PDU size?	Max MMS PDU size 65536 bytes Min MMS PDU size 8192 bytes	
As8	1, 2	What is the maximum start up time after a power supply interrupt?	The typical start up time of basic Ethernet services, following an interruption to the power supply is approximately 30 seconds. Full IEC 61850 services are available after an approximate start up time of min 80 seconds (the time is according to configuration).	
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	
As10	2	How does the server behave when the associate request fails?	N/A (server does not send associate requests)	
		<additional items>		

5 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)?	<p>Validity:</p> <p>Y Good, Y Invalid, N Reserved, Y Questionable Y Overflow YOutOfRange N BadReference N Oscillatory Y Failure (only for Fault Record LN 'PriFltMLFR1') YOldData N Inconsistent N Inaccurate</p> <p>Source:</p> <p>Y Process Y Substituted Y Test Y OperatorBlocked</p>										
Sr2	1, 2	Which status value (ST) quality bits are supported (can be set by server)?	<p>Validity:</p> <p>Y Good, Y Invalid N Reserved, Y Questionable N BadReference Y Oscillatory Y Failure, for GosGGIO1.Indx only YOldData N Inconsistent N Inaccurate</p> <p>Source:</p> <p>Y Process Y Substituted Y Test Y OperatorBlocked</p>										
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?	<table> <tr> <td>On</td> <td>Y</td> </tr> <tr> <td>[On-]Blocked</td> <td>N</td> </tr> <tr> <td>Test</td> <td>Y</td> </tr> <tr> <td>Test/Blocked</td> <td>Y</td> </tr> <tr> <td>Off</td> <td>Y</td> </tr> </table>	On	Y	[On-]Blocked	N	Test	Y	Test/Blocked	Y	Off	Y
On	Y												
[On-]Blocked	N												
Test	Y												
Test/Blocked	Y												
Off	Y												
	1, 2	Measurement deadband	Any deadband values written online by an IEC 61850 client since the Memory Bank was previously activated, will be overwritten if the 'Restore MCL' setting is activated.										

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.

6 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)?	N/A (refer to SCL)
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)?	N/A (refer to SCL)
Ds3	1	How many non-persistent data sets can be created by one or more clients?	N/A (refer to SCL)

7 PIXIT FOR SUBSTITUTION

ID	Ed	Description	Value/Clarification
Sb1	1	Are substituted values stored in volatile memory	Y
		<additional items>	

8 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?	4
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)?	None. ConfirmEditSGValues not supported.
Sg3	1	Can multiple clients edit the same setting group?	na
Sg4	1	What happens if the association is lost while editing a setting group?	na
Sg5	1	Is EditSG value 0 allowed?	na
Sg6	2	When ResvTms is not present how long is an edit setting group locked?	Na
Sg7	2	Can the active setting group be changed locally? Can a setting in the active setting group be changed locally?	Y Y
		<additional items>	

9 PIXIT FOR REPORTING MODEL

ID	Ed	Description	Value/Clarification
Rp1	1	The supported trigger conditions are (compare PICS)	Integrity Y data change Y quality change Y data update N general interrogation Y
Rp2	1	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	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 Ed2 \$17.2.2.9)	Send report immediately
Rp5	1	Multi client URCB approach (compare IEC 61850-7-2:2003 \$14.2.1)	Each URCB is reserved by one client only
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?	1000000 bytes for one instance 125000 bytes for each of the maximum 8 instances
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	Y Y
Rp10	1, 2	What is the scan cycle for binary events Is this fixed, configurable?	10 ms Fixed
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. The change of DataSet from SetBRCBValues Service is not supported.
Rp13	1, 2	Does the server accept any client to configure/enable an RCB with BRCB.ResvTms=-1 or URCB.Resv=T? What fields are used to do the identification?	N IP PSEL SEL TSEL AP Title if configured AE Qualifier if configured AP Invoke ID if configured AE Invoke ID if configured
Rp14	1, 2	When BRCB.ResvTms is exposed, what is the default value for BRCB.ResvTms if client does not write (must be > 0)? Note: For Amd1 the client shall always write ResvTms and ResvTms is mandatory.	20 Seconds
Rp15	2	Is data model db=0 supported?	Y

10 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?	Y According to IED 'Publisher Sim' setting.
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect?	NdsCom=T DUT keeps GoEna=F
Gp3	1, 2	Published FCD supported common data classes are	All the common data classes in the data model.
Gp4	1, 2	What is the slow retransmission time Is it fixed or configurable?	1000 milliseconds with TAL = 2010 Configured by 'Maximum Cycle Time' parameter ('IED Configurator')
Gp5	1, 2	What is the fastest retransmission time Is it fixed or configurable?	Approx. 10 ms Configurable
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 = 1
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

11 PIXIT FOR GOOSE PERFORMANCE

ID	Ed	Description	Value/Clarification	
Gf1	1, 2	Performance class	P2 = 10 ms	
Gf2	1, 2	GOOSE ping-pong processing method	Scan cycle based	
Gf3	1, 2	Application logic scan cycle (ms)	Max.	P44/P54/P84: 1.25 ms P64: 2.5 ms
			Min.	P44/P54/P84: 1 ms P64: 2.08 ms
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	Not limited by configuration	
		<additional items>		

12 PIXIT FOR GOOSE SUBSCRIBE MODEL

ID	Ed	Description	Value/Clarification
Gs1	1, 2	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. Notes: The VLAN tag may be removed by an ethernet switch and shall not be checked. The simulation flag shall always be checked (Ed2). The ndsCom shall always be checked (Ed2).	Y destination MAC address Y APPID N gocbRef Y timeAllowedtoLive Y dataSet Y goID N t N stNum N sqNum Y simulation/test Y confRev Y ndsCom N numDataSetEntries (After successful subscription, DUT checks the numDataSetEntries and invalid the first GOOSE with different numDataSetEntries) Y out-of-order dataset members
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 prior to TAL TAL = (2 * (time to next message)) + ('Minimum Cycle Time' parameter). A 'GOOSE IED Absent' alarm is raised by the IED.
Gs3	1, 2	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)?	If one subscribed message is not received or is syntactically incorrect, it is ignored. (If the next message is also not received or is syntactically incorrect, the TAL will be exceeded.)
Gs4	1, 2	What is the behaviour when a subscribed GOOSE message is out-of-order?	It is processed as if it were in order.
Gs5	1, 2	What is the behaviour when a subscribed GOOSE message is duplicated?	It is processed as if it were in order.
Gs6	1	Does the device subscribe to GOOSE messages with/without the VLAN tag?	Y, with the VLAN tag Y, 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 DPS SPC DPC
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	No count limitation. User can configure dataset members up to maximum limit GOOSE packet can hold.
Gs11	1	Is Fixed-length encoded GOOSE supported?	Y
Gs12	Amd1	Is IEC 62351-6 security supported?	N
Gs13	Amd1	How does the subscriber handle incoming data flagged as test when the destination LN.Beh is On or Blocked? Is this behaviour:	Keep default (configurable) Configurable
		<additional items>	

13 PIXIT FOR CONTROL MODEL

ID	Ed	Description	Value/Clarification
Ct1	-	What control models are supported (compare PICS)?	Deprecated
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 sb0Class)?	Deprecated
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, 2	What is the behaviour of the DUT when the check conditions are not set? This behaviour is:	DUT bypasses the interlocking check (All Ed) Fixed
Ct9	1, 2	Which additional cause diagnosis are supported?	<p> Y Unknown Y Not-supported Y Blocked-by-switching-hierarchy Y Select-failed Y Invalid-position Y Position-reached N Parameter-change-in-execution (Ed1) N Step-limit Y Blocked-by-Mode N Blocked-by-process Y Blocked-by-interlocking N Blocked-by-synchrocheck Y 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 </p> <p> Edition 2 specific values: </p> <p> 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 Y Locked-by-other-client N Parameter-change-in-execution (Ed2 semantics) </p>
Ct10	1, 2	How to force a "test-not-ok" respond with SelectWithValue request	<ol style="list-style-type: none"> Send an invalid orCat value Select control object twice Select an operating control object Send a SelectWithValue with a value the same as the current Data Objects stVal <p>Note: This list is not exhaustive.</p>

ID	Ed	Description	Value/Clarification
Ct11	1, 2	How to force a “test-not-ok” respond with Select request	Select request only returns ReadResponse+ with: The selected control object name for a successful operation An empty/null string for a failed select request
Ct12	1, 2	How to force a “test-not-ok” respond with Operate request	<ol style="list-style-type: none"> 1. Blocked by mode checking 2. Select more than 1 control object (fail on control uniqueness checks) 3. Send an invalid orCat value 4. Attempt to operate an already operating control object 5. Select control object from Client A, operate same control object from Client B. 6. For SBO/SBOW, do not select the control object prior to sending the operate request 7. For SBO/SBOW, ensure data in operate request is different to that sent in the select request 8. Send an operate request with a value the same as the current Data Objects stVal <p>Note: This list is not exhaustive.</p>
Ct13	1, 2	Which origin categories are supported/ accepted?	<p>Y bay-control Y station-control Y remote-control Y automatic-bay Y automatic-station Y automatic-remote Y maintenance Y process</p> <p>Internally the IED supports: Process From external clients: All categories supported (the IED simply records the given category so long as it is within the valid range).</p>
Ct14	1, 2	What happens if the orCat value is not supported or invalid?	IED returns AddCause ‘Not-supported’.
Ct15	1, 2	<p>Does the IED accept a SelectWithValue/Operate with the same control value as the current status value?</p> <p>Is this behaviour configurable?</p>	<p>DOns: N SBOns: N DOes: N SBOes: N Configurable N</p> <p>AddCause = ‘Position-reached’ with MMS AccessResult = ‘object-access-denied’</p>
Ct16	1	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	<p>DOns: N SBOns: N DOes: N SBOes: N</p>
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)?	<p>SBOns: N SBOes: N</p>
Ct18	1	Deprecated	
Ct19	-	Can a control operation be blocked by Mod=Off or [On]-Blocked (Compare PIXIT-Sr5)?	Deprecated (ThmPTTR1.MTRRs only)
Ct20	1, 2	Does the IED support local/remote operation?	Y for XCBR and XSWI
Ct21	1, 2	Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security?	<p>SBOns: Y DOns: Y</p>
Ct22	2	How to force a “parameter-change-in- execution”	<p>SBOns: Not supported SBOes: Not supported</p>
Ct23	1, 2	How many SBOns/SBOes control objects can be selected at the same time?	<p>SBOns: n = 1 SBOes: n = 1</p>

ID	Ed	Description	Value/Clarification
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 (CB)
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)	Control/XCBR.Pos, 2000 ms
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOns: Y DOes: Y SBOes: Y
Ct28		Deprecated	
Ct29	Amd1	Does the IED support XCBR/XSWI.Loc=False and LLN0/CSWI.Loc=True? When yes, does the IED accept the control when orCat=1 or 4 Local?	DOns: Y, orCat 1-4: N SBOns: Y, orCat 1-4: N DOes: Y, orCat 1-4: N SBOes: Y, orCat 1-4: N
Ct30	2	What is the Operate timeout?	Configurable, default 2000 ms

14 PIXIT FOR TIME SYNCHRONISATION 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 the time server(s) ceases to respond What is the time server lost detection time?	SNTP: If no configured external SNTP server responds, the 'ClockNotSynchronized' bit will be set to 1. For example, when the Poll Rate (seconds) is configured to be 64 seconds, and both SNTP servers are configured, it would take 94 seconds. PTP: 2 seconds.
Tm3	1, 2	How long does it take to take over the new time from time server?	If configured external SNTP server responds within 5 seconds, the 'ClockNotSynchronized' bit will be set to 0. For example, when the Poll Rate (seconds) is configured to be 64 seconds, it would take up to 69 seconds. PTP: 2 seconds
Tm4	1, 2	When is the time quality bit "ClockFailure" set?	If configured external source is not available for > 50 seconds OR if external SNTP, PTP or IRIG-B server accuracy exceeds 1 ms.
Tm5	1, 2	When is the time quality bit "Clock not Synchronized" set?	The 'Clock not synchronized' bit at power-up has a default status of not synchronized (set to 1). When the clock becomes synchronized, the bit will be reset to 0. All available time synchronization sources will affect the 'Clock not synchronized' bit. These time sources include SNTP and, where applicable, IRIG-B, PTP.
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?	Y Leap indicator not equal to 3 Y Mode is equal to SERVER N Originate Timestamp 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 Y other (describe)
Tm9	1, 2	Do the COMTRADE files have local time or UTC time and is this configurable?	Local Not Configurable

15 PIXIT FOR FILE TRANSFER MODEL

ID	Ed	Description	Value/Clarification
Ft1	1	What is the structure of files and directories?	Device Root/ COMTRADE/ dr/ dr_unextracted/
		Where are the COMTRADE files stored?	Files (*.cfg and *.dat) according to the COMTRADE standard ASCII format. /COMTRADE/ and /dr_unextracted/
		Are comtrade files zipped and what files are included in each zip file?	Not Zipped
Ft2	1, 2	Directory names are separated from the file name by	"/" The use of "/" directory separator will return a positive result to the file transfer MMS service requests but with no data elements (directory or filenames).
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	Not supported for SetFile
Ft6	1	Is the requested file path included in the MMS fileDirectory respond file name?	Y (Ed2: always complete path)
Ft7	1	Is the wild char supported in the MMS fileDirectory request?	Yes, wild card = * No
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?	.cfg and .dat files Only from/dr_unextracted/ Once the .cfg or .dat file is deleted, the paired .dat or .cfg file will be automatically removed.



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