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About This User Manual

Any security measures described in this User Manual, for example, for user access, password security, network security, firewalls, virus protection, etc., represent possible steps that a user of an 800xA System may want to consider based on a risk assessment for a particular application and installation. This risk assessment, as well as the proper implementation, configuration, installation, operation, administration, and maintenance of all relevant security related equipment, software, and procedures, are the responsibility of the user of the 800xA System.

This user manual describes the IEC61850 Operations Library for Substation Equipment in 800xA System.

User Manual Conventions

Microsoft Windows conventions are normally used for the standard presentation of material when entering text, key sequences, prompts, messages, menu items, screen elements, etc.

Feature Pack

The Feature Pack content (including text, tables, and figures) included in this User Manual is distinguished from the existing content using the following two separators:

Feature Pack Functionality

<Feature Pack Content>
Feature Pack functionality included in an existing table is indicated using a table footnote (*):

*Feature Pack Functionality

Unless noted, all other information in this User Manual applies to 800xA Systems with or without a Feature Pack installed.

**Warning, Caution, Information, and Tip Icons**

This User Manual includes Warning, Caution, and Information where appropriate to point out safety related or other important information. It also includes Tip to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

- Electrical warning icon indicates the presence of a hazard that could result in *electrical shock*.
- Warning icon indicates the presence of a hazard that could result in *personal injury*.
- Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard that could result in *corruption of software or damage to equipment/property*.
- Information icon alerts the reader to pertinent facts and conditions.
- Tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, fully comply with all Warning and Caution notices.

**Terminology**

A complete and comprehensive list of Terms is included in the *System 800xA, Engineering Concepts instruction (3BDS100972*)*. The listing includes terms and definitions that apply to the 800xA System where the usage is different from
commonly accepted industry standard definitions and definitions given in standard dictionaries such as Webster’s Dictionary of Computer Terms. Terms that uniquely apply to this User Manual are listed in the following table.

<table>
<thead>
<tr>
<th>Term/Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>800xA</td>
<td>ABB automation system (eXtended Automation).</td>
</tr>
<tr>
<td>CBR</td>
<td>Circuit Breaker</td>
</tr>
<tr>
<td>CCA</td>
<td>Control Connection Aspect.</td>
</tr>
<tr>
<td>CTR</td>
<td>Current Transformer</td>
</tr>
<tr>
<td>DIS</td>
<td>Disconnector</td>
</tr>
<tr>
<td>GEN</td>
<td>Generator</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission.</td>
</tr>
<tr>
<td>IEC 61850</td>
<td>IEC standard for Communication Networks and Systems in Substations.</td>
</tr>
<tr>
<td>IED</td>
<td>Intelligent Electronic Device.</td>
</tr>
<tr>
<td>NLS</td>
<td>Native Language Support</td>
</tr>
<tr>
<td>OT</td>
<td>Object Type, object template in Object Type Structure in 800xA.</td>
</tr>
<tr>
<td>PPA</td>
<td>Process Portal A.</td>
</tr>
<tr>
<td>PTR</td>
<td>Power Transformer</td>
</tr>
<tr>
<td>SA</td>
<td>Substation Automation.</td>
</tr>
<tr>
<td>SCD</td>
<td>Substation Configuration Description, type of SCL file.</td>
</tr>
<tr>
<td>SCL</td>
<td>Substation Configuration Language.</td>
</tr>
<tr>
<td>SLD</td>
<td>Single Line Diagram.</td>
</tr>
<tr>
<td>VTR</td>
<td>Voltage Transformer</td>
</tr>
</tbody>
</table>
Released User Manuals and Release Notes

A complete list of all User Manuals and Release Notes applicable to System 800xA is provided in *System 800xA Released User Manuals and Release Notes (3BUA000263*)*.

*System 800xA Released User Manuals and Release Notes (3BUA000263*)* is updated each time a document is updated or a new document is released. It is in PDF format and is provided in the following ways:

- Included on the documentation media provided with the system and published to ABB SolutionsBank when released as part of a major or minor release, Service Pack, Feature Pack, or System Revision.

- Published to ABB SolutionsBank when a User Manual or Release Note is updated in between any of the release cycles listed in the first bullet.

A product bulletin is published each time *System 800xA Released User Manuals and Release Notes (3BUA000263*)* is updated and published to ABB SolutionsBank.
Section 1  Introduction

IEC61850 Operation Library for Substation Equipment is delivered together with the 800xA IEC 61850 Connect package and can be installed and used as an optional software.

IEC61850 Operation Library for Substation Equipment allows Visualization, Monitoring, and Control of Bays and Primary Equipment from 800xA Graphics displays through Faceplates.

The Library should be used when no ABB market specific libraries with their specific Faceplate design are used in 800xA System with IEC61850 Base connect package.

The Operation library software package contains the following contents:

- Faceplates for Objects:
  - Bay, CBR, DIS, PTR, GEN, VTR, and CTR.

- Graphic Elements of ANSI and IEC types for objects:
  - Substation and Voltage Level in addition to Bay, CBR, DIS, PTR, GEN, VTR, and CTR.

- Control Connection Aspect with Predefined properties used in Faceplate and Faceplate Elements dynamic points.

- General Properties Aspect Operation Display Selection for selecting the representation styles in Faceplates as required in project.

- NLS Aspects for configuring Faceplate text strings to additional language locales as required in Project.
Section 2 Installation

**Prerequisite**

Following are the pre-requisites before installing IEC 61850 Operation Library for Substation:

- ABB 800xA IEC61850 Connect is installed.
- ABB IEC 61850 Operation Library for Substation Equipment License is available.

**Installation**

IEC 61850 Operation Library for Substation Equipment is licensed and installed as a separate package.

Perform the following steps to install the Operation Library for Substation Equipment manually:

Screen shot in this manual is used for illustration purpose only, the version number varies according to the latest software version packaged with System Version release.
1. From the Operation Library for Substation Equipment folder, double click the \textit{.msi} file. The Installation Wizard appears, read the instructions and then click \textbf{Next}.

\begin{center}
\includegraphics[width=\textwidth]{installation_wizard.png}
\end{center}

\textit{Figure 1. Installation Wizard}
2. Read and then click **Accept**, to acknowledge the License Agreement

![License Agreement](image)

*Figure 2. License Agreement*
3. In the **Customer Information** widow, enter **User Name** and **Organization**, and then click **Next**.
   In this sample screen, User Name and Organization provided is **ABB**.

![Customer Information](image)

*Figure 3. Customer Information*
4. In the **Setup Type** window, select **Complete** and then click **Next**.

![Setup Type window](image)

**Figure 4. Installation Setup Type**
5. Click **Install** to start the Installation process.

![Installation Confirmation](image)

*Figure 5. Installation Confirmation*
6. Notice the progress of the installation.

*Figure 6. Installation Progress*
7. After Installation, click **Finish** to complete the installation process.

![Installation Complete](image)

*Figure 7. Installation Complete*

This completes the installation of IEC 61850 Operation Library for Substation Equipment.
Loading System Extension

Perform the following steps to load the System extensions:

1. Click in the Library Structure to open the list of Installed Products and Extensions screen and verify if ABB IEC61850 Connect System Extension is loaded as shown in Figure 17.

![Figure 8. ABB IEC61850 Connect - Installed Products and Extensions](image)

2. From the Windows Taskbar, right click and select Configuration Wizard.

![Figure 9. Configuration Wizard](image)
3. Configuration Wizard opens. Select **System Administration** and click **Next**.
4. Select the System Name and then click **Next**.

![Configuration Wizard - Select System](image)

*Figure 11. Configuration Wizard - Select System*
5. Select the **System Extension Load** as type of configuration and then click **Next**.

![Configuration Wizard - Configuration Type](image)

*Figure 12. Configuration Wizard - Configuration Type*
6. In the System Extension Load window:

![Configuration Wizard - System Extension Load](image)

**Figure 13. Configuration Wizard - System Extension Load**

Select ABB IEC61850 Operation Library for Substation Equipment and then click ⏩.


A green color Tick mark indicates that the System Extension ABB IEC61850 Operation Library for Substation Equipment is ready to be loaded.
7. Notice the progress of the System Extension Loading process.

Figure 15. Configuration Wizard - Apply Setting Progress Window
8. Click **Finish** to complete the loading of ABB IEC61850 Operation Library for Substation Equipment.

*Figure 16. Configuration Wizard - loading Extension Complete*
9. Click ☰ in the Library Structure to open the list of Installed Products and Extensions screen and verify if ABB IEC61850 Operation Library for Substation Equipment is loaded as shown in Figure 17.

![Figure 17. ABB IEC61850 Operation Library for Substation Equipment - Installed Products and Extensions](image)

This completes the loading of ABB IEC61850 Operation Library for Substation Equipment into the System.
Section 3  Faceplates

IEC 61850 Operation Library for Substation Equipment contains Faceplates and Graphic Elements to monitor and control Bay and Conducting equipments in a Substation.

The operating elements required for Bay and Conducting equipment operation are provided in the faceplate, depending on the function. The Graphic Elements can be used directly in Graphics displays to visualize the entire Substation in 800xA.

Faceplates available for each type of Conducting Equipment and Bay is explained in the following topic.

Faceplates for Conducting Equipment Objects

Faceplates are available for following Conducting Equipment:
- Bay
- Circuit Breaker
- Disconnector
- Current Transformer
- Power Transformer
- Generator
- Voltage Transformer
Display Style Selection in Faceplates

IEC 61850 Operation Library for Substation Equipment provides Graphic Elements with ANSI and IEC Symbols. Graphic Elements for ANSI and IEC Symbol can be configured using Operation Display Selection aspect available in Functional Objects under Object Type Library structure as shown in Figure 18.

![Figure 18. Operation Display Selection Aspect](image)

**Display Symbol Type**: This property can be configured for Graphic elements to be represented as IEC style or ANSI style in all the faceplates.

**Display Style IED Operate**: This property can be configured for all faceplates to represent the IED Operation mode as Local / Remote or Manual / Auto style.

Table 1 shows the common icons used in the faceplates.

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Faceplate Locked status" /></td>
<td>Faceplate Locked status</td>
</tr>
<tr>
<td><img src="image" alt="Alarm Idle State" /></td>
<td>Alarm Idle State</td>
</tr>
<tr>
<td><img src="image" alt="Alarm" /></td>
<td>Alarm is active, but not acknowledged</td>
</tr>
</tbody>
</table>
### Table 1. Faceplates Icons (Continued)

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Alarm is neither active nor acknowledged.</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Alarm condition is acknowledged</td>
</tr>
</tbody>
</table>

**Indicators and Aspect Link Area**

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Operator note</td>
</tr>
</tbody>
</table>

**Button Area**

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Apply Enabled</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Apply Disabled</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Cancel Enabled</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Cancel Disabled</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Command Close Enabled</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Command Close Disabled</td>
</tr>
</tbody>
</table>
Table 1. Faceplates Icons (Continued)

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Command Open Enabled" /></td>
<td>Command Open Enabled</td>
</tr>
<tr>
<td><img src="image2" alt="Command Open Disabled" /></td>
<td>Command Open Disabled</td>
</tr>
<tr>
<td><img src="image3" alt="Transformer Tap Change Lower Enabled" /></td>
<td>Transformer Tap Change Lower Enabled</td>
</tr>
<tr>
<td><img src="image4" alt="Transformer Tap Change Lower Disabled" /></td>
<td>Transformer Tap Change Lower Disabled</td>
</tr>
<tr>
<td><img src="image5" alt="Transformer Tap Change Raise Enabled" /></td>
<td>Transformer Tap Change Raise Enabled</td>
</tr>
<tr>
<td><img src="image6" alt="Transformer Tap Change Raise Disabled" /></td>
<td>Transformer Tap Change Raise Disabled</td>
</tr>
<tr>
<td><img src="image7" alt="Auto Enabled" /></td>
<td>Auto Enabled</td>
</tr>
<tr>
<td><img src="image8" alt="Auto Disabled" /></td>
<td>Auto Disabled</td>
</tr>
<tr>
<td><img src="image9" alt="Manual Enabled" /></td>
<td>Manual Enabled</td>
</tr>
<tr>
<td><img src="image10" alt="Manual Disabled" /></td>
<td>Manual Disabled</td>
</tr>
</tbody>
</table>
### Table 1. Faceplates Icons (Continued)

<table>
<thead>
<tr>
<th>Icons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>REM</td>
<td>Remote Status</td>
</tr>
<tr>
<td>LOC</td>
<td>Local Status</td>
</tr>
</tbody>
</table>

### Graphic Element of Substation

**Figure 20** shows the Aspects of Substation object.

**Table 1. Aspects of Substation**

<table>
<thead>
<tr>
<th>Aspects of Substation</th>
<th>Modified</th>
<th>Description</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>5/15/2007</td>
<td>The base Aspect Category category</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>7/8/2006</td>
<td>Objects with the aspect are candidates</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>PCA Upload Type</td>
<td>7/25/2007</td>
<td>Object Types with this aspect are candidates</td>
<td>False</td>
<td>PCA Upload Type</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>10/13/2007</td>
<td>A name that holds the functional design</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Functional Object Ref</td>
<td>5/15/2007</td>
<td>False</td>
<td>False</td>
<td>Functional Objects</td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>1/18/2013</td>
<td>True</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>GetSubstationStatus</td>
<td>1/1/2013</td>
<td>Graphic Elements are object aware</td>
<td>False</td>
<td>Graphic Element P2</td>
</tr>
<tr>
<td>IEDSignalMapping</td>
<td>1/1/2013</td>
<td>The aspect category was added by ...</td>
<td>False</td>
<td>IEDSignalMapping</td>
</tr>
<tr>
<td>Library Member</td>
<td>7/8/2006</td>
<td>False</td>
<td>False</td>
<td>Library Member</td>
</tr>
<tr>
<td>Name</td>
<td>1/1/2013</td>
<td>The basic name for most objects</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>Object Icon</td>
<td>7/25/2007</td>
<td>False</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>Object Type Reference</td>
<td>5/15/2007</td>
<td>Icon for an object</td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>Substation Type Definition</td>
<td>1/1/2013</td>
<td>False</td>
<td>False</td>
<td>Substation Type Definition</td>
</tr>
<tr>
<td>Object Type Structure</td>
<td>5/15/2007</td>
<td>False</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
<tr>
<td>Status</td>
<td>1/1/2013</td>
<td>Holds information about available properties</td>
<td>False</td>
<td>CPC Control Connection</td>
</tr>
</tbody>
</table>

**Figure 19. Aspects of Substation**
Figure 20 shows the graphic element of Substation object showing Local status.

![Substation Graphic Element](image)

**Figure 20. Substation Graphic Element**

**Control Connection Aspect**

Table 2 describes the property defined for Control Connection Aspect of Substation object.

*Table 2. Substation - Control Connection Aspect*

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SubstationLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Substation Local Remote Status</td>
</tr>
</tbody>
</table>
Graphic Element of Voltage level

Figure 40 shows Aspects of Voltage level object.

<table>
<thead>
<tr>
<th>Aspects of Voltage Level</th>
<th>Modified</th>
<th>Description</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspect Category Definition</td>
<td>5/15/2007 12:47:...</td>
<td>The base Aspect Category category</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>7/8/2005 12:03:1...</td>
<td>Objects with this aspect are candidates</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>PCA Upload Type</td>
<td>7/25/2007 8:21:2...</td>
<td>Object Types with this aspect are candidates</td>
<td>False</td>
<td>PCA Upload Type</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>10/13/2007 12:0...</td>
<td>A name that holds the functional design</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>1/10/2013 8:31:0...</td>
<td>True</td>
<td>General Properties</td>
<td></td>
</tr>
<tr>
<td>OperationStatus</td>
<td>1/16/2013 8:26:1...</td>
<td>Graphic Elements are object aware</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>IEDSignalMapping</td>
<td>1/11/2013 8:30:1...</td>
<td>This aspect category was added by</td>
<td>False</td>
<td>IEDSignalMapping</td>
</tr>
<tr>
<td>Library Member</td>
<td>7/8/2005 12:02:5...</td>
<td></td>
<td>False</td>
<td>Library Member</td>
</tr>
<tr>
<td>Library Member</td>
<td>7/8/2005 12:02:5...</td>
<td></td>
<td>False</td>
<td>Library Member</td>
</tr>
<tr>
<td>Name</td>
<td>5/15/2007 12:47:...</td>
<td>The basic name used for most object...</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>Object Icon</td>
<td>7/25/2007 4:19:5...</td>
<td>Icon for an object.</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>Object Type Type Reference</td>
<td>5/15/2007 12:47:...</td>
<td></td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>Voltage Level Type Definition</td>
<td>6/25/2012 4:24:2...</td>
<td></td>
<td>False</td>
<td>Voltage Level Type Definition</td>
</tr>
<tr>
<td>Object Type Structure</td>
<td>5/15/2007 12:47:...</td>
<td>[Object Type Structure]Object Type...</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
<tr>
<td>Control Connection</td>
<td>1/16/2013 8:32:1...</td>
<td>Holds information about available pr...</td>
<td>False</td>
<td>OPC Control Connection</td>
</tr>
</tbody>
</table>

Figure 21. Aspects of Voltage Level

Figure 22 shows the graphic element of Voltage level object showing Local status.

Figure 22. Voltage Level Graphic Element
Control Connection Aspect

Table 3 describes the property defined for Control Connection Aspect of Voltage level object.

Table 3. Voltage level - Control Connection Aspect

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VoltageLevelLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Voltage Level Local Remote Status</td>
</tr>
</tbody>
</table>
Faceplate of Bay

Bay faceplate provides the functionality to visualize the real-time status in the respective Bay.

Figure 23 shows the Bay Aspects in Object Type Structure.
Figure 24 shows the Faceplate of the Bay.

The HH, H, L, LL alarms displayed in the Monitor tab are from the respective Control Connection Aspect boolean property whose value is set within IED.

Control Connection Aspect

Table 4 describes the properties defined for Bay Control Connection Aspect.

Table 4. Bay - Control Connection Aspect

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ActivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Active Power</td>
</tr>
<tr>
<td>BayLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Bay Local Remote Status</td>
</tr>
<tr>
<td>CBRBlockClose</td>
<td>VT_BOOL</td>
<td>R</td>
<td>CBR Block Close</td>
</tr>
</tbody>
</table>
### Table 4. Bay - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBRBlockOpen</td>
<td>VT_Bool</td>
<td>R</td>
<td>CBR Block Open</td>
</tr>
<tr>
<td>CBREnableClose</td>
<td>VT_Bool</td>
<td>R/W</td>
<td>Enable Close Command</td>
</tr>
<tr>
<td>CBREnableOpen</td>
<td>VT_Bool</td>
<td>R/W</td>
<td>Enable Open Command</td>
</tr>
<tr>
<td>CBRLocalRemoteStatus</td>
<td>VT_Bool</td>
<td>R</td>
<td>CBR Local Remote Status</td>
</tr>
<tr>
<td>CBRNumberOfOperations</td>
<td>VT_I4</td>
<td>R</td>
<td>Number of operations</td>
</tr>
<tr>
<td>CBRPositionStatus</td>
<td>VT_I4</td>
<td>R</td>
<td>CBR Position Status</td>
</tr>
<tr>
<td>CBRPositionStatusQuality</td>
<td>VT_BSTR</td>
<td>R</td>
<td>CBR Position Status Quality</td>
</tr>
<tr>
<td>CBRPositionStatusTime</td>
<td>VT_BSTR</td>
<td>R</td>
<td>CBR Position Status Time Stamp</td>
</tr>
<tr>
<td>CBRSelectionStatus</td>
<td>VT_Bool</td>
<td>R</td>
<td>CBR Selection Status</td>
</tr>
<tr>
<td>EarthingSwitchPosition</td>
<td>VT_I4</td>
<td>R</td>
<td>Earthing Switch Position</td>
</tr>
<tr>
<td>Frequency</td>
<td>VT_R4</td>
<td>R</td>
<td>Frequency</td>
</tr>
<tr>
<td>FrequencyHighAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Frequency High Alarm</td>
</tr>
<tr>
<td>FrequencyHighHighAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Frequency High High Alarm</td>
</tr>
<tr>
<td>FrequencyLowAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Frequency Low Alarm</td>
</tr>
<tr>
<td>FrequencyLowLowAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Frequency Low Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentN</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current N</td>
</tr>
<tr>
<td>PhaseCurrentL1HighAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Phase Current L1 High Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL1HighHighAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Phase Current L1 High High Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL1LowAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Phase Current L1 Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL1LowLowAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Phase Current L1 Low Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL2</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L2</td>
</tr>
<tr>
<td>PhaseCurrentL2HighAlarm</td>
<td>VT_Bool</td>
<td>R</td>
<td>Phase Current L2 High Alarm</td>
</tr>
</tbody>
</table>
Table 4. Bay - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhaseCurrentL2HighHighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L2 High High Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL2LowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L2 Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL2LowLowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L2 Low Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL3</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L3</td>
</tr>
<tr>
<td>PhaseCurrentL3HighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L3 High Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL3HighHighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L3 High High Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL3LowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L3 Low Alarm</td>
</tr>
<tr>
<td>PhaseCurrentL3LowLowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Current L3 Low Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL12</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L12</td>
</tr>
<tr>
<td>PhaseVoltageL12HighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L12 High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL12HighHighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L12 High High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL12LowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L12 Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL12LowLowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L12 Low Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL23</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L23</td>
</tr>
<tr>
<td>PhaseVoltageL23HighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L23 High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL23HighHighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L23 High High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL23LowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L23 Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL23LowLowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L23 Low Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL31</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L31</td>
</tr>
</tbody>
</table>
Table 4. Bay - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhaseVoltageL31HighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L31 High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL31HighHighAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L31 High High Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL31LowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L31 Low Alarm</td>
</tr>
<tr>
<td>PhaseVoltageL31LowLowAlarm</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Phase Voltage L31 Low Low Alarm</td>
</tr>
<tr>
<td>PowerFactor</td>
<td>VT_R4</td>
<td>R</td>
<td>Power Factor</td>
</tr>
<tr>
<td>RackedInRackedOut</td>
<td>VT_I4</td>
<td>R</td>
<td>RackedIn RackedOut</td>
</tr>
<tr>
<td>ReactivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Reactive Power</td>
</tr>
<tr>
<td>ResidualVoltage</td>
<td>VT_R4</td>
<td>R</td>
<td>Residual Voltage</td>
</tr>
</tbody>
</table>

Graphic Symbols for Bay

Table 5 shows the Graphic Symbols for Bay.

Table 5. ANSI and IEC Type of Graphical Symbols for Bay

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td><img src="image1" alt="Earth Icon" /></td>
<td><img src="image2" alt="Earth Icon" /></td>
</tr>
<tr>
<td>Status</td>
<td><img src="image3" alt="Status Icon" /></td>
<td><img src="image4" alt="Status Icon" /></td>
</tr>
</tbody>
</table>
Table 5. ANSI and IEC Type of Graphical Symbols for Bay (Continued)

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>![MOT]</td>
<td>![M]</td>
</tr>
<tr>
<td>InFeeder</td>
<td>![▲]</td>
<td>![▲]</td>
</tr>
<tr>
<td>Outfeeder</td>
<td>![▼]</td>
<td>![▼]</td>
</tr>
<tr>
<td>Bay Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Position</td>
<td>![❌]</td>
<td>![❌]</td>
</tr>
<tr>
<td>Open position</td>
<td>![☐]</td>
<td>![❌]</td>
</tr>
<tr>
<td>Closed position</td>
<td>![☐]</td>
<td>![❌]</td>
</tr>
<tr>
<td>Bad (faulty) position</td>
<td>![➕]</td>
<td>![➕]</td>
</tr>
</tbody>
</table>
Faceplate of Circuit Breaker

The Circuit Breaker faceplate provides functionality to Monitor and Control the Circuit Breaker.

**Figure 25** shows the Aspects of Circuit Breaker object in Object Type Structure.

![Figure 25. Aspects of Circuit Breaker](image-url)
**Circuit Breaker Status Presentation**

The reduced faceplate view of the circuit breaker displays the Circuit Breaker position as shown in Figure 26.

![Circuit Breaker Faceplate - Reduced View](image)

*Figure 26. Circuit Breaker Faceplate - Reduced View*
Figure 27 shows the extended view faceplate of Circuit Breaker Conducting Equipment.

**Control Logic for Circuit Breaker Faceplate**

Procedure for controlling CBR:

1. Open and Close the CBR using **Open** and **Close** buttons.
2. Open and Close buttons are enabled when the CBR status is **Bad** or **Intermediate** position.
   
   $CSWI_1.Pos.stVal=3 \text{ or } CSWI_1.Pos.stVal=0$

3. Open button is disabled when the CBR status is **Open**.
   
   $CSWI_1.Pos.stVal=1$
4. Close button is disabled when the CBR status is **Close**.
   \[ \text{CSWI}_1.\text{Pos}.\text{stVal}=1 \]

5. To close the CBR, Select **Close** and **Apply** button.

6. To open the CBR, Select **Open** and **Apply** button.

7. The apply button will be enabled only if,
   - Open Command = 1 (\text{CSWI}_1.\text{Pos}.\text{ctlSelOn} = 1) and Selected Feedback = True (\text{CSWI}_1.\text{Pos}.\text{stSeld} = \text{True}),
   - OR
   - Close Command = 1 (\text{CSWI}_1.\text{Pos}.\text{ctlSelOff} = 1) and Selected Feedback = True (\text{CSWI}_1.\text{Pos}.\text{stSeld} = \text{True}).

8. The **Cancel** button is used to clear the open and close requests.

**Logic for Circuit Breaker (CBR) Faceplate Button**

**Logic for Open Enabled**

```plaintext
if \text{CBRLocalRemoteStatus} = \text{False} then
    if \text{CBRPositionStatus} = 3 then
        \text{False}
    else if \text{RackedInRackedOut} = 1 then
        \text{False}
    else if \text{CBRPositionStatus} = 1 \&\& \text{CBRControlSelectionOn} = 0 then
        \text{False}
    else if \text{CBRControlSelectionOff} = 1 then
        \text{False}
    else if \text{CBRControlSelectionOn} = 1 then
        \text{True}
    else
        \text{True}
```
False

**Logic for Close Enabled**

if CBRLocalRemoteStatus = False then
    if CBRPositionStatus = 3 then
        False
    else if RackedInRackedOut = 1 then
        False
    else if CBRPositionStatus = 2 &&
        CBRControlSelectionOff = 0 then
        False
    else if CBRControlSelectionOffn = 1 then
        False
    else if CBRControlSelectionOff = 1 then
        True
    else
        True
else
    False

**Logic for Cancel Enabled**

if CBRControlSelectionOn = 1 && CBRPositionStatus = 1 ||
CBRControlSelectionOff = 1 && CBRPositionStatus = 2 then
    True
else if CBRControlSelectionOn = 1 && CBRControlOperationOn =
1 then
    False
else if CBRControlSelectionOff = 1 && CBRControlOperationOff =
1 then
    False
else if RackedInRackedOut = 1 then
False
else
  False

**Logic for Apply Disabled**

if CBRControlSelectionOn = 1 && CBREnableClose && CBRSelectionStatus || CBRControlSelectionOff = 1 && CBREnableOpen && CBRSelectionStatus then
  True
else if CBRControlSelectionOff = 0 && CBRControlOperationOn = 1 then
  False
else if CBRControlSelectionOn = 0 && CBRControlOperationOff = 1 then
  False
else if RackedInRackedOut = 1 then
  False
else
  False

**Control Connection Aspect**

Table 6 describes the properties defined for Circuit Breaker Control Connection Aspect.

*Table 6. Circuit Breaker - Control Connection Aspect*

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ActivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Active Power</td>
</tr>
<tr>
<td>CBRBlockClose</td>
<td>VT_BOOL</td>
<td>R</td>
<td>CBR Block Close</td>
</tr>
<tr>
<td>CBRBlockOpen</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Block Open</td>
</tr>
<tr>
<td>CBRControlOperationOff</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Control Operation Off</td>
</tr>
<tr>
<td>CBRControlOperationOn</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Control Operation On</td>
</tr>
</tbody>
</table>
Table 6. Circuit Breaker - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBRControlSelectionOff</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Control Selection Off</td>
</tr>
<tr>
<td>CBRControlSelectionOn</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Control Selection On</td>
</tr>
<tr>
<td>CBREnableClose</td>
<td>VT_BOOL</td>
<td>R/W</td>
<td>Enable Close Command for CBR</td>
</tr>
<tr>
<td>CBREnableOpen</td>
<td>VT_BOOL</td>
<td>R/W</td>
<td>Enable Open Command for CBR</td>
</tr>
<tr>
<td>CBRLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>CBR Local Status</td>
</tr>
<tr>
<td>CBRNumberOfOperations</td>
<td>VT_I4</td>
<td>R</td>
<td>Number of Operations</td>
</tr>
<tr>
<td>CBRPositionControlCancel</td>
<td>VT_I4</td>
<td>R/W</td>
<td>CBR Open / Close Command Cancel</td>
</tr>
<tr>
<td>CBRPositionStatus</td>
<td>VT_I4</td>
<td>R</td>
<td>CBR Position Status</td>
</tr>
<tr>
<td>CBRPositionStatusQuality</td>
<td>VT_BSTR</td>
<td>R</td>
<td>CBR Position Status Quality</td>
</tr>
<tr>
<td>CBRPositionStatusTime</td>
<td>VT_DATE</td>
<td>R</td>
<td>CBR Position Status Time Stamp</td>
</tr>
<tr>
<td>CBRSelectionStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>CBR Selection Status</td>
</tr>
<tr>
<td>EarthingSwitchPosition</td>
<td>VT_I4</td>
<td>R</td>
<td>Earthing Switch Position</td>
</tr>
<tr>
<td>Frequency</td>
<td>VT_R4</td>
<td>R</td>
<td>Frequency</td>
</tr>
<tr>
<td>LoadShedTripCmdStatus1</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Master Trip CB High side</td>
</tr>
<tr>
<td>LoadShedTripCmdStatus2</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Load Shed Trip Command</td>
</tr>
<tr>
<td>PhaseCurrentL1</td>
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<td>PhaseCurrentL2</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L2</td>
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<tr>
<td>PhaseCurrentL3</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L3</td>
</tr>
<tr>
<td>PhaseVoltageL12</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L12</td>
</tr>
<tr>
<td>PhaseVoltageL23</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L23</td>
</tr>
<tr>
<td>PhaseVoltageL31</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Voltage L31</td>
</tr>
<tr>
<td>PowerFactor</td>
<td>VT_R4</td>
<td>R</td>
<td>Power Factor</td>
</tr>
</tbody>
</table>
Table 6. Circuit Breaker - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RackedInRackedOut</td>
<td>VT_I4</td>
<td>R</td>
<td>CBR RackedIn RackedOut</td>
</tr>
<tr>
<td>ReactivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Reactive Power</td>
</tr>
<tr>
<td>ResidualCurrent</td>
<td>VT_R4</td>
<td>R</td>
<td>Residual Current</td>
</tr>
<tr>
<td>ResidualVoltage</td>
<td>VT_R4</td>
<td>R</td>
<td>Residual Voltage</td>
</tr>
</tbody>
</table>

Graphic Symbols for Circuit Breaker

Table 4 shows the Graphic Symbols for Circuit Breaker.

Table 7. ANSI and IEC Type of Graphical Symbols for Circuit Breaker

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit Breaker</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Position</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Open position</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Closed position</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>Bad (faulty) position</td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Section 3  Faceplates  

Faceplate of Disconnector

Figure 28 shows the Aspects of Disconnector object Object Type Structure.

<table>
<thead>
<tr>
<th>Aspects of DIS</th>
<th>Modified</th>
<th>Desc...</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event List</td>
<td>1/15/2013 6:46:0...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>Alarm List</td>
<td>1/15/2013 6:45:5...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>AlarmAndLockControl</td>
<td>7/14/2012 12:44:1...</td>
<td>False</td>
<td></td>
<td>AlarmAndLockControl</td>
</tr>
<tr>
<td>Aspect Category Definition</td>
<td>7/10/2007 1:02:2...</td>
<td>The...</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>7/8/2006 12:03:1...</td>
<td>Objec...</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>pcaUploadType</td>
<td>7/25/2007 6:21:0...</td>
<td>Objec...</td>
<td>False</td>
<td>Controller Upload Type</td>
</tr>
<tr>
<td>Faceplate Element_PG2</td>
<td>1/18/2013 11:12...</td>
<td>Objec...</td>
<td>False</td>
<td>Faceplate Element_PG2</td>
</tr>
<tr>
<td>Faceplate Element_PG2</td>
<td>1/21/2013 12:31...</td>
<td>Objec...</td>
<td>False</td>
<td>Faceplate Element_PG2</td>
</tr>
<tr>
<td>Faceplate Element_PG2</td>
<td>1/18/2013 4:33:5...</td>
<td>Objec...</td>
<td>False</td>
<td>Faceplate Element_PG2</td>
</tr>
<tr>
<td>Main Faceplate</td>
<td>1/15/2013 5:47:4...</td>
<td>False</td>
<td></td>
<td>Main Faceplate</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>10/13/2007 12:0...</td>
<td>Ana...</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Functional Objects Reference</td>
<td>7/10/2007 1:02:2...</td>
<td>False</td>
<td>True</td>
<td>Functional Objects</td>
</tr>
<tr>
<td>General Properties</td>
<td>1/18/2013 6:32:0...</td>
<td>True</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>Graphic Element_PG2</td>
<td>1/10/2013 2:05:2...</td>
<td>Gra...</td>
<td>False</td>
<td>Graphic Element_PG2</td>
</tr>
<tr>
<td>Graphic Element_PG2</td>
<td>4/25/2010 4:12:3...</td>
<td>Gra...</td>
<td>True</td>
<td>Graphic Element_PG2</td>
</tr>
<tr>
<td>Graphic Element_PG2</td>
<td>5/14/2010 2:52:4...</td>
<td>Gra...</td>
<td>True</td>
<td>Graphic Element_PG2</td>
</tr>
<tr>
<td>IEDSignalMapping</td>
<td>1/21/2013 12:30...</td>
<td>Gra...</td>
<td>False</td>
<td>IEDSignalMapping</td>
</tr>
<tr>
<td>Library Member</td>
<td>1/15/2013 5:45:0...</td>
<td>False</td>
<td></td>
<td>Library Member</td>
</tr>
<tr>
<td>Name</td>
<td>10/24/2007 10:5...</td>
<td>The...</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>Object Icon</td>
<td>7/25/2007 5:20:1...</td>
<td>Icon...</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>Object Type</td>
<td>7/10/2007 1:02:4...</td>
<td>False</td>
<td>True</td>
<td>Object Type</td>
</tr>
<tr>
<td>Object Type Definition</td>
<td>6/25/2012 4:24...</td>
<td>False</td>
<td>True</td>
<td>Object Type Definition</td>
</tr>
<tr>
<td>Object Type Structure</td>
<td>7/10/2007 1:02:4...</td>
<td>Objec...</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
<tr>
<td>OPC Control Connection</td>
<td>1/18/2013 6:35:5...</td>
<td>Holds...</td>
<td>False</td>
<td>OPC Control Connection</td>
</tr>
<tr>
<td>Operator Note</td>
<td>6/25/2012 5:53:1...</td>
<td>Opera...</td>
<td>False</td>
<td>Operator Note</td>
</tr>
</tbody>
</table>

Figure 28. Aspects of Disconnector
Figure 29 shows the reduced faceplate view of Disconnector position.

Figure 29. Disconnector Faceplate - Reduced View
Figure 30 shows the extended view faceplate of Disconnector Conducting Equipment.

Figure 30. Disconnector Faceplate - Extended View

Logic for Disconnector Faceplate Button

Logic for Open Enabled

if DISLocalRemoteStatus = False then
    if DISPositionStatus = 3 then
        False
    else if DISPositionStatus = 1 && DISControlSelectionOn = 0 then
        DISLocalRemoteStatus = True
    end if
end if
else if $\text{DISControlSelectionOff} = 1$ then
    False
else if $\text{DISControlSelectionOn} = 1$ then
    True
else

    True
else

    False

Logic for Close Enabled

if $\text{DISLocalRemoteStatus} = \text{False}$ then
    if $\text{DISPositionStatus} = 3$ then
        False
    else if $\text{DISPositionStatus} = 2$ && $\text{DISControlSelectionOff} = 0$ then
        False
    else if $\text{DISControlSelectionOn} = 1$ then
        False
    else if $\text{DISControlSelectionOff} = 1$ then
        True
    else

        True
    else

        False

Logic for Cancel Enabled

if $\text{DISControlSelectionOn} = 1$ && $\text{DISPositionStatus} = 1$ ||
$\text{DISControlSelectionOff} = 1$ && $\text{DISPositionStatus} = 2$ then
    True
else if DISControlSelectionOn = 1 && DISControlOperationOn = 1 then
    False
else if DISControlSelectionOff = 1 && DISControlOperationOff = 1 then
    False
else
    False

**Logic for Apply Disabled**

if DISControlSelectionOn = 1 && DISEnableClose && DISSelectionStatus || DISControlSelectionOff = 1 && DISEnableOpen && DISSelectionStatus then
    True
else if DISControlSelectionOff = 0 && DISControlOperationOn = 1 then
    False
else if DISControlSelectionOn = 0 && DISControlOperationOff = 1 then
    False
else
    False

**Control Connection Aspect**

*Table 8* describes the properties defined for Disconnector Control Connection Aspect.

*Table 8. Disconnector - Control Connection Aspect*

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISBlockClose</td>
<td>VT_BOOL</td>
<td>R</td>
<td>DIS Block Close</td>
</tr>
<tr>
<td>DISBlockOpen</td>
<td>VT_BOOL</td>
<td>R</td>
<td>DIS Block Open</td>
</tr>
<tr>
<td>DISControlOperationOff</td>
<td>VT_R4</td>
<td>R/W</td>
<td>DIS Control Operation Off</td>
</tr>
</tbody>
</table>
Table 8. Disconnector - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISControlOperationOn</td>
<td>VT_R4</td>
<td>R/W</td>
<td>DIS Control Operation On</td>
</tr>
<tr>
<td>DISControlSelectionOff</td>
<td>VT_R4</td>
<td>R/W</td>
<td>DIS Control Selection Off</td>
</tr>
<tr>
<td>DISControlSelectionOn</td>
<td>VT_R4</td>
<td>R/W</td>
<td>DIS Control Selection On</td>
</tr>
<tr>
<td>DISEnableClose</td>
<td>VT_BOOL</td>
<td>R/W</td>
<td>DIS Enable Close</td>
</tr>
<tr>
<td>DISEnableOpen</td>
<td>VT_BOOL</td>
<td>R/W</td>
<td>Enable Open Command for DIS</td>
</tr>
<tr>
<td>DISLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>DIS Local Status</td>
</tr>
<tr>
<td>DISNumberOfOperations</td>
<td>VT_I4</td>
<td>R</td>
<td>Number of Operations</td>
</tr>
<tr>
<td>DISPositionControlCancel</td>
<td>VT_I2</td>
<td>R/W</td>
<td>DIS Open/Close Command Cancel</td>
</tr>
<tr>
<td>DISPositionStatus</td>
<td>VT_I4</td>
<td>R</td>
<td>DIS Position Status</td>
</tr>
<tr>
<td>DISPositionStatusQuality</td>
<td>VT_BSTR</td>
<td>R</td>
<td>DIS Position Status Quality</td>
</tr>
<tr>
<td>DISPositionStatusTime</td>
<td>VT_DATE</td>
<td>R</td>
<td>DIS Position Status Time Stamp</td>
</tr>
<tr>
<td>DISSelectionStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>DIS Selection Status</td>
</tr>
<tr>
<td>EarthingSwitchPosition</td>
<td>VT_I4</td>
<td>R</td>
<td>Earthing Switch Position</td>
</tr>
<tr>
<td>LoadShedTripCmdStatus1</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Master Trip CB High side</td>
</tr>
<tr>
<td>LoadShedTripCmdStatus2</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Load Shed Trip Command</td>
</tr>
<tr>
<td>RackedInRackedOut</td>
<td>VT_I4</td>
<td>R</td>
<td>DIS RackedIn RackedOut</td>
</tr>
</tbody>
</table>
**Graphic Symbols for Disconnector**

Table 9 shows the Graphic Symbols for Disconnector.

*Table 9. ANSI and IEC Type of Graphical Symbols for Disconnector*

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnector</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Intermediate position</td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Open position</td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>Closed position</td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
<tr>
<td>Bad (faulty) position</td>
<td><img src="image9.png" alt="Image" /></td>
<td><img src="image10.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Figure 31 shows Aspects of Current Transformer in Object Type Structure.

<table>
<thead>
<tr>
<th>Aspects of CTR</th>
<th>Modified</th>
<th>Desc...</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event List</td>
<td>1/15/2013 6:45:03...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>Alarm List</td>
<td>1/15/2013 6:44:41...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>AlarmAndLockControl</td>
<td>7/14/2012 12:44,...</td>
<td>False</td>
<td>AlarmAndLockControl</td>
<td></td>
</tr>
<tr>
<td>AC Category Definition</td>
<td>10/7/2011 2:26,...</td>
<td>The...</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>10/19/2011 2:53,...</td>
<td>Obj...</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>PCA Upload Type</td>
<td>10/17/2011 2:27,...</td>
<td>Obj...</td>
<td>False</td>
<td>Controller Upload Type</td>
</tr>
<tr>
<td>IPmMainviewCTR</td>
<td>1/21/2013 12:45,...</td>
<td>Obj...</td>
<td>False</td>
<td>Faceplate Element PG2</td>
</tr>
<tr>
<td>Main Faceplate</td>
<td>2/9/2013 11:57:13...</td>
<td>False</td>
<td>False</td>
<td>Faceplate PG2</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>10/17/2011 4:45,...</td>
<td>A name...</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Functional Objects Reference</td>
<td>10/10/2011 2:26,...</td>
<td>False</td>
<td>False</td>
<td>Functional Objects</td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>1/18/2013 6:31:0,...</td>
<td>True</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>ipacCTR_IEC</td>
<td>2/9/2014 0:00:05...</td>
<td>Graphic...</td>
<td>False</td>
<td>Graphic Element PG2</td>
</tr>
<tr>
<td>AlarmControl</td>
<td>4/27/2014 0:12:35...</td>
<td>Graphic...</td>
<td>True</td>
<td>Graphic Element PG2</td>
</tr>
<tr>
<td>ipacCTR_ANSI</td>
<td>1/9/2013 2:59:51...</td>
<td>Graphic...</td>
<td>True</td>
<td>Graphic Element PG2</td>
</tr>
<tr>
<td>LockControl</td>
<td>5/14/2010 2:52:4...</td>
<td>Graphic...</td>
<td>True</td>
<td>Graphic Element PG2</td>
</tr>
<tr>
<td>IEDSignalMapping</td>
<td>1/21/2013 10:03,...</td>
<td>This...</td>
<td>False</td>
<td>IEDSignalMapping</td>
</tr>
<tr>
<td>Library Member</td>
<td>10/15/2012 2:36,...</td>
<td>False</td>
<td>False</td>
<td>Library Member</td>
</tr>
<tr>
<td>Name</td>
<td>10/17/2011 2:26,...</td>
<td>The...</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>Object Icon</td>
<td>10/15/2011 3:11,...</td>
<td>Icon...</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>Object Type Reference</td>
<td>10/17/2011 2:26,...</td>
<td>False</td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>CTR Type Definition</td>
<td>10/9/2012 1:07:5,...</td>
<td>False</td>
<td>False</td>
<td>Object Type Definition</td>
</tr>
<tr>
<td>Object Type Reference</td>
<td>10/17/2011 2:26,...</td>
<td>False</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
<tr>
<td>Control Connection</td>
<td>3/21/2013 10:03,...</td>
<td>Holds...</td>
<td>False</td>
<td>OPC Control Connection</td>
</tr>
<tr>
<td>Operator Note</td>
<td>6/26/2012 5:52:2...</td>
<td>Oper...</td>
<td>False</td>
<td>Operator Note</td>
</tr>
</tbody>
</table>

Figure 31. Aspects of Current Transformer
The Current Transformer has Faceplate view. The Faceplate view contains Main tab that displays the values of the Current Transformer as shown in Figure 32.

Figure 32. Current Transformer Faceplate
Control Connection Aspect

Table 10 describes the properties defined for Current Transformer Control Connection Aspect.

Table 10. Current Transformer - Control Connection Aspect

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhaseCurrentL1</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L1</td>
</tr>
<tr>
<td>PhaseCurrentL2</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L2</td>
</tr>
<tr>
<td>PhaseCurrentL3</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current L3</td>
</tr>
<tr>
<td>PhaseCurrentN</td>
<td>VT_R4</td>
<td>R</td>
<td>Phase Current N</td>
</tr>
</tbody>
</table>

Graphic Symbols for Current Transformer

Table 11 shows the Graphic Symbols for Current Transformer.

Table 11. ANSI and IEC Type of Graphical Symbols for Current transformer

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Transformer</td>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
</tr>
</tbody>
</table>
### Faceplate of Power Transformer

Figure 33 shows the Aspects of Power Transformer object in Object Type Structure.

#### Figure 33. Aspects of Power Transformer
Figure 34 shows the Faceplate of the Power Transformer Conducting Equipment.

Figure 34. Power Transformer Faceplate

Control Logic for Power Transformer Faceplate

Procedures for controlling the PTR:

1. The button , is used to raise the Tap changer position.
2. The button , is used to lower the Tap changer position.
3. Click the  button followed with apply button  to execute the Raise tap change.
4. Click the  button followed with apply button  to execute the Lower tap change.
5. The apply button  is not enabled before the  button OR  button is clicked.
6. The cancel button \( \text{cancel} \) is not enabled before the \( \text{up} \) button OR \( \text{down} \) button is clicked.

The HH, H, L, LL alarms displayed in the Monitor2 tab are from the respective Control Connection Aspect boolean property whose value is set within IED.

**Control Connection Aspect**

Table 12 describes the properties defined for Power Transformer Control Connection Aspect.

*Table 12. Power Transformer - Control Connection Aspect*

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ActivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Active Power</td>
</tr>
<tr>
<td>Frequency</td>
<td>VT_R4</td>
<td>R</td>
<td>Frequency</td>
</tr>
<tr>
<td>HighSidePhaseCurrentN</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Current N</td>
</tr>
<tr>
<td>HighSidePhaseCurrentL1</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Current L1</td>
</tr>
<tr>
<td>HighSidePhaseCurrentL2</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Current L2</td>
</tr>
<tr>
<td>HighSidePhaseCurrentL3</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Current L3</td>
</tr>
<tr>
<td>HighSidePhaseVoltageL12</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Voltage L12</td>
</tr>
<tr>
<td>HighSidePhaseVoltageL23</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Voltage L23</td>
</tr>
<tr>
<td>HighSidePhaseVoltageL31</td>
<td>VT_R4</td>
<td>R</td>
<td>High Side Phase Voltage L31</td>
</tr>
<tr>
<td>LowSidePhaseCurrentN</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Current N</td>
</tr>
<tr>
<td>LowSidePhaseCurrentL1</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Current L1</td>
</tr>
<tr>
<td>LowSidePhaseCurrentL2</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Current L2</td>
</tr>
<tr>
<td>LowSidePhaseCurrentL3</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Current L3</td>
</tr>
<tr>
<td>LowSidePhaseVoltageL12</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Voltage L12</td>
</tr>
<tr>
<td>LowSidePhaseVoltageL23</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Voltage L23</td>
</tr>
<tr>
<td>LowSidePhaseVoltageL31</td>
<td>VT_R4</td>
<td>R</td>
<td>Low Side Phase Voltage L31</td>
</tr>
<tr>
<td>PowerFactor</td>
<td>VT_R4</td>
<td>R</td>
<td>Power Factor</td>
</tr>
</tbody>
</table>
Table 12. Power Transformer - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTRLocalRemoteStatus</td>
<td>VT_BOOL</td>
<td>R</td>
<td>PTR Local Remote Status</td>
</tr>
<tr>
<td>PTRNumberOfOperations</td>
<td>VT_I4</td>
<td>R</td>
<td>PTR Number of Operations</td>
</tr>
<tr>
<td>PRTTapIndicationQuality</td>
<td>VT_BSTR</td>
<td>R</td>
<td>Tap Changer Quality</td>
</tr>
<tr>
<td>PRTTapIndicationTime</td>
<td>VT_DATE</td>
<td>R</td>
<td>Tap Changer Time Stamp</td>
</tr>
<tr>
<td>PRTTapPosition</td>
<td>VT_I4</td>
<td>R</td>
<td>Tap Changer Position</td>
</tr>
<tr>
<td>ReactivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Reactive Power</td>
</tr>
<tr>
<td>ResidualVoltage</td>
<td>VT_R4</td>
<td>R</td>
<td>Residual Voltage</td>
</tr>
<tr>
<td>TapChangerCommand</td>
<td>VT_I4</td>
<td>R/W</td>
<td>Tap Changer Rise / Lower Command</td>
</tr>
<tr>
<td>WindingTempH</td>
<td>VT_BOOL</td>
<td>R</td>
<td>WindingTemperature H</td>
</tr>
<tr>
<td>WindingTempHH</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Winding Temperature HH</td>
</tr>
<tr>
<td>WindingTempL</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Winding Temperature L</td>
</tr>
<tr>
<td>WindingTempLL</td>
<td>VT_BOOL</td>
<td>R</td>
<td>Winding Temperature LL</td>
</tr>
</tbody>
</table>

Graphic Symbols for Power Transformer

Table 11 shows the Graphic Symbols for Power Transformer.

Table 13. Graphical Symbols ANSI and IEC Type

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Transformer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two Windings without Tap Changer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 13. Graphical Symbols ANSI and IEC Type  (Continued)

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Windings with Tap Changer</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Three Windings without Tap Changer</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Three Windings with Tap Changer</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Figure 35 shows Aspects of Power Transformer Winding object in Object Type Structure and this object has no Faceplates.

<table>
<thead>
<tr>
<th>Aspects of PTW</th>
<th>Modified</th>
<th>Description</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Aspect Category Definition</td>
<td>4/23/2012 1:54:5...</td>
<td>The base Aspect Category category</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>8/8/2012 2:04:39...</td>
<td>Objects with this aspect are candidates for the controller name</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>PCA Upload Type</td>
<td>5/14/2012 5:57:2...</td>
<td>Object Types with this aspect are candidates for the PCA Upload Type</td>
<td>False</td>
<td>Controller Upload Type</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>7/18/2012 3:25:1...</td>
<td>A name that holds the functional designation</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Functional Objects Reference</td>
<td>4/23/2012 1:54:5...</td>
<td>The name of the objects that describe the functional objects</td>
<td>False</td>
<td>Functional Objects</td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>1/18/2013 6:31:0...</td>
<td>True for general properties</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>Library Member</td>
<td>7/18/2012 3:24:3...</td>
<td>False for library member</td>
<td>False</td>
<td>Library Member</td>
</tr>
<tr>
<td>Name</td>
<td>4/23/2012 1:54:5...</td>
<td>The basic name used for most objects</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>Object Icon</td>
<td>5/14/2012 5:52:0...</td>
<td>Icon for an object.</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>Object Type Description</td>
<td>4/23/2012 1:54:5...</td>
<td>False for object type description</td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>Object Type Definition</td>
<td>4/23/2012 1:54:5...</td>
<td>False for object type definition</td>
<td>False</td>
<td>Object Type Definition</td>
</tr>
<tr>
<td>Object Type Structure</td>
<td>4/23/2012 1:54:5...</td>
<td>[Object Type Structure] for object structure</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
</tbody>
</table>

Figure 35. Aspects of Power Transformer Winding
Figure 36 shows the Aspects of Low Tap Change object in Object Type Structure and this object has no Faceplates.

<table>
<thead>
<tr>
<th>Aspects of LTC</th>
<th>Modified</th>
<th>Description</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aspects Category Definition</td>
<td>4/23/2012 10:28:07 AM</td>
<td>The base Aspect C... False</td>
<td>False</td>
<td>Aspects Category Definition</td>
</tr>
<tr>
<td>2. Controller Name</td>
<td>8/9/2012 2:04:28 PM</td>
<td>Objects with this a... False</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>3. Functional Designation</td>
<td>7/10/2012 3:28:03 PM</td>
<td>A name that holds ... False</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>5. Library Member</td>
<td>7/10/2012 3:29:33 PM</td>
<td>False</td>
<td>True</td>
<td>Library Member</td>
</tr>
<tr>
<td>6. LTC Type Definition</td>
<td>6/25/2012 2:38:44 PM</td>
<td>False</td>
<td>False</td>
<td>LTC Type Definition</td>
</tr>
<tr>
<td>7. Name</td>
<td>4/23/2012 10:28:07 AM</td>
<td>The basic name us... False</td>
<td>False</td>
<td>Name</td>
</tr>
<tr>
<td>8. Object Icon</td>
<td>5/14/2012 5:52:09 PM</td>
<td>Icon for an object. False</td>
<td>False</td>
<td>Object Icon</td>
</tr>
<tr>
<td>9. Object Type Structure</td>
<td>4/23/2012 10:28:07 AM</td>
<td>[Object Type Struct... False</td>
<td>False</td>
<td>Object Type Structure</td>
</tr>
<tr>
<td>10. Object Type Reference</td>
<td>4/23/2012 10:28:07 AM</td>
<td>False</td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>11. Operation Display Selection</td>
<td>1/18/2013 6:33:10 PM</td>
<td>True</td>
<td>False</td>
<td>General Properties</td>
</tr>
<tr>
<td>12. PCA Upload Type</td>
<td>5/14/2012 3:50:09 PM</td>
<td>Object Types with ... False</td>
<td>False</td>
<td>Controller Upload Type</td>
</tr>
</tbody>
</table>

Figure 36. Aspects of Low Tap Change
Faceplate of Generator

Figure 37 shows the Aspects of Generator object in Object Type Structure.

<table>
<thead>
<tr>
<th>Aspects of GEN</th>
<th>Modified</th>
<th>Desc.</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm List</td>
<td>1/15/2013 6:46:1...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>Event List</td>
<td>1/15/2013 6:47:1...</td>
<td>This...</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>Alarm And Lock Control</td>
<td>7/14/2012 12:46:1...</td>
<td>False</td>
<td>Alarm and Lock Control</td>
<td></td>
</tr>
<tr>
<td>Aspect Category Definition</td>
<td>9/15/2007 12:47:1...</td>
<td>False</td>
<td>Aspect Category Definition</td>
<td></td>
</tr>
<tr>
<td>Controller Name</td>
<td>9/19/2007 8:56:1...</td>
<td>False</td>
<td>Controller Name</td>
<td></td>
</tr>
<tr>
<td>PCA Upload Type</td>
<td>9/19/2007 8:50:0...</td>
<td>False</td>
<td>Controller Upload Type</td>
<td></td>
</tr>
<tr>
<td>plcStatus GEN</td>
<td>1/18/2013 2:18:1...</td>
<td>False</td>
<td>Faceplate Element P62</td>
<td></td>
</tr>
<tr>
<td>plcMeasurements GEN</td>
<td>1/18/2013 12:34:1...</td>
<td>False</td>
<td>Faceplate Element P62</td>
<td></td>
</tr>
<tr>
<td>plcEmView GEN</td>
<td>1/19/2013 4:47:1...</td>
<td>False</td>
<td>Faceplate Element P62</td>
<td></td>
</tr>
<tr>
<td>Main Faceplate</td>
<td>1/13/2013 4:27:5...</td>
<td>False</td>
<td>Faceplate P62</td>
<td></td>
</tr>
<tr>
<td>Functional Designation</td>
<td>3/2/2008 11:49:1...</td>
<td>False</td>
<td>Functional Designation</td>
<td></td>
</tr>
<tr>
<td>Functional Objects Reference</td>
<td>5/15/2007 12:47:1...</td>
<td>False</td>
<td>Functional Objects</td>
<td></td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>1/18/2013 6:31:0...</td>
<td>True</td>
<td>General Properties</td>
<td></td>
</tr>
<tr>
<td>General Properties</td>
<td>4/24/2012 6:33:4...</td>
<td>False</td>
<td>General Properties</td>
<td></td>
</tr>
<tr>
<td>genGEN_JEC</td>
<td>1/9/2013 4:37:53...</td>
<td>False</td>
<td>JEC Element P62</td>
<td></td>
</tr>
<tr>
<td>Alarm Control</td>
<td>4/25/2010 4:12:5...</td>
<td>False</td>
<td>JEC Element P62</td>
<td></td>
</tr>
<tr>
<td>genGEN ANSI</td>
<td>1/9/2013 4:37:40...</td>
<td>False</td>
<td>ANSI Element P62</td>
<td></td>
</tr>
<tr>
<td>Lock Control</td>
<td>5/14/2010 2:52:4...</td>
<td>False</td>
<td>Lock Element P62</td>
<td></td>
</tr>
<tr>
<td>genGenerator</td>
<td>1/9/2013 4:38:37...</td>
<td>False</td>
<td>generator P62</td>
<td></td>
</tr>
<tr>
<td>IEDSignalMapping</td>
<td>11/27/2012 1:43:1...</td>
<td>False</td>
<td>IEDSignalMapping</td>
<td></td>
</tr>
<tr>
<td>Library Member</td>
<td>10/19/2012 2:43:1...</td>
<td>False</td>
<td>Library Member</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>10/24/2007 10:5...</td>
<td>False</td>
<td>Name</td>
<td></td>
</tr>
<tr>
<td>Object Icon</td>
<td>9/19/2007 10:52:1...</td>
<td>False</td>
<td>Object Icon</td>
<td></td>
</tr>
<tr>
<td>Object Type Reference</td>
<td>5/15/2007 12:47:1...</td>
<td>False</td>
<td>Object Type</td>
<td></td>
</tr>
<tr>
<td>GEN Type Definition</td>
<td>10/9/2012 11:34:1...</td>
<td>False</td>
<td>GEN Type Definition</td>
<td></td>
</tr>
<tr>
<td>Object Type Structure</td>
<td>3/17/2008 2:38:0...</td>
<td>False</td>
<td>Object Type Structure</td>
<td></td>
</tr>
<tr>
<td>Control Connection</td>
<td>10/10/2012 2:44:1...</td>
<td>False</td>
<td>Control Connection</td>
<td></td>
</tr>
<tr>
<td>Operator Note</td>
<td>2/25/2010 2:32:5...</td>
<td>False</td>
<td>Operator Note</td>
<td></td>
</tr>
</tbody>
</table>

Figure 37. Aspects of Generator
Figure 38 shows the Faceplate Generator Conducting Equipment.

![Figure 38. Generator Faceplate](image)

Control Connection Aspect

Table 14 describes the properties defined for Generator Control Connection Aspect.

Table 14. Generator Transformer - Control Connection Aspect

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ActivePower</td>
<td>VT_R4</td>
<td>R</td>
<td>Active Power</td>
</tr>
<tr>
<td>CBRPositionStatus</td>
<td>VT_I4</td>
<td>R</td>
<td>CBR Position Status</td>
</tr>
<tr>
<td>EarthingSwitchPosition</td>
<td>VT_I4</td>
<td>R</td>
<td>Earth Switch Position Status</td>
</tr>
<tr>
<td>Frequency</td>
<td>VT_R4</td>
<td>R</td>
<td>Frequency</td>
</tr>
</tbody>
</table>
Table 14. Generator Transformer - Control Connection Aspect (Continued)

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeneratorControlBreakerFaulty</td>
<td>VT.BOOL</td>
<td>R</td>
<td>Generator Control Breaker Faulty</td>
</tr>
<tr>
<td>GENLocalRemoteStatus</td>
<td>VT.BOOL</td>
<td>R</td>
<td>Generator Local/Remote Status</td>
</tr>
<tr>
<td>GENMVARh</td>
<td>VT.I4</td>
<td>R</td>
<td>Demand VAr Hour</td>
</tr>
<tr>
<td>GENMWWh</td>
<td>VT.I4</td>
<td>R</td>
<td>Demand Watt Hour</td>
</tr>
<tr>
<td>GENPhaseCurrentL1</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Current L1</td>
</tr>
<tr>
<td>GENPhaseCurrentL2</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Current L2</td>
</tr>
<tr>
<td>GENPhaseCurrentL3</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Current L3</td>
</tr>
<tr>
<td>GENPhaseVoltageL12</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Voltage L12</td>
</tr>
<tr>
<td>GENPhaseVoltageL23</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Voltage L23</td>
</tr>
<tr>
<td>GENPhaseVoltageL31</td>
<td>VT.R4</td>
<td>R</td>
<td>Generator Phase Voltage L31</td>
</tr>
<tr>
<td>PowerFactor</td>
<td>VT.R4</td>
<td>R</td>
<td>Power Factor</td>
</tr>
<tr>
<td>ReactivePower</td>
<td>VT.R4</td>
<td>R</td>
<td>Reactive Power</td>
</tr>
</tbody>
</table>

Graphic Symbols for Generator

Table 11 shows the Graphic Symbols for Generator.

Table 15. ANSI and IEC Type Graphical Symbols for Generator

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator</td>
<td>GEN</td>
<td>G</td>
</tr>
</tbody>
</table>
Faceplate of Voltage Transformer

Figure 39 shows Aspects of Voltage Transformer object in Object Type Structure.

<table>
<thead>
<tr>
<th>Aspects of VTR</th>
<th>Modified</th>
<th>Description</th>
<th>Inherited</th>
<th>Category name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event List</td>
<td>1/15/2013 6:46p</td>
<td>This aspect category is used to create the event list.</td>
<td>False</td>
<td>Alarm and Event List</td>
</tr>
<tr>
<td>Alarm List</td>
<td>1/15/2013 6:46p</td>
<td>This aspect category is used to create the alarm list.</td>
<td>False</td>
<td>Alarm and Event Let</td>
</tr>
<tr>
<td>AlarmAndLockControl</td>
<td>7/14/2012 12:44</td>
<td>This aspect category is used to create the alarm and lock control list.</td>
<td>False</td>
<td>AlarmAndLockControl</td>
</tr>
<tr>
<td>Aspect Category Definition</td>
<td>10/17/2011 2:26</td>
<td>The base Aspect Category category</td>
<td>False</td>
<td>Aspect Category Definition</td>
</tr>
<tr>
<td>Controller Name</td>
<td>10/17/2011 2:26</td>
<td>Objects with this aspect are candidate for controller.</td>
<td>False</td>
<td>Controller Name</td>
</tr>
<tr>
<td>Object Type</td>
<td>10/17/2011 2:26</td>
<td>Objects with this aspect are candidate for object type.</td>
<td>False</td>
<td>Object Type</td>
</tr>
<tr>
<td>Main Faceplate</td>
<td>10/17/2011 2:26</td>
<td>Object aware building block for faceplate.</td>
<td>False</td>
<td>Main Faceplate</td>
</tr>
<tr>
<td>Functional Designation</td>
<td>10/17/2011 2:26</td>
<td>A name that holds the functional designations.</td>
<td>False</td>
<td>Functional Designation</td>
</tr>
<tr>
<td>Operation Display Selection</td>
<td>10/17/2011 2:26</td>
<td>Operation display selection</td>
<td>False</td>
<td>Operation Display Selection</td>
</tr>
</tbody>
</table>

Figure 39. Aspects of Voltage Transformer
The Voltage Transformer faceplate contains a Main tab that displays the Voltage values as shown in Figure 40.

![Voltage Transformer Faceplate](image)

*Figure 40. Voltage Transformer Faceplate*
Control Connection Aspect

Table 16 describes the properties defined for Voltage Transformer Control Connection Aspect.

Table 16. Voltage Transformer - Control Connection Aspect

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Data Type</th>
<th>Access</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhaseVoltageL12</td>
<td>VT_R4</td>
<td>R</td>
<td>Voltage between Phases L12</td>
</tr>
<tr>
<td>PhaseVoltageL23</td>
<td>VT_R4</td>
<td>R</td>
<td>Voltage between Phases L23</td>
</tr>
<tr>
<td>PhaseVoltageL31</td>
<td>VT_R4</td>
<td>R</td>
<td>Voltage between Phases L31</td>
</tr>
<tr>
<td>ResidualVoltage</td>
<td>VT_R4</td>
<td>R</td>
<td>Residual Voltage</td>
</tr>
</tbody>
</table>

Graphic Symbols for Voltage Transformer

Table 11 shows the Graphic Symbols for Voltage Transformer.

Table 17. ANSI and IEC Type Graphical Symbols for Voltage Transformer

<table>
<thead>
<tr>
<th>Element</th>
<th>ANSI Format</th>
<th>IEC Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Transformer</td>
<td>![ ANSI Format ]</td>
<td>![ IEC Format ]</td>
</tr>
</tbody>
</table>
Control Connection Aspect

The Control Connection aspect have a predefined properties that are used in the faceplates of the corresponding Conducting Equipment. Each conducting equipment has an IED Signal Mapping aspect, with assigned .csv file as a template for default mapping of IED Attribute to predefined properties of conducting equipment and their Faceplate.

The IED Signal Mapping aspect, is a graphical interface represented by,

- **Property Name**, which defines a generic property name of the IED types
- **Remote LN Reference**, column defines the logical node rules for sharing LN data access across Substation, Voltage, Bay, Conducting Equipment
- **IED type**, each columns represents an IED type with the Logical Node attributes. This can be updated with IED types as required for the project.

For example, a default mapping is prepared for default ABB IEDs. But this mapping must be verified and updated during the start of project based on the type of IED used in the project.

The uploader automatically creates the correct mapping between conducting equipment and the IED type during .scd file update or import.
For more details on IED Signal Mapping and Uploader functionality, refer to System 800xA IEC 61850 Connect Configuration (9ARD171387*) Manual.
Figure 42 shows **Control Connection Aspect - OPC Tab** of the Bay Conducting Equipment object.

Figure 42. Control Structure - Bay Control Connection Aspect
Faceplates Localization

For Localizing the Faceplates from English to other language, perform the following steps:

1. Select **Functional Objects** under **Object Type Structure** and Open **NLS Resource Manager** Aspect as shown in **Figure 43**.

![Figure 43. NLS resource Manager Aspect](image)

2. Click **Add Locale**, and select the required language in the list of available languages.

   In this example, select **German (Germany)** as locale language.
3. The selected **German (Germany)** language is listed as shown in Figure 45.

![Figure 44. NLS Add Locale Language](image)

![Figure 45. NLS Locale Language listed](image)
4. The new column created for the language needs to be filled up with respective translated text for all NLS IDs to display those translated text in Faceplates instead of English language.

   English (United States) is added by default.

   For changing the **Windows Regional Settings**, refer to *Section 4 Regional Setting, Installation Guide (2PAA102031*)*. 
Section 4  Re Configuration

This topic explains the re-configuration of Faceplates when additional changes are required by the Project. The steps are as follows:

- Create Child Library of IEC61850 Base Library
- Addition and Modification of Graphic Elements
- Customize faceplates as per requirement
- Configure NLS Resource manager to include new NLS IDs

Create New version of Base Library IEC61850 Object Types

Create a new version of all the Object Types of IEC61850 base Library and extension libraries and link these new extension libraries to the newly created base library version.

It is mandatory that the version number of instantiated IEC 61850 Object Type Library is not higher than the Feature version number specified in the License (*.sla) file for Feature IEC61850_FP_LIB.

For more details, refer to System 800xA IEC 61850 Connect Configuration (9ARD171387*) Manual.
Addition and Modification of Graphic Elements

This section describes how to create and modify user defined faceplates and graphic elements containing only IEC 61850 data along with other connectivity data.

Faceplates and Graphic Elements Containing IEC 61850 Data

While creating faceplates or graphic elements for an object of existing default set of object types. Perform the following steps to create the faceplate/faceplate element/graphic element in the chosen object type:

1. Only the users with application engineer rights can create faceplates and graphic elements.

2. Graphic elements and faceplates must be created only for Functional Structure object types.

While creating a faceplate for an object type that is not part of the default set of object types, create a new object type under the ‘Functional Objects’ folder. The new object type name and type name in SCD file must be the same.

Perform the following steps, to create/edit a faceplate for an object type:

1. Open the Plant Explorer.

Section 4  Re Configuration  
Faceplates and Graphic Elements Containing IEC 61850 Data

IEC61850_ObjectTypes_GraphicsExtLib 1.0.0, Extension Library Version.

![Image of Plant Explorer with Extension Library Selected](image1)

**Figure 46. Plant Explorer With Extension Library Selected**

3. Select the **Extension Library Version Definition** aspect from the Aspects List.

![Image of Aspects List](image2)

**Figure 47. Aspects List With Extension Library Version Definition Selected**

![Figure 48. Aspect Preview With New Version Selected](image)

5. In the **New Version** dialog box, select the number in Major version and click **Create**.
   
   Ensure that the number for major version is greater than 1.

![Figure 49. New Version Dialog Box](image)


7. Navigate to the object type in the **Object Type Structure**.
8. Select the object on which you want to create/edit the faceplate (For example, the DIS, Object Type).

![Object Type Group With Object Selected](image)

*Figure 50. Object Type Group With Object Selected*


For more information, refer to *System 800xA Engineering Process Graphics (3BSE049230*)*.  

**Faceplates and Graphic Elements Containing Data from Other Connectivity**

The faceplates and graphic elements have to be created on the instances in *Functional Structure* using standard 800xA functionalities.

All graphic elements and faceplates created are customizable using standard 800xA functionalities.

For more information on addition and modification of graphic elements, refer to *System 800xA Engineering Process Graphics (3BSE049230*)*.

**Configuring the Control Connection Aspect of Functional Objects**

The *Control Connection* aspect of the functional objects can have predefined attributes for use in the faceplates/graphic elements. These predefined attributes can be made to obtain data from a particular type of logical node, which are associated
with a functional object. For example, a functional object CBR can be associated with LN XCBR and CILO. The predefined attribute in the CBR object can be configured to get data from XCBR logical node. This can be achieved by providing a name syntax for the predefined attribute of the functional object (CBR in the above example). The following is the syntax:

\[ \text{<LN name>\_<instance number>.<attribute of the LN>.} \]

**Example**

A predefined attribute in the Control Connection aspect of CBR Object Type can contain an attribute like ‘XCBR_1.BlkOpn.stVal’.

This means that the attribute ‘XCBR_1.BlkOpn.stVal’, refers to ‘Blkopn.stVal’ attribute of the first instance of the XCBR Logical Node (first instance under the functional object CBR).

During upload, the Uploader parses this syntax and puts the appropriate OPC Item ID for this attribute.

Use the above syntax to predefined the Control Connection aspect of the functional objects and use this predefined attribute in the faceplate element/graphic element.
Figure 51 shows a snapshot of an example of Control Connection aspect in the CBR Object Type.

Figure 51. Example of Control Connection Aspect Configuration in a Functional Object.
Figure 52 shows an example of OPC Item ID that is added by the Uploader, by parsing the name given in the Control Connection aspect.

Figure 52. Example of OPC Item ID Addition by Uploader

Customize Faceplates

Perform the following steps to customize the faceplates. For new text elements added in Faceplate, it is required to create and assign NLS resource IDs.

Creating NLS IDs

Perform the following steps to create NLS IDs for new text items:
1. Select **Functional Objects** under **Object Type Structure** and Open **NLS Resource Manager** Aspect as shown in Figure 53.

![Figure 53. NLS Resource Manager](image)

1. Click **Add** and enter the new NLS Resource ID name.

   In this example, Add **Voltage** as new Resource ID.

Use the following convention for the NLSID: NLSID_<user-defined name>.
The new Resource ID **Voltage** is added in the NLS Resource Manager Aspect.

**Figure 54. NLS New Resource ID**

**Figure 55. NLS New Resource ID**
2. Select and click on the required **NLS Resource ID** from the **Resource ID list** to add the text string.

![Figure 56. NLS Resource Language Text Label](image.png)

3. Click **Language** column of the resource Id to translate.
   a. In the **Text** field, enter the text string.
   b. Click **Apply** to save the changes
Edited Faceplate

1. Right-click the Faceplate and select Edit from the context menu.
   
   In this example, Circuit Breaker faceplate is in the edit mode.

![Circuit Breaker Edit, Context Menu](image)

Figure 57. Circuit Breaker Edit, Context Menu
2. Add dynamic fields and text elements as required
3. Go to properties of the selected text and click on **Text**.
4. Click on the **Expression Window** in the Text field and click on **Localized Text**.

![Figure 59. NLS Text - Properties](image)

5. Select **NLSID_Voltage** and click **Insert selection**.
6. Click **Apply**.

*Figure 60. Faceplate Text Update*
The **NLSID Local** Resource ID is updated in the faceplate element.

*Figure 61. NLS Text - Localized Text*
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