

IEC 61850 – PIXIT

High **PROTEC** | PROTECTION TECHNOLOGY
MADE SIMPLE

MCA4 |

Protocol Implementation Extra Information for Testing (PIXIT)

UCA International Users Group Testing Sub Committee

Version: 3.7

Original document

English

Original reference manual

SEG Electronics GmbH

Krefelder Weg 47 • D-47906 Kempen (Germany)

Postfach 10 07 55 (P.O.Box) • D-47884 Kempen (Germany)

Telephone: +49 (0) 21 52 145 1

Internet: www.SEGelectronics.de

Sales

Telephone: +49 (0) 21 52 145 331

Fax: +49 (0) 21 52 145 354

E-mail: SalesPGD_EMEA@SEGelectronics.de

Service

Telephone: +49 (0) 21 52 145 614

Fax: +49 (0) 21 52 145 354

E-mail: industrial.support@SEGelectronics.de

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1 Contents of this document

This document is applicable for MCA4 Version 3.7.

Each chapter specifies the PIXIT for each applicable ACSI service model as structured in IEC 61850-10.

2 PIXIT for Association model

| Description | Value / Clarification |
|--|---|
| Maximum number of clients that can set-up an association simultaneously | 4 |
| TCP_KEEPAALIVE values | Keep Alive Time: configurable between 1 - 7200s Keep Alive Interval: configurable between 1 - 60s Keep Alive Retry: fix 3 |
| Lost connection detection time | A lost connection is detected after Keep Alive Time + (Keep Alive Retry + 1) * Keep Alive Interval |
| 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 |

3 PIXIT for Server model

| Description | Value / Clarification |
|--|--|
| Which analog value (MX) quality bits are supported (can be set by server)? | Validity: Y Good, N Invalid, N Reserved, N Questionable N Overflow N OutofRange N BadReference N Oscillatory N Failure N OldData N Inconsistent N Inaccurate Source: Y Process N Substituted N Test N OperatorBlocked |
| Which status value (ST) quality bits are supported (can be set by server)? | Validity: Y Good Y Invalid N Reserved Y Questionable N BadReference N Oscillatory Y Failure N OldData Y Inconsistent N Inaccurate Source: Y Process N Substituted N Test N OperatorBlocked |
| What is the maximum number of data values in one GetDataValues request? | Not restricted; MMS PDU is the limit. |

| Description | Value / Clarification |
|---|---|
| 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. |

4 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 |

5 PIXIT for Reporting model

| Description | Value / Clarification |
|---|--|
| The supported trigger conditions are (compare PICS) | integrity: Y data change: Y quality change: Y data update: N general interrogation: Y |
| 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 |
| 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: <ul style="list-style-type: none"> • structured data objects? • data attributes? • timestamp data attributes? | <ul style="list-style-type: none"> • Y • Y • Y |
| <ul style="list-style-type: none"> • What is the scan cycle for binary events? • Is this fixed, configurable? | <ul style="list-style-type: none"> • There is no scan cycle for binary events. Reporting works event driven. • Fixed |

6 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> <ul style="list-style-type: none"> • (1) Messages will be ignored. • (2) Status change will be ignored by the DUT and the quality is set as INVALID • (3) Status change will be accepted by the DUT and the quality is set as QUESTIONABLE • (4) Status change will be accepted by the DUT and the quality is set as GOOD | <p>Reaction to received incorrect or missing GOOSE message:</p> <ul style="list-style-type: none"> • wrong destination MAC address (1) • Ethertype != 0x88B8 (1) • wrong gocbRef (1) • timeAllowedtoLive exceeded: <ul style="list-style-type: none"> ◦ by factor 1: (3) ◦ by factor 2: (2) • wrong datSet (2) • wrong goID (2) • unexpected stNum (3) • unexpected sqNum (3) • test flag set (1) • wrong confRev (2) • ndsCom flag set (2) • numDatSetEntries != data entries in received message (1) • unexpected datatype in received message (2) • numDatSetEntries < expected (2) • numDatSetEntries > expected (4) |
| <p>Can the test flag in the published GOOSE be turned on / off ?</p> | N |
| <p>What is the behavior when the GOOSE publish configuration is incorrect?</p> | <p>Wrong GOOSE configuration in SCD-File is not possible, because it is checked when downloading it to the device.</p> <p>Changing the GOOSE configuration during runtime is not supported.</p> |
| <p>When is a subscribed GOOSE marked as lost?</p> | message does not arrive prior to TAL |

| Description | Value / Clarification | | | | | | | | | | | | | | | | | | | | | |
|--|--|----------|---------|-----|---|---------|---------|---|---------|---------|---|---------|----------|---|----------|----------|---|----------|----------|-----------|--------|--------|
| (TAL = time allowed to live value from the last received GOOSE message) | | | | | | | | | | | | | | | | | | | | | | |
| 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: <ul style="list-style-type: none"> structured data objects? data attributes? timestamp data attributes? | Subscribed / Published <ul style="list-style-type: none"> 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? | Fixed scheme retrans: retrans time before next message | | | | | | | | | | | | | | | | | | | | | |
| | <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 |
| 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 | | | | | | | | | | | | | | | | | | | | |
| Can the Goose publish be turned on / off by using SetGoCBValues(GoEna)? | N | | | | | | | | | | | | | | | | | | | | | |

TAL = Time Allowed to Live

7 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. |

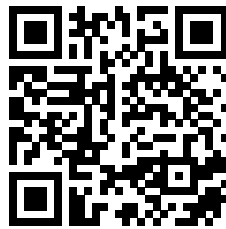
| Description | Value / Clarification |
|---|--|
| How to force a “test-not-ok” respond with Select request? | n.a. |
| How to force a “test-not-ok” respond with Operate request? | DOns: n.a. SBOs: n.a. DOes:n.a. SBOes: Send an Operate with actual value to an unselected SBOes object. |
| Which origin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

8 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) |

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SEG Electronics GmbH
Krefelder Weg 47 • D-47906 Kempen (Germany)
Postfach 10 07 55 (P.O.Box) • D-47884 Kempen (Germany)
Telephone: +49 (0) 21 52 145 1

Internet: www.SEGelectronics.de

Sales
Telephone: +49 (0) 21 52 145 331
Fax: +49 (0) 21 52 145 354

Service
Telephone: +49 (0) 21 52 145 614
Fax: +49 (0) 21 52 145 354

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