

GE
Grid Solutions

Multilin Agile

P14D, P14N, P94V

PIXIT
Protocol Implementation eXtra Information for Testing - IEC 61850 Edition 2

Software version: 06
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1 INTRODUCTION

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in Multilin Agile range of products (P14D, P14N and P94V) with firmware version 06.

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.

Note:

This range is undergoing a transition, with 30TE models being branded as Multilin Agile, whereas the 20TE model carries P40 Agile Enhanced branding for a transition period. Both 20TE and 30TE products are similar, with any differences between them highlighted by reference to the case size. For more information refer to instruction manual MAP14-TM-EN-5.pdf on the Grid Solutions web page.

1.1 Contents of this document

Each chapter specifies the PIXIT for each 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 PIXIT FOR DOCUMENTATION

ID	Ed	Description	Value/Clarification
Do1	2	How to expose required firmware versions not present in the datamodel	In any LDevice: LPHD1\$DC\$PhyNam.swRev or AnyLN\$DC\$NamPlt.swRev or In the HMI: Device Status->Information->Main CPU->Firmware Version
		<additional items>	

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: N
		<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	8
As2	1, 2	TCP_KEEPALIVE value. The recommended range is 1..20s	7200 seconds but if no application message is detected within the As3 value, the device will close the connection
As3	1, 2	Lost connection detection time	120 seconds
As4	-	Is authentication supported?	N
As5	1, 2	What association parameters are necessary for successful association?	Transport selector Y Session selector Y Presentation selector Y AP Title N AE Qualifier N Other
		Called values:	Transport selector N Session selector N Presentation selector N AP Title N AE Qualifier N Other
As6	1, 2	If association parameters are necessary for association, describe the correct values, e.g.:	Transport selector 0001 Session selector 0001 Presentation selector 00000001 AP Title na AE Qualifier na Other
		Called values:	Transport selector na Session selector na Presentation selector na AP Title na AE Qualifier na Other
As7	1, 2	What is the maximum and minimum MMS PDU size?	Max MMS PDU size 120,000 bytes
			Min MMS PDU size 512 bytes
As8	1, 2	What is the maximum start up time after a power supply interrupt?	180 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
As10	2	How does the server behave when the associate request fails?	N/A
		<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)?	Validity: Y Good, N Invalid, N Reserved, Y Questionable Detail Quality: N Overflow Y OutOfRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Miscellaneous: N Source Y Test N OperatorBlocked
Sr2	1, 2	Which status value (ST) quality bits are supported (can be set by server)?	Validity: Y Good, N Invalid N Reserved, N Questionable Detail Quality: N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Miscellaneous: N Source Y Test N OperatorBlocked
Sr3	-	What is the maximum number of data values in one GetDataValues request?	Deprecated
Sr4	-	What is the maximum number of data values in one SetDataValues request?	Deprecated
Sr5	1	Which Mode values are supported ¹ ?	On Y [On-]Blocked N Test Y Test/Blocked N Off N
		<additional items>	

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.

Note: Quality bits partially implemented:

- Test bit when the unit is set in Test Mode
- OutOfRange for metering

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)?	64
Ds2	1	How many persistent data sets can be created by one or more clients (this number includes predefined datasets)?	N/A, Not Supported
Ds3	1	How many non-persistent data sets can be created by one or more clients?	N/A, Not Supported
	2	What is the maximum number of basic data types in one data set?	192
		<additional items>	

7 PIXIT FOR SUBSTITUTION MODEL

ID	Ed	Description	Value/Clarification
Sb1	1	Are substituted values stored in volatile memory?	N/A, Not Supported
		<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?	N/A, Not Supported
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, Not Supported
Sg3	1	Can multiple clients edit the same setting group?	N/A, Not Supported
Sg4	1	What happens if the association is lost while editing a setting group?	N/A, Not Supported
Sg5	1	Is EditSG value 0 allowed?	N/A, Not Supported
Sg6	2	When ResvTms is not present, how long is an edit setting group locked?	N/A, Not Supported
Sg7	2	Can the active setting group be changed locally? Can a setting in the active setting group be changed locally?	N/A, Not Supported N/A, Not Supported
		<additional items>	

9 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>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																				
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																				
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 (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 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 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?	50000 Bytes																		
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 (timestamp attributes are not supported)																		
Rp10	1, 2	What is the scan cycle for binary events? Is this fixed, configurable?	Event Driven Fixed																		
Rp11	1	Does the device support to pre-assign an 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																		
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?	<table> <tr><td>N/A, ResvTms is not implemented</td><td></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 field></td><td>N/A</td></tr> </table>	N/A, ResvTms is not implemented		AP-Title	N/A	AE-Qualifier	N/A	<other field>	N/A										
N/A, ResvTms is not implemented																					
AP-Title	N/A																				
AE-Qualifier	N/A																				
<other field>	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 0																		
Rp15	2	Is data model db=0 supported?	Y																		

10 PIXIT FOR LOGGING MODEL

ID	Ed	Description	Value/Clarification
Lg1	1, 2	What is the default value of LogEna? (Compare IEC 61850-8-1 §17.3.3.2.1, the default value should be FALSE)	N/A, Not Supported
Lg2	-	What is the format of EntryID?	N/A, Not Supported
Lg3	1, 2	Are there multiple Log Control Blocks that specify the Journaling of the same MMS NamedVariable and TrgOps and the Event Condition? (Compare IEC 61850-8-1 §17.3.3.3.2)	N/A, Not Supported
Lg4	-	Pre-configured LCB attributes that cannot be changed online	N/A, Not Supported
Lg5	1	Which TrgOps are supported for logging? (Note: Ed2 and up requires support for all TrgOps)	dchg N/A qchg N/A dupd N/A integrity N/A
		<additional items>	

11 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
Gp2	1	What is the behaviour when the GOOSE publish configuration is incorrect?	DUT keeps GoEna=F Configuration tool does not allow wrong configuration to be uploaded into device. E.g.: empty dataset
Gp3	1, 2	Published FCD supported common data classes are	SPS, INS, ENS, ACT, ACD, MV, CMV, SAV, WYE, DEL, SEQ, INC, ENC, SPC, DPC, INC, ENC. (Only the elements with FC=ST or MX will be published)
Gp4	1, 2	What is the maximum value of TAL (maxTime)? Is it fixed or configurable?	Configured by SCL or GoCB MaxTime
Gp5	1, 2	What is the fastest retransmission time? Is it fixed or configurable?	MinTime = 5ms 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 (timestamp attributes are not supported)
Gp9	1, 2	Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports?	Y
		<additional items>	

Note:

Retransmission curve after a change:

- sqNum = 0 New change
- sqNum = 1 -> 5ms later with TAL = 1000
- sqNum = 2 -> 10ms later with TAL = 1000
- sqNum = 3 -> 15ms later with TAL = 4000
- sqNum = 4 -> 1000ms later with TAL = Update time* multiplied by 4
- sqNum = 5 -> Update time* later with TAL = Update time* multiplied by 4
- sqNum = 6-> Update time* later with TAL = Update time* multiplied by 4
- sqNum = 7

* Update time (Maximum cycle time) is configured in the ICT.

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 Y gocbRef Y timeAllowedtoLive N datSet Y golD N T N stNum N sqNum Y simulation/test N confRev Y ndsCom Y numDatSetEntries 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)	Message does not arrive after TAL
Gs3	1, 2	What is the behaviour when one or more subscribed GOOSE messages isn't received or syntactically incorrect (missing GOOSE)?	Message will be ignored, but when the next correct message is received, it will proceed as normal
Gs4	1, 2	What is the behaviour when a subscribed GOOSE message is out-of-order?	Message will be processed
Gs5	1, 2	What is the behaviour when a subscribed GOOSE message is duplicated?	Message will be ignored
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 N
Gs8	1, 2	Subscribed FCD supported common data classes are	DUT can receive all kinds of data, digitals (128 SPS and 16 DPS) and analogs (24 of float type and 8 integer type) can be mapped
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	ConfDataSet max="14" maxAttributes="64"
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 last non test value Fixed

Note:

- What is the behaviour when a subscribed GOOSE message with TAL = 0 is received by the subscriber? The message will be ignored. The mechanism applies where the new GOOSE message is not received within a TAL.
- What is the behaviour when a subscribed GOOSE message hasn't the expected data structure? The message will be ignored. The mechanism applies where the new GOOSE message is not received within a TAL.

13 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)	2.5 ms
Gf4	1	Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)	64
		<additional items>	

14 PIXIT FOR CONTROL MODEL

ID	Ed	Description	Value/Clarification
Ct1	-	What control models are supported? (compare ICD file enums for Ed2)	Dons: Y SBOs: Y Does: Y SBOes: Y
Ct2	1, 2	Is the control model fixed, configurable and/or dynamic?	Configurable & Dymic
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, 2	What is the behaviour of the DUT when the check conditions are set? This behaviour is:	DUT ignores the check value and always performs the check (allowed for Ed1 only) or DUT refuses to bypass the check with "Not supported" or "Blocked-by-interlocking" (All Ed) or DUT bypasses the interlocking check (All Ed) Fixed/Configurable/Dynamic
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 N 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 Y Time-limit-over N Abortion-by-trip Y Object-not-selected Edition 1 specific values: N Parameter-change-in-execution 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 Y Locked-by-other-client N Parameter-change-in-execution

ID	Ed	Description	Value/Clarification
Ct10	1, 2	How to force a “test-not-ok” respond with SelectWithValue request	Device in local mode
Ct11	1, 2	How to force a “test-not-ok” respond with Select request	Device in local mode
Ct12	1, 2	How to force a “test-not-ok” respond with Operate request	Direct control with normal security: Sending T=1 SBO control with normal security: Sending T=1 Direct control with enhanced security: Sending T=1 SBO control with enhanced security: Sending T=1
Ct13	1, 2	Which origin categories are supported/ accepted?	N bay-control Y station-control Y remote-control N automatic-bay Y automatic-station Y automatic-remote N maintenance N process
Ct14	1, 2	What happens if the orCat value is not supported or invalid?	Direct control with normal security: Control is rejected (Oper- ObjectAccessDenied) SBO control with normal security: Control is rejected (Oper- ObjectAccessDenied) Direct control with enhanced security: Control is rejected (Oper- ServiceError, ObjectAccessDenied) SBO control with enhanced security: Control is rejected (SBOw- ServiceError, ObjectAccessDenied)
Ct15	1, 2	Does the IED accept a SelectWithValue/Operate with the same control value as the current status value? Is this behaviour configurable:	Direct control with normal security: N SBO control with normal security: N Direct control with enhanced security: N SBO control with enhanced security: N Configurable: N
Ct16	1, 2	Does the IED accept a select/operate on the same control object from 2 different clients at the same time?	Direct control with normal security: N SBO control with normal security: N Direct control with enhanced security: N SBO control with enhanced security: N
Ct17	1	Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)?	SBO control with normal security: N SBO control with enhanced security: N
Ct18	1	Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?	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 (Only for XCBR, CSWI)
Ct21	1, 2	Does the IED send an InformationReport with LastAppError as part of the Operate response- for control with normal security?	SBO control with normal security: N Direct control with enhanced security: N
Ct22	2	How to force a “parameter-change-in- execution”	SBO control with normal security: N/A SBO control with enhanced security: N/A
Ct23	1, 2	How many SBOs/SBOes control objects can be selected at the same time?	SBOs: multiple SBOes: multiple

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
Ct25	1, 2	When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)	Y
Ct26	1, 2	Name an enhanced security point (if any) with a finite operate timeout Specify the timeout (in milliseconds)	Ctrl/XCBR.Pos Does: 30000 (configurable) SBOes: 30000 (configurable)
Ct27	2	Does the IED support control objects with external signals?	DOns: Y SBOs: Y DOes: Y SBOes: Y
Ct28		Deprecated, kept as placeholder	
Ct29	Amd1	Does the IED support XCBR/CSWI.Loc = False and LLNO.CSWI.Loc = True? When Yes, does the IED accept the control when orCat=1 or 4 Local?	Not applicable to ED2.0
Ct30	2	What is the Operate timeout?	Default 30 000ms Configurable and writable
		<additional items>	

15 PIXIT FOR TIME SYNCHRONISATION MODEL

ID	Ed	Description	Value/Clarification
Tm1	1, 2	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?	On one time server: An event is generated On all time servers: An event is generated 60 seconds
Tm3	1, 2	How long does it take to take over the new time from time server?	2 seconds
Tm4	1, 2	When is the time quality bit "ClockFailure" set?	When "Clock not Synchronized" is set
Tm5	1, 2	When is the time quality bit "Clock not Synchronized" set?	15 seconds after the time server(s) ceases to respond
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 Y RX/TX timestamp fields are checked for reasonableness Y SNTP version 3 and/or 4 N other (describe)
Tm9	1, 2	Do the COMTRADE files have local time or UTC time and is this configurable?	Local N
		<additional items>	

16 PIXIT FOR FILE TRANSFER MODEL

ID	Ed	Description	Value/Clarification
Ft1	1	What is the structure of files and directories?	File system with folders
		Where are the COMTRADE files stored?	/COMTRADE
		Are comtrade files zipped and what files are included in each zip file?	N
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	N/A
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?	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?	N/A
		<additional items>	

17 **PIXIT FOR SERVICE TRACKING MODEL**

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



Imagination at work

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