Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 Edition 2 interface in ABB 670 Series version 2.2.2

Based on PIXIT template from UCA International Users Group Testing Sub Committee

Edition 1 and Edition 2

Test Procedures Change List (TPCL) version 1.2.4

Document Review Summary:

<table>
<thead>
<tr>
<th>Reviewer Role</th>
<th>Reviewer Name</th>
<th>Organization</th>
<th>Review Date</th>
<th>Review Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>Johan Sälj</td>
<td>TPTF</td>
<td>2018-06-08</td>
<td>✔ No remarks</td>
</tr>
</tbody>
</table>

To be revised
1. Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in ABB 670 Series (REB670, REC670, RED670, REG670, REL670, RER670, RES670 and RET670), all of version 2.2.2 and when configured in Edition 2 mode.

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.

2. PIXIT for Association model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>As1</td>
<td>1</td>
<td>Maximum number of clients that can set-up an association simultaneously</td>
<td>8</td>
</tr>
<tr>
<td>As2</td>
<td>1,2</td>
<td>TCP_KEEPALIVE value. The recommended range is 1..20s</td>
<td>5 seconds</td>
</tr>
<tr>
<td>As3</td>
<td>1,2</td>
<td>Lost connection detection time</td>
<td>15 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> TCP_KEEPIDLE = 10 s</td>
<td>TCP_KEEPCNT = 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TCP_KEEPINIT = 10 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TCP_KEEPINTVL = 5 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 s after association start to begin sending keepalive, and 15 s (3 * 5 s) to detect lost connection.</td>
</tr>
<tr>
<td>As4</td>
<td></td>
<td>Authentication is not supported yet</td>
<td></td>
</tr>
<tr>
<td>As5</td>
<td>1,2</td>
<td>What association parameters are necessary for successful association</td>
<td>Transport selector Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Session selector Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Presentation selector Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AP Title N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AE Qualifier N</td>
</tr>
<tr>
<td>As6</td>
<td>1,2</td>
<td>If association parameters are necessary for association, describe the correct values e.g.</td>
<td>Transport selector 0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Session selector 0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Presentation selector 00000001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AP Title n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AE Qualifier n/a</td>
</tr>
<tr>
<td>As7</td>
<td>1,2</td>
<td>What is the maximum and minimum MMS PDU size</td>
<td>Max MMS PDU size 32000 bytes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min MMS PDU size 1024 bytes</td>
</tr>
<tr>
<td>As8</td>
<td>1,2</td>
<td>What is the maximum start up time after a power supply interrupt</td>
<td>180 seconds</td>
</tr>
<tr>
<td>As9</td>
<td>1,2</td>
<td>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)</td>
<td>N</td>
</tr>
</tbody>
</table>
## 3. PIXIT for Server model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr1</td>
<td>1,2</td>
<td>Which analogue value (MX) quality bits are supported (can be set by server)</td>
<td>Validity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Good,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Invalid,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Reserved,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Questionable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Overflow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y OutofRange</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N BadReference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Oscillatory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>YOldData</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Inconsistent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Inaccurate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Source:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Process</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Substituted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y OperatorBlocked</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>See Remark 1.</td>
</tr>
<tr>
<td>Sr2</td>
<td>1,2</td>
<td>Which status value (ST) quality bits are supported (can be set by server)</td>
<td>Validity:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Good,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Invalid,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Reserved,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Questionable</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N BadReference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Oscillatory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>YOldData</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Inconsistent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N Inaccurate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Source:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Process</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Substituted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y Test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y OperatorBlocked</td>
</tr>
</tbody>
</table>
### 4. PIXIT for Data set model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ds1</td>
<td>1</td>
<td>What is the maximum number of data elements in one data set (compare ICD setting)</td>
<td>maxAttributes = 330 maximum FCDAs = 150 -&gt; whatever limit is reached first.</td>
</tr>
<tr>
<td>Ds2</td>
<td>1</td>
<td>How many persistent data sets can be created by one or more clients (this number includes predefined datasets)</td>
<td>No online creation</td>
</tr>
<tr>
<td>Ds3</td>
<td>1</td>
<td>How many non-persistent data sets can be created by one or more clients</td>
<td>No online creation</td>
</tr>
</tbody>
</table>

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.
### 5. PIXIT for Substitution model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sb1</td>
<td>1</td>
<td>Are substituted values stored in volatile memory</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;additional items&gt;</td>
<td></td>
</tr>
</tbody>
</table>

### 6. PIXIT for Setting group control model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sg1</td>
<td>1</td>
<td>What is the number of supported setting groups for each logical device</td>
<td>Maximum 6, default value = 1&lt;br&gt;The amount of setting groups is set in the configuration.&lt;br&gt;There is only one setting group control block, it is defined in the Root LD.</td>
</tr>
<tr>
<td>Sg2</td>
<td>1,2</td>
<td>What is the effect of when and how the non-volatile storage is updated</td>
<td>The settings are directly stored in volatile memory, the non-volatile storage is updated by a background process. Normally within a minute after ConfirmEditSGValues.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(compare IEC 61850-8-1 §16.2.4)</td>
<td></td>
</tr>
<tr>
<td>Sg3</td>
<td>1</td>
<td>Can multiple clients edit the same setting group</td>
<td>N</td>
</tr>
<tr>
<td>Sg4</td>
<td>1</td>
<td>What happens if the association is lost while editing a setting group</td>
<td>The SE values changes are lost, the EditSG is reset to 0</td>
</tr>
<tr>
<td>Sg5</td>
<td>1</td>
<td>Is EditSG value 0 allowed</td>
<td>Y</td>
</tr>
<tr>
<td>Sg6</td>
<td>2</td>
<td>When ResvTms is not present how long is an edit setting group locked</td>
<td>60 seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;additional items&gt;</td>
<td></td>
</tr>
</tbody>
</table>
### 7. PIXIT for Reporting model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rp1</td>
<td>1</td>
<td>The supported trigger conditions are (compare PICS)</td>
<td>integrity Y, data change Y, quality change Y, data update Y, general interrogation Y</td>
</tr>
<tr>
<td>Rp3</td>
<td>1,2</td>
<td>Can the server send segmented reports (when not supported, it is allowed to refuse an association with a PDU smaller than the supported minimum PDU size)</td>
<td>Y</td>
</tr>
<tr>
<td>Rp4</td>
<td>1,2</td>
<td>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)</td>
<td>Send report immediately</td>
</tr>
<tr>
<td>Rp5</td>
<td>1</td>
<td>Multi client URCB approach (compare IEC 61850-7-2:2003 $14.2.2.9)</td>
<td>Each URCB is visible to one client only, independent of indexed or non-indexed URCB</td>
</tr>
<tr>
<td>Rp6</td>
<td></td>
<td>What is the format of EntryID</td>
<td>Deprecated</td>
</tr>
<tr>
<td>Rp7</td>
<td>1,2</td>
<td>What is the buffer size for each BRCB or how many reports can be buffered</td>
<td>50000 bytes for each used BRCB (max. 100 BRCB instances)</td>
</tr>
<tr>
<td>Rp8</td>
<td></td>
<td>Pre-configured RCB attributes that are dynamic, compare SCL report settings</td>
<td>Deprecated</td>
</tr>
<tr>
<td>Rp9</td>
<td>1</td>
<td>May the reported data set contain:</td>
<td>Y, Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- structured data objects</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- data attributes</td>
<td></td>
</tr>
<tr>
<td>Rp10</td>
<td>1,2</td>
<td>What is the scan cycle for binary events</td>
<td>3 ms, Fixed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is this fixed, configurable</td>
<td></td>
</tr>
<tr>
<td>Rp11</td>
<td>1</td>
<td>Does the device support to pre-assign a RCB to a specific client in the SCL</td>
<td>Y (*)</td>
</tr>
</tbody>
</table>
### ID Rp12 Ed 2
<table>
<thead>
<tr>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>After restart of the server is the value of ConfRev restored from the original configuration or retained prior to restart</td>
<td>Restored from original configuration</td>
</tr>
</tbody>
</table>

### ID Rp13 Ed 1,2
<table>
<thead>
<tr>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the server accepts any client to configure / enable a BRCB with ResvTms=-1?</td>
<td>N (ResvTms not supported)</td>
</tr>
<tr>
<td>What fields are used to do the identification?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AP-Title N/A</td>
</tr>
<tr>
<td></td>
<td>AE-Qualifier N/A</td>
</tr>
<tr>
<td></td>
<td>&lt;other field&gt; N/A</td>
</tr>
</tbody>
</table>

(*) In case of unbuffered reporting the Resv attribute will be set to ‘true’ for pre-assigned URCBs. However the device will not block other clients from connecting the RCBs. Client has to utilise the pre-assign information from SCL to enable the correct RCB instance.

### 8. PIXIT for Logging model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lg1</td>
<td>1,2</td>
<td>What is the default value of LogEna (Compare IEC 61850-8-1 $17.3.3.2.1, the default value should be FALSE)</td>
<td>N/A</td>
</tr>
<tr>
<td>Lg2</td>
<td>-</td>
<td>What is the format of EntryID</td>
<td>Deprecated</td>
</tr>
<tr>
<td>Lg3</td>
<td>1,2</td>
<td>Are there are 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)</td>
<td>N/A</td>
</tr>
<tr>
<td>Lg4</td>
<td>1</td>
<td>Pre-configured LCB attributes that cannot be changed online</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<additional items>
## 9. PIXIT for GOOSE publish model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gp1</td>
<td>1,2</td>
<td>Can the test (Ed1) / simulation (Ed2) flag in the published GOOSE be set</td>
<td>N</td>
</tr>
<tr>
<td>Gp2</td>
<td>1</td>
<td>What is the behaviour when the GOOSE publish configuration is incorrect</td>
<td>NdsCom=T, DUT keeps GoEna=F</td>
</tr>
<tr>
<td>Gp3</td>
<td>1,2</td>
<td>Published FCD supported common data classes are</td>
<td>ACD, ACT, APC, ASG, BSC, CMV, DPC, INC, ING, INS, MV, ORG, SPC, SPG, SPS, ENC, ENS,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arrays are not supported</td>
</tr>
<tr>
<td>Gp4</td>
<td>1,2</td>
<td>What is the slow retransmission time Is it fixed or configurable</td>
<td>Configured by IED tool (have to be &gt; than the fast retransmission time, and &lt;=60000 ms). Cannot be set &lt;100ms.</td>
</tr>
<tr>
<td>Gp5</td>
<td>1,2</td>
<td>What is the fastest retransmission time Is it fixed or configurable</td>
<td>1 ms, Configurable</td>
</tr>
<tr>
<td>Gp6</td>
<td>-</td>
<td>Can the GOOSE publish be turned on / off by using SetGoCBValues(GoEna)</td>
<td>Deprecated, See PICS – SetGoCBValues</td>
</tr>
<tr>
<td>Gp7</td>
<td>1,2</td>
<td>What is the initial GOOSE sqNum after restart</td>
<td>sqNum = 1</td>
</tr>
<tr>
<td>Gp8</td>
<td>1</td>
<td>May the GOOSE data set contain:</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- structured data objects (FCD)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- timestamp data attributes</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;additional items&gt;</td>
<td></td>
</tr>
</tbody>
</table>
## 10. PIXIT for GOOSE subscribe model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gs1</td>
<td>1,2</td>
<td>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. Notes:</td>
<td>Y destination MAC address</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the VLAN tag may be removed by a Ethernet switch and shall not be checked</td>
<td>Y APPID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• the simulation flag shall always be checked (Ed2)</td>
<td>Y gocbRef</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y timeAllowedtoLive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y dataSet</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y goID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N t</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y stNum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y sqNum</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y simulation / test</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y confRev</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y ndsCom</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y numDatSetEntries</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y out-of-order dataset members</td>
</tr>
</tbody>
</table>

**Note:** GOOSE with wrong dataset order will result in not updating data with mismatching type.
<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
</table>
| Gs2 | 1,2 | When is a subscribed GOOSE marked as lost (TAL = time allowed to live value from the last received GOOSE message) | b) message does not arrive by 2x TAL  
**Note 1:** GOOSE with TAL = 0ms is treated as GOOSE with TAL = 100ms and accepted.  
**Note 2:** Following wrong/missmatching elements in the GOOSE header are leading to invalid data for the application after 2*TAL timeout:  
- AppID  
- gocbRef  
- missing goID  
Following wrong/missmatching elements in the GOOSE header are leading to immediate invalid data for the application:  
- dataSet  
- goID  
- test  
- confRev  
- ndsCom  
- numDataSetEntries  
**Note 3:** GOOSE with wrong dataset order will result in not updating data with mismatching type. |
| Gs3 | 1,2 | What is the behaviour when one or more subscribed GOOSE messages isn’t received or syntactically incorrect (missing GOOSE) | Internal data is set to invalid if 2*TAL+100ms (time allowed to live) of received GOOSE times out. |
| Gs4 | 1,2 | What is the behaviour when a subscribed GOOSE message is out-of-order | sqNum is monitored for internal error tracking, but data is still accepted in case of stNum change. |
| Gs5 | 1,2 | What is the behaviour when a subscribed GOOSE message is duplicated | Is 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 |
<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gs7</td>
<td>1</td>
<td>May the GOOSE data set contain:</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- structured data objects (FCD)</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- timestamp data attributes</td>
<td></td>
</tr>
<tr>
<td>Gs8</td>
<td>1,2</td>
<td>Subscribed FCD supported common data classes are</td>
<td>ACD, ACT, ASG, BSC, CMV, DPC, INC, ING, INS, MV, SPC, SPG, SPS, ENC, ENS Arrays are not supported</td>
</tr>
<tr>
<td>Gs9</td>
<td>1,2</td>
<td>Are subscribed GOOSE with test=T (Ed1) / simulation=T (Ed2) accepted in test/simulation mode</td>
<td>Y Note: Only applicable for Ed2 When subscribed GOOSE is received with simulated = T device will not accept unless parameter AllowSimulation = Yes and Sys.LPHD.Sim.stVal=true</td>
</tr>
<tr>
<td>Gs10</td>
<td>1,2</td>
<td>Max number of dataset members</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>

### 11. PIXIT for GOOSE performance

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gf1</td>
<td>1,2</td>
<td>Performance class</td>
<td>IEC 61850-5 Edition 2 P1 (3ms)</td>
</tr>
<tr>
<td>Gf2</td>
<td>1,2</td>
<td>GOOSE ping-pong processing method</td>
<td>Scan cycle based</td>
</tr>
<tr>
<td>Gf3</td>
<td>1,2</td>
<td>Application logic scan cycle (ms)</td>
<td>Max. 100 ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min. 3 ms</td>
</tr>
<tr>
<td>Gf4</td>
<td>1</td>
<td>Maximum number of data attributes in GOOSE dataset (value and quality has to be counted as separate attributes)</td>
<td>150</td>
</tr>
</tbody>
</table>

### 12. PIXIT for Control model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ct1</td>
<td>1</td>
<td>What control models are supported (compare ICD file enums for Ed2)</td>
<td>DOns: Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOns: N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOes: N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: Y</td>
</tr>
<tr>
<td>ID</td>
<td>Ed</td>
<td>Description</td>
<td>Value / Clarification</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>-------------</td>
<td>-----------------------</td>
</tr>
</tbody>
</table>
| Ct2 | 1,2 | Is the control model fixed, configurable and/or dynamic | Fixed  
Can be changed for some functions using the PCM 600 IED tool. |
| 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 Ct2 is applicable) | Y |
| 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 | What is the behaviour of the DUT when the check conditions are set | Y `synchrocheck`  
Y `interlock-check`  
DUT uses the check value to perform the check (Ed2)  
This is only applicable for `CSWI.pos`, otherwise ignored.  
Fixed |

Is this behaviour fixed, configurable, online changeable
<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
</table>
| Ct9 | 1,2| Which additional cause diagnosis are supported                                | N 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  
Y 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  
Y Abortion-by-cancel  
Y Time-limit-over  
N Abortion-by-trip  
Y Object-not-selected |
| Ct10| 1,2| How to force a “test-not-ok” respond with SelectWithValue request            | Issued on negative response due to addCause values eg Time-limit-over, blocked-by-interlocking etc. And the TEST-bit is set when issuing the command. |
| Ct11| 1,2| How to force a “test-not-ok” respond with Select request                     | Not Supported                                                                       |
| Ct12| 1,2| How to force a “test-not-ok” respond with Operate request                    | DOns: Not Supported  
SBOns: Not Supported  
DOes: Not Supported  
SBOes: Issued on negative response due to addCause values e.g. Time-limit-over, blocked-by-interlocking etc. And the TEST-bit is set when issuing the command. |
<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ct13</td>
<td>1,2</td>
<td>Which origin categories are supported / accepted</td>
<td>Y bay-control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y station-control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y remote-control</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y automatic-bay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y automatic-station</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y automatic-remote</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N process</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Note:</strong> orCat is only checked for DPC and SPC DATA’s for the logical node types CSWI, ATCC, SPC8GAPC, VSGAPC and SLGAPC (*). This means that the check of Local/Remote switch will only occur for these attributes.</td>
<td></td>
</tr>
<tr>
<td>Ct14</td>
<td>1,2</td>
<td>What happens if the orCat value is not supported or invalid</td>
<td>DOns: Rejected for the above(*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOns: Not Supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOes: Not Supported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: Rejected for the above(*)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rejected means returning addCause Blocked-by-switching-hierarchy</td>
</tr>
<tr>
<td>Ct15</td>
<td>1,2</td>
<td>Does the IED accept a SelectWithValue / Operate with the same control value as the current status value</td>
<td>DOns: Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOes: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Is this behaviour configurable</td>
<td>Configurable N</td>
</tr>
<tr>
<td>Ct16</td>
<td>1,2</td>
<td>Does the IED accept a select/operate on the same control object from 2 different clients at the same time</td>
<td>DOns: N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOes: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: N</td>
</tr>
<tr>
<td>Ct17</td>
<td>1</td>
<td>Does the IED accept a Select/SelectWithValue from the same client when the control object is already selected (Tissue #334)</td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: N</td>
</tr>
<tr>
<td>Ct18</td>
<td>1,2</td>
<td>Is for SBOes the internal validation performed during the SelectWithValue and/or Operate step</td>
<td>SelectWithValue and Operate</td>
</tr>
<tr>
<td>ID</td>
<td>Ed</td>
<td>Description</td>
<td>Value / Clarification</td>
</tr>
<tr>
<td>-----</td>
<td>----</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Ct19</td>
<td></td>
<td>Can a control operation be blocked by Mod=Off or [On-]Blocked (Compare PIXIT-Sr5)</td>
<td>Deprecated</td>
</tr>
<tr>
<td>Ct20</td>
<td>1,2</td>
<td>Does the IED support local / remote operation</td>
<td>Y</td>
</tr>
<tr>
<td>Ct21</td>
<td>1,2</td>
<td>Does the IED send an InformationReport with LastApplError as part of the Operate response- for control with normal security</td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOns: N</td>
</tr>
<tr>
<td>Ct22</td>
<td>2</td>
<td>How to force a “parameter-change-in-execution”</td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“Parameter-change-in-execution” not Supported</td>
</tr>
<tr>
<td>Ct23</td>
<td>1,2</td>
<td>How many SBOns/SBOes control objects can be selected at the same time?</td>
<td>SBOns: n = “N/A”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: n = “multiple”</td>
</tr>
<tr>
<td>Ct24</td>
<td>1,2</td>
<td>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?</td>
<td>Y</td>
</tr>
<tr>
<td>Ct25</td>
<td>1,2</td>
<td>When CDC=DPC is supported, is it possible to have DPC (Controllable Double Point) go to the intermediate state? (00)</td>
<td>N</td>
</tr>
<tr>
<td>Ct26</td>
<td>1,2</td>
<td>Name a DOes point (if any) with a finite operate timeout and specify the timeout (in milliseconds)</td>
<td>LD0/CTRL/SCSWI.Pos DOes: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: 30000 (default, configurable in PST)</td>
</tr>
<tr>
<td>Ct27</td>
<td>2</td>
<td>Does the IED support control objects with external signals?</td>
<td>DOns: Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOns: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DOes: N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SBOes: Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 13. PIXIT for Time synchronisation model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tm1</td>
<td>1</td>
<td>What time quality bits are supported (may be set by the IED)</td>
<td>Y LeapSecondsKnown&lt;br&gt;Y ClockFailure&lt;br&gt;Y ClockNotSynchronized</td>
</tr>
<tr>
<td>Tm2</td>
<td>1,2</td>
<td>Describe the behaviour when the time server(s) ceases to respond</td>
<td>The ABB 670 series can have 2 configured SNTP Servers. If the first fails, the second is taken into use. There is an automatic switch ‘back’ if an erroneous one comes operable. If all SNTP servers are off-line the event timestamps get ClockFailure and ClockNotSynchronized status. The SNTP servers are polled with an interval up to 64 seconds. If the SNTP server don’t respond two extra tries will be done with short interval. After that the second SNTP server is polled. If no backup server is defined, there is a timeout of 5 minutes. The server is polled with an interval up to 64 seconds and after that polled with short interval 2 times more, so up to 67 seconds.</td>
</tr>
<tr>
<td>Tm3</td>
<td>1,2</td>
<td>How long does it take to take over the new time from time server</td>
<td>Depends on how much the time differ, from 2 seconds to 10 minutes.</td>
</tr>
<tr>
<td>Tm4</td>
<td>1,2</td>
<td>When is the time quality bit “ClockFailure” set</td>
<td>Upon start of the IED, until synchronization is received. As the time system is self-adjusted, the clock failure is set when the estimated deviation exceeds a certain value. Due to the good internal accuracy, this deviation occurs in the order of &gt; 30 days.</td>
</tr>
<tr>
<td>Tm5</td>
<td>1,2</td>
<td>When is the time quality bit “Clock not Synchronized” set</td>
<td>When connection to all time servers is lost (see PIXIT-Tm2)</td>
</tr>
<tr>
<td>ID</td>
<td>Ed</td>
<td>Description</td>
<td>Value / Clarification</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Tm6</td>
<td>-</td>
<td>Is the timestamp of a binary event adjusted to the configured scan cycle</td>
<td>Deprecated</td>
</tr>
<tr>
<td>Tm7</td>
<td>1</td>
<td>Does the device support time zone and daylight saving</td>
<td>Y</td>
</tr>
<tr>
<td>Tm8</td>
<td>1,2</td>
<td>Which attributes of the SNTP response packet are validated</td>
<td>Y Leap indicator not equal to 3&lt;br&gt;N Mode is equal to SERVER&lt;br&gt;Y OriginateTimestamp is equal to value sent by the SNTP client as Transmit Timestamp&lt;br&gt;Y RX/TX timestamp fields are checked for reasonableness&lt;br&gt;Y SNTP version 3 and/or 4&lt;br&gt;N other (describe)</td>
</tr>
<tr>
<td>Tm9</td>
<td>1,2</td>
<td>Do the COMTRADE files have local time or UTC time and is this configurable</td>
<td>The file attribute is in UTC. The START Time inside the COMTRADE file is in local time. No not configurable.</td>
</tr>
</tbody>
</table>

<additional items>
### 14. PIXIT for File transfer model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft1</td>
<td>1</td>
<td>What is structure of files and directories</td>
<td>Flat file system with pseudo folder</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Where are the COMTRADE files stored</td>
<td>/COMTRADE/</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are comtrade files zipped and what files are included in each zip file</td>
<td>Zipped</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zip includes: .hdr, .cfg and .dat</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The IED can also create Through Fault Reports. The through fault reports are stored in a flat file system with pseudo folder “/FAULTREPORT/”. The report files are zip xml-files.</td>
</tr>
<tr>
<td>Ft2</td>
<td>1,2</td>
<td>Directory names are separated from the file name by</td>
<td>“/” or “\” for FTP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“/” for MMS</td>
</tr>
<tr>
<td>Ft3</td>
<td>1</td>
<td>The maximum file name size including path (recommended 64 chars)</td>
<td>200 chars</td>
</tr>
<tr>
<td>Ft4</td>
<td>1,2</td>
<td>Are directory/file name case sensitive</td>
<td>Not Case sensitive</td>
</tr>
<tr>
<td>Ft5</td>
<td>1,2</td>
<td>Maximum file size for SetFile</td>
<td></td>
</tr>
<tr>
<td>Ft6</td>
<td>1</td>
<td>Is the requested file path included in the MMS fileDirectory respond file name</td>
<td>Y (Ed2: always complete path)</td>
</tr>
<tr>
<td>Ft7</td>
<td>1</td>
<td>Is the wild char supported MMS fileDirectory request</td>
<td>Yes, wild card = * or &quot;.&quot; or empty string</td>
</tr>
<tr>
<td>Ft8</td>
<td>1,2</td>
<td>Is it allowed that 2 clients get a file at the same time</td>
<td>Y same file</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Y different files</td>
</tr>
<tr>
<td>Ft9</td>
<td>1,2</td>
<td>Which files can be deleted</td>
<td>Drec_x.zip, See Remark1. Frep_x.zip</td>
</tr>
</tbody>
</table>

Remark1: Delete file only works on disturbance files (drec_x.zip) and not disturbance header files (drec_xh.zip). But once the disturbance file is deleted, the IED itself will remove the disturbance header file.

### 15. PIXIT for Service tracking model

<table>
<thead>
<tr>
<th>ID</th>
<th>Ed</th>
<th>Description</th>
<th>Value / Clarification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr1</td>
<td>2</td>
<td>Which ACSI services are tracked by LTRK.GenTrk</td>
<td>Associate, Abort, Release, SetDataValues and DeleteFile</td>
</tr>
</tbody>
</table>
### REVISION

<table>
<thead>
<tr>
<th>Rev.ind.</th>
<th>Page (P)</th>
<th>Chapt. (C)</th>
<th>Description</th>
<th>Date</th>
<th>Dept./Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All</td>
<td></td>
<td>New Document</td>
<td>2018-04-23</td>
<td>TPTB/CB</td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td></td>
<td>Tr1 - Value, SetGoCBValues removed</td>
<td>2018-05-21</td>
<td>TPTB/CB</td>
</tr>
<tr>
<td>C</td>
<td>14</td>
<td></td>
<td>Ft1 and FT9 – Through Fault added</td>
<td>2018-06-05</td>
<td>TPTB/CB</td>
</tr>
</tbody>
</table>