

Protocol Implementation eXtra Information for Testing (PIXIT)
for the IEC 61850 Edition 2 server interface in MVI56E-61850C

Version 1.01 Date 08/04/21

Based Upon UCAlug Server PIXIT Template version 20

PIXIT for Server

Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in MVI56E-61850C with firmware version 1.01.022.

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.

PIXIT for Documentation

| ID | Ed | Description | Value / Clarification |
|-----|----|---|-------------------------------|
| Do1 | 2 | How to expose required firmware versions not present in the datamodel | Viewable on the DUT’s webpage |
| | | <additional items> | |

PIXIT for Association model

| ID | Ed | Description | Value / Clarification |
|-----|-----|---|-----------------------|
| As1 | 1 | Maximum number of clients that can set-up an association simultaneously | Not supported |
| As2 | 1,2 | TCP_KEEPALIVE value. The recommended range is 1..20s | NS |
| As3 | 1,2 | Lost connection detection time | NS |
| As4 | - | Authentication is not supported yet | |
| As5 | 1,2 | What association parameters are necessary for successful association: | NS |
| As6 | 1,2 | If association parameters are necessary for association, describe the correct Called values: e.g. Calling parameters: e.g. | NS |
| As7 | 1,2 | What is the maximum and minimum MMS PDU size | NS |
| As8 | 1,2 | What is the maximum start up time after a power supply interrupt | 60 seconds |

| ID | Ed | Description | Value / Clarification |
|-----|-----|---|-----------------------|
| 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 |
| | | <additional items> | |

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) | None; local server does not support analogue values |
| Sr2 | 1,2 | Which status value (ST) quality bits are supported (can be set by server) | Validity: Y Good, Y Invalid, N Reserved, Y Questionable Detail Quality N BadReference Y Oscillatory N Failure Y OldData N Inconsistent N Inaccurate Miscellaneous: N Source N 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 | Deprecated |
| Sr5 | 1 | Which Mode values are supported ¹ | NS |
| | | <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

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) | Local server: 120 |
| Ds2 | 1 | How many persistent data sets can be created by one or more clients (this number includes predefined datasets) | Local server configures max 8. Remote client cannot create. |
| Ds3 | 1 | How many non-persistent data sets can be created by one or more clients | 0 |
| | | <additional items> | |

PIXIT for Substitution model

| ID | Ed | Description | Value / Clarification |
|-----|----|--|-----------------------|
| Sb1 | 1 | Are substituted values stored in volatile memory | Not supported |
| | | <additional items> | |

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 | 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) | |
| Sg3 | 1 | Can multiple clients edit the same setting group | |
| Sg4 | 1 | What happens if the association is lost while editing a setting group | |
| Sg5 | 1 | Is EditSG value 0 allowed | |
| Sg6 | 2 | When ResvTms is not present how long is an edit setting group locked | |
| | | <additional items> | |

PIXIT for Reporting model

| ID | Ed | Description | Value / Clarification |
|------|-----|---|---|
| Rp1 | 1 | The supported trigger conditions are (compare PICS) | Reporting not supported by local server |
| Rp2 | 1 | The supported optional fields are | |
| 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) | |
| 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) | |
| Rp5 | 1 | Multi client URCB approach (compare IEC 61850-7-2:2003 §14.2.1) | |
| Rp6 | - | What is the format of EntryID | |
| Rp7 | 1,2 | What is the buffer size for each BRCB or how many reports can be buffered | |
| Rp8 | - | Pre-configured RCB attributes that are dynamic, compare SCL report settings | |
| Rp9 | 1 | May the reported data set contain: - structured data objects - data attributes | |
| Rp10 | 1,2 | What is the scan cycle for binary events Is this fixed, configurable | |
| Rp11 | 1 | Does the device support to pre-assign a RCB to a specific client in the SCL | |
| Rp12 | 2 | After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart | |
| 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? | |
| Rp14 | 1,2 | When BRCB.ResvTms is exposed, what is the default value for BRCB.ResvTms if client does not write (must be > 0) or When BRCB.ResvTms is not exposed, what is the internal reservation time (must be >= 0) | |

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| ID | Ed | Description | Value / Clarification |
|------|----|------------------------------|-----------------------|
| Rp15 | 2 | Is data model db=0 supported | NS |
| | | <additional items> | |

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) | Logging not supported |
| Lg2 | - | What is the format of EntryID | |
| 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) | |
| Lg4 | - | Pre-configured LCB attributes that cannot be changed online | |
| Lg5 | 1 | Which TrgOps are supported for logging (note Ed2 and up requires support for all TrgOps) | |
| | | <additional items> | |

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 | NdsCom=T DUT keeps GoEna=F |
| Gp3 | 1,2 | Published FCD supported common data classes are | SPS, INS, no others FC="ST" only FCDA is either full DO {"stVal","q","t"} or standalone "stVal"; nothing else Arrays are not supported |
| Gp4 | 1,2 | What is the maximum value of TAL (maxTime) Is it fixed or configurable | Configured by (internal) SCL; see CID accompanying MICS |
| Gp5 | 1,2 | What is the fastest retransmission time | 1 ms |
| 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 N (unless member of a FCD) |
| Gp9 | 1,2 | Does Server or ICT refuse GOOSE payload dataset length greater than SCSM supports? | Y |
| | | <additional items> | |

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 : must match</p> <p>N APPID</p> <p>Y gocbRef : must match</p> <p>Y timeAllowedtoLive : fail => timeout; a received TAL=0 is treated as 1 second</p> <p>Y datSet : must match</p> <p>Y gold : must match</p> <p>N T (UTC time)</p> <p>Y stNum : change => new data; sequencing not verified</p> <p>Y sqNum : sequencing verified if same stNum; auto-resynced; data unchanged so no record of this; if stNum changes, sqNum not verified.</p> <p>Y simulation / test : T message discarded</p> <p>Y confRev : must match</p> <p>Y ndsCom : T message discarded</p> <p>Y numDatSetEntries : must match</p> <p>N out-of-order dataset members : Dataset FCD(A)s are expected to match between server and SCL. Discrepancies usually will result in data misinterpretation and consequent unexpected values in DUT's database. FCDs with differing structures may raise decoding errors, which may abort decoding of the current FCD and may also abort decoding of the remainder of the packet.</p> |

| ID | Ed | Description | Value / Clarification |
|------|-----|---|--|
| 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 by TAL, message is discarded |
| Gs3 | 1,2 | What is the behaviour when one or more subscribed GOOSE messages is not received or syntactically incorrect (missing GOOSE) | Syntactically incorrect message discarded. No notification of missing messages. |
| Gs4 | 1,2 | What is the behaviour when a subscribed GOOSE message is out-of-order | stNum sequencing not detected (detect change only); sqNum sequencing verified, auto-resynced |
| Gs5 | 1,2 | What is the behaviour when a subscribed GOOSE message is duplicated | duplicate stNum ignored (no new data); duplicate sqNum detected, auto-resynced |
| 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 | Refer to the client MICS for the supported CDCs. Datatype INT128 interpreted as INT64. Arrays are not supported. |
| Gs9 | 1 | Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode | N Test/Sim mode not supported; received Test/Sim messages discarded |
| Gs10 | 1,2 | Max number of dataset members | 120 |
| Gs11 | 1 | Is Fixed-length encoded GOOSE supported | Note: Ed2 Am1 requires support |
| Gs12 | 2 | Is IEC 62351-6 security supported | N |
| | | <additional items> | |

PIXIT for GOOSE performance

| ID | Ed | Description | Value / Clarification |
|-----|-----|-----------------------------------|-----------------------|
| Gf1 | 1,2 | Performance class | P3 = 20 ms |
| Gf2 | 1,2 | GOOSE ping-pong processing method | Scan cycle based |

| ID | Ed | Description | Value / Clarification | |
|-----|-----|---|---|-------|
| Gf3 | 1,2 | Application logic scan cycle (ms) | Max. | 20 Ms |
| | | | Min. | 1 Ms |
| Gf4 | 1 | Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes) | Subscribe: unlimited. Publish: limited by max FCDA count (120) and structured FCDA standard contents ("stVal", "q", "t") =>120*3=360 | |
| | | <additional items> | | |

PIXIT for Control model

| ID | Ed | Description | Value / Clarification |
|-----|-----|--|---|
| Ct1 | 1 | What control models are supported (compare PIGSICD file enums for Ed2) | Controls are not supported |
| Ct2 | 1,2 | Is the control model fixed, configurable and/or dynamic | |
| 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) | |
| 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 |

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| ID | Ed | Description | Value / Clarification |
|------|-----|--|-----------------------|
| Ct8 | 1 | <p>What is the behaviour of the DUT when the check conditions are set</p> <p>Is this behaviour fixed, configurable, online changeable</p> | |
| Ct9 | 1,2 | Which additional cause diagnosis are supported | |
| Ct10 | 1,2 | How to force a “test-not-ok” respond with SelectWithValue request | |
| Ct11 | 1,2 | How to force a “test-not-ok” respond with Select request | |
| Ct12 | 1,2 | How to force a “test-not-ok” respond with Operate request | |
| Ct13 | 1,2 | Which origin categories are supported / accepted | |
| Ct14 | 1,2 | What happens if the orCat value is not supported or invalid | |
| 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> | |
| Ct16 | 1 | Does the IED accept a select/operate on the same control object from 2 different clients at the same time | |
| Ct17 | 1 | Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334) | |
| 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 | |

-12- PIXIT Template for Server Ed1/Ed2 revision 20

| ID | Ed | Description | Value / Clarification |
|------|-----|--|-----------------------|
| Ct21 | 1,2 | Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security | |
| Ct22 | 2 | How to force a “parameter-change-in-execution” | |
| Ct23 | 1,2 | How many SBOs/SBOes control objects can be selected at the same time? | |
| 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? | |
| Ct25 | 1,2 | When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00) | |
| Ct26 | 1,2 | Name an enhanced security control point (if any) with a finite operate timeout Specify the operate timeout (in milliseconds) | |
| Ct27 | 2 | Does the IED support control objects with external signals? | |
| Ct28 | | Deprecated, kept as placeholder | |
| | | <additional items> | |

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 all time server(s) cease to respond What is the time server lost detection time | Assert CNS after lost detection time 20 ms |
| Tm3 | 1,2 | How long does it take to take over the new time from time server | 1 second or less |
| Tm4 | 1,2 | When is the time quality bit "ClockFailure" set | Set when seconds-of-epoch of time source is zero. |
| Tm5 | 1 | When is the time quality bit "Clock not Synchronized" set | When connection to all time servers is lost (see PIXIT-Tm2) or other (specify) Note: For Ed2 and up, CNS is set according to PIXIT Tm2 |
| 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 | N – timestamp always UTC |
| Tm8 | 1,2 | Which attributes of the SNTP response packet are validated | Y/N Leap indicator not equal to 3 Y/N Mode is equal to SERVER Y/N OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp Y/N RX/TX timestamp fields are checked for reasonableness Y/N SNTP version 3 and/or 4 Y/N other (describe) |
| Tm9 | 1,2 | Do the COMTRADE files have local time or UTC time and is this configurable | COMTRADE files not implemented |
| | | <additional items> | |

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 | File transfer not supported. |
| Ft2 | 1,2 | Directory names are separated from the file name by | |
| Ft3 | 1 | The maximum file name size including path (recommended 64 chars) | |
| Ft4 | 1,2 | Are directory/file name case sensitive | |
| Ft5 | 1,2 | Maximum file size for SetFile | |
| Ft6 | 1 | Is the requested file path included in the MMS fileDirectory respond file name | |
| Ft7 | 1 | Is the wild card supported in the MMS fileDirectory request | |
| Ft8 | 1,2 | Is it allowed that 2 clients get a file at the same time | |
| Ft9 | 1,2 | Which files can be deleted | |
| | | <additional items> | |

PIXIT for Service tracking model

| ID | Ed | Description | Value / Clarification |
|-----|----|--|--------------------------------|
| Tr1 | 2 | Which ACSI services are tracked by LTRK.GenTrk | Service tracking not supported |