

High **PROTEC**

**MCA4**

**IEC 61850 (Edition 1) – PIXIT**

**Protocol Implementation Extra Information for Testing (PIXIT)**

**UCA International Users Group Testing Sub Committee**

Build 61991

Revision A

Version: 3.10

Date: 2024-03-16

Original document English

© 2024 SEG Electronics GmbH. All rights reserved.

**SEG Electronics GmbH**

Krefelder Weg 47 • D-47906 Kempen (Germany)

Telephone: +49 (0) 21 52 145 0

Internet: [www.SEGelectronics.de](http://www.SEGelectronics.de)

Sales

Telephone: +49 (0) 21 52 145 331

Fax: +49 (0) 21 52 145 354

E-mail: [sales@SEGelectronics.de](mailto:sales@SEGelectronics.de)

Service

Telephone: +49 (0) 21 52 145 600

Fax: +49 (0) 21 52 145 354

E-mail: [support@SEGelectronics.de](mailto:support@SEGelectronics.de)

SEG Electronics GmbH reserves the right to update any portion of this publication at any time.

Information provided by SEG Electronics GmbH is believed to be correct and reliable.

However, no responsibility is assumed by SEG Electronics GmbH unless otherwise expressly undertaken.

Complete address / phone / fax / email information for all locations is available on our website.

# Table of Contents

|          |  |           |
|----------|--|-----------|
| <b>1</b> | <b>Contents of this document</b> .....                     | <b>4</b>  |
| <b>2</b> | <b>PIXIT for Association model</b> .....                   | <b>5</b>  |
| <b>3</b> | <b>PIXIT for Server model</b> .....                        | <b>6</b>  |
| <b>4</b> | <b>PIXIT for Data set model</b> .....                      | <b>8</b>  |
| <b>5</b> | <b>PIXIT for Reporting model</b> .....                     | <b>9</b>  |
| <b>6</b> | <b>PIXIT for Generic substation events model</b> .....     | <b>10</b> |
| <b>7</b> | <b>PIXIT for GOOSE performance</b> .....                   | <b>12</b> |
| <b>8</b> | <b>PIXIT for Control model</b> .....                       | <b>13</b> |
| <b>9</b> | <b>PIXIT for Time and time synchronisation model</b> ..... | <b>15</b> |

# 1 Contents of this document

This document is applicable for MCA4 Version 3.10.

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_KEEPAIVE values  | Keep Alive Time: configurable between 1 - 7200s<br>Keep Alive Interval: configurable between 1 - 60s<br>Keep Alive Retry: fix 3 |
| Lost connection detection time   | A lost connection is detected after<br>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<br>Session selector: Y<br>Presentation selector: Y<br>AP Title: N<br>AE Qualifier: N                      |
| If association parameters are necessary for association, describe the correct values e. g. | Transport selector: 0001<br>Session selector: 0001<br>Presentation selector: 00000001<br>AP Title: any<br>AE Qualifier: any     |
| What is the maximum and minimum MMS PDU size?  | Max MMS PDU size: 64kB<br>Min MMS PDU size: 4000  |
| What is the maximum start-up time after a power supply interrupt?                          | max 300 seconds until HMI is operable<br>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:<br>Y Good,<br>N Invalid,<br>N Reserved,<br>N Questionable<br>N Overflow<br>N OutofRange<br>N BadReference<br>N Oscillatory<br>N Failure<br>N OldData<br>N Inconsistent<br>N Inaccurate<br><br>Source:<br>Y Process<br>N Substituted<br>N Test<br>N OperatorBlocked |
| Which status value (ST) quality bits are supported (can be set by server)? | Validity:<br>Y Good<br>Y Invalid<br>N Reserved<br>Y Questionable<br>N BadReference<br>N Oscillatory<br>Y Failure<br>N OldData<br>Y Inconsistent<br>N Inaccurate<br><br>Source:<br>Y Process<br>N Substituted<br>N Test<br>N OperatorBlocked                                  |
| What is the maximum number of data values in one GetDataValues request?    | Not restricted; MMS PDU is the limit.  |

| <b>Description</b>  | <b>Value / Clarification</b>  |
|---|---|
| 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.<br><br>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?               | 35<br><br>(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?           | 35  |



## 5 PIXIT for Reporting model

| Description   | Value / Clarification  |
|---|--|
| The supported trigger conditions are<br>(compare PICS)  | integrity: Y<br>data change: Y<br>quality change: Y<br>data update: N<br>general interrogation: Y  |
| The supported optional fields are   | sequence-number: Y<br>report-time-stamp: Y<br>reason-for-inclusion: Y<br>data-set-name: Y<br>data-reference: Y<br>buffer-overflow: Y<br>entryID: Y<br>conf-rev: Y<br>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<br>(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<br>(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"> <li>structured data objects?</li> <li>data attributes?</li> <li>timestamp data attributes?</li> </ul> | <ul style="list-style-type: none"> <li>Y</li> <li>Y</li> <li>Y</li> </ul>  |
| <ul style="list-style-type: none"> <li>What is the scan cycle for binary events?</li> <li>Is this fixed, configurable?</li> </ul>   | <ul style="list-style-type: none"> <li>There is no scan cycle for binary events. Reporting works event driven.</li> <li>Fixed</li> </ul>   |

## 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"> <li>• <b>(1)</b> Messages will be ignored.</li> <li>• <b>(2)</b> Status change will be ignored by the DUT and the quality is set as INVALID</li> <li>• <b>(3)</b> Status change will be accepted by the DUT and the quality is set as QUESTIONABLE</li> <li>• <b>(4)</b> Status change will be accepted by the DUT and the quality is set as GOOD</li> </ul> | <p>Reaction to received incorrect or missing GOOSE message:</p> <ul style="list-style-type: none"> <li>• wrong destination MAC address (1)</li> <li>• Ethertype != 0x88B8 (1)</li> <li>• wrong gocbRef (1)</li> <li>• timeAllowedtoLive exceeded: <ul style="list-style-type: none"> <li>◦ by factor 1: (3)</li> <li>◦ by factor 2: (2)</li> </ul> </li> <li>• wrong datSet (2)</li> <li>• wrong goID (2)</li> <li>• unexpected stNum (3)</li> <li>• unexpected sqNum (3)</li> <li>• test flag set (1)</li> <li>• wrong confRev (2)</li> <li>• ndsCom flag set (2)</li> <li>• numDatSetEntries != data entries in received message (1)</li> <li>• unexpected datatype in received message (2)</li> <li>• numDatSetEntries &lt; expected (2)</li> <li>• numDatSetEntries &gt; expected (4)</li> </ul> |
| <p>Can the test flag in the published GOOSE be turned on / off ?</p>   | <p>N</p>   |
| <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>  | <p>message does not arrive prior to TAL</p>  |

| 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<br>Y without the VLAN tag  |          |         |     |   |         |         |   |         |         |   |         |          |   |          |          |   |          |          |           |        |        |
| May the GOOSE data set contain: <ul style="list-style-type: none"> <li>structured data objects?</li> <li>data attributes?</li> <li>timestamp data attributes?</li> </ul> | Subscribed / Published <ul style="list-style-type: none"> <li>N / N</li> <li>Y / Y</li> <li>Y / Y</li> </ul>   |          |         |     |   |         |         |   |         |         |   |         |          |   |          |          |   |          |          |           |        |        |
| What is the slow retransmission time?<br>Is it fixed or configurable?  | 33 sec with TAL = 66 sec<br>Fixed  |          |         |     |   |         |         |   |         |         |   |         |          |   |          |          |   |          |          |           |        |        |
| What is the fast retransmission scheme?<br>Is it fixed or configurable?  | Fixed scheme<br>retrans: retrans time <b>before next</b> 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 GOOSE performance

| Description  | Value / Clarification             |
|--|-----------------------------------|
| Performance class:   | P1 = 3 ms                         |
| GOOSE ping-pong processing method:   | Event driven based                |
| Application logic scan cycle (ms):   | Min.: 2.25 ms<br>Max.: typ. 10 ms |
| Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes): | 60                                |

## 8 PIXIT for Control model

| Description   | Value / Clarification   |
|---|---|
| What control modes are supported<br>(compare PICS)?   | N status-only<br>Y direct-with-normal-security<br>N sbo-with-normal-security<br>N direct-with-enhanced-security<br>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?   | Y   |
| What is the behavior of the DUT when the check conditions are set<br><br>Is this behavior fixed, configurable, online changeable? | DUT ignores the check value transmitted by IEC61850 and performs the check depending on the device settings.<br><br>Behavior is fixed   |
| What additional cause diagnosis are supported?  | Y Blocked-by-switching-hierarchy<br>Y Select-failed<br>N Invalid-position<br>Y Position-reached<br>Y Parameter-change-in-execution<br>N Step-limit<br>N Blocked-by-Mode<br>Y Blocked-by-process<br>Y Blocked-by-interlocking<br>Y Blocked-by-synchrocheck<br>Y Command-already-in-execution<br>N Blocked-by-health<br>Y 1-of-n-control<br>N Abortion-by-cancel<br>Y Time-limit-over<br>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.<br>SBOs: n.a.<br>DOes:n.a.<br>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”<br>SBOs: n.a.<br>DOes: n.a.<br>SBOes: Error message “not supported”          |
| Does the IED accept an selectwithvalue/ operate with the same ctlVal as the current status value?                           | DOns: Y<br>SBOs: n.a.<br>DOes: n.a.<br>SBOes: N<br>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<br>SBOs: n.a.<br>DOes: n.a.<br>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.<br>SBOes: N   |
| Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step?                              | SelectWithValue or Operate<br>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?  | SBOes: Y<br>DOns: N  |
| Is it possible to select more than one switch at the same time?   | N<br>The DUT allows to select only one switch at a time  |

## 9 PIXIT for Time and time synchronisation model

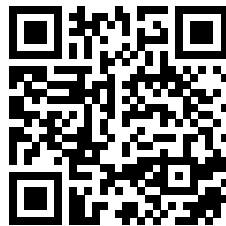
| Description  | Value / Clarification   |
|--|---|
| What quality bits are supported?   | N LeapSecondsKnown<br>N ClockFailure<br>Y ClockNotSynchronized  |
| Describe the behavior when the time synchronization signal/messages are lost | The quality bit "ClockNotSynchronized" is set to TRUE after a fixed 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<br><br>(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?<br>Y Mode is equal to SERVER<br><br>N OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp<br><br>N RX/TX timestamp fields are checked for reasonableness<br><br>Y SNTP version (3 and 4 accepted) |

High **PROTEC**

**MCA4**

IEC 61850 (Edition 1) — PIXIT

[docs.SEGelectronics.de/HighPROTEC](https://docs.SEGelectronics.de/HighPROTEC)



SEG Electronics GmbH reserves the right to update any portion of this publication at any time.  
Information provided by SEG Electronics GmbH is believed to be correct and reliable.  
However, SEG Electronics GmbH assumes no responsibility  
unless otherwise expressly undertaken.



SEG Electronics GmbH  
Krefelder Weg 47 • D-47906 Kempen (Germany)  
Telephone: +49 (0) 21 52 145 0

Internet: [www.SEGelectronics.de](http://www.SEGelectronics.de)

Sales  
Telephone: +49 (0) 21 52 145 331  
Fax: +49 (0) 21 52 145 354  
E-mail: [sales@SEGelectronics.de](mailto:sales@SEGelectronics.de)

Service  
Telephone: +49 (0) 21 52 145 600  
Fax: +49 (0) 21 52 145 354  
E-mail: [support@SEGelectronics.de](mailto:support@SEGelectronics.de)