

System 80xA Engineering Engineering Studio Topology Designer

System Version 6.0

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System 800xA Engineering

Engineering Studio Topology Designer

System Version 6.0

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Revision History

Updates in Revision Index A85
Updates in Revision Index B86
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About this User Manual

General



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 Topology Designer, the engineering tool for system-wide Topology Diagrams. It also describes the use of Topology Designer as a Topology Status Viewer in operation and maintenance of a plant.

Topology Diagrams visualize the control system topology including live system status information of hardware unit objects. User can configure Topology Diagrams to include any further accessible system or plant information.

[Section 1, Introduction](#) provides an introduction to Topology Designer and Topology Status Viewer.

[Section 2, Configuration](#) describes configuration and application procedures with Topology Designer and Topology Status Viewer.

For a quick start user can read [Features of Topology Designer](#) on page 14 and [Getting Started](#) on page 23 (including [Application Tutorial](#) on page 31) first.



Topology Designer shares its Graphic Editor Reference with Function Designer. For more information, refer to *System 800xA Engineering, Function Designer (3BDS011224*)*, section Graphic Editor Reference.

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

Feature Pack functionality in an existing figure is indicated using callouts.

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 *System 800xA System Guide Functional Description (3BSE038018*)*. 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.

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 Documents (3BUA000263*)*.

System 800xA Released User Documents (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 Documents (3BUA000263*)* is updated and published to ABB SolutionsBank.

Section 1 Introduction

Product Overview

Topology Designer is the engineering tool that easily allows the user to configure the following:

- On-screen graphical diagrams (Topology Diagrams) displaying the control system topology of the 800xA system, the updated status of the devices and additional system and hardware unit information.
- Aspects representing hardware unit objects by graphical symbols extended with topology related data (Topology Components) in the diagrams.

Configuration of the Topology diagrams is supported by standard diagram skeletons and templates and ready-made Topology components delivered with Topology Designer.

Topology Diagrams with updated status information are a valuable help in problem tracing and maintenance of a plant.

With Topology Designer used as Topology Status Viewer an operator or a maintenance employee can inspect and navigate these diagrams on Operator Workplaces.

Product Scope

Topology Designer is an option to System 800xA. It is delivered as a part of the Engineering Studio product, which is the base for 800xA Engineering Workplaces. It is integrated in the Plant Explorer, available in Engineering Workplace or Plant Explorer Workplace.

Topology Designer provides:

- Viewing control system topology including live status information in graphical diagrams

- Vertical navigation - top down, bottom up - throughout the control system hierarchy.
- Documenting control system topology in graphical diagrams.
- Aspect System Integration, navigation to other aspect systems through context menus.
- Facilities to create homogeneous graphical representations for different aspect systems.
- Design tool for Topology Diagrams and Topology Components.

Topology Designer is optimized for hierarchies and instances of hardware related object types within Control Structure as provided by the system extension AC 800M Connect.

Features of Topology Designer

User can create and design diagrams through Topology Designer to view and document control system topology for plants on different levels. Topology Diagrams display a consistent view to Aspect Objects within Control Structure and data available within referenced aspect systems.

Loading the Topology Designer system extensions equips the Hardware Unit Object Types for AC 800M on CPU, Communication Interface and I/O board level (currently for S800 I/O only) with Topology aspects which hold Topology components. The graphical symbols of the components visually represent these hardware units. These symbols are designed in the Component view and can be used in the Diagram view.



Topology Designer does not support creation of instances of AC 800M Connect control object types in the Control Structure (**Insert > Object...** or Drag and Drop from Object Type Structure). It does not also support **Edit > Cut, Copy, Paste** or **Paste Special**, and **Delete** on such instances.

For these object types Topology Designer currently only supports to configure Topology Components and the use of existing instances of these object types in Topology Diagrams. Use Plant Explorer or Control Builder M Professional or Bulk Data Manager to built the hardware related parts of Control Structure.

The automatic placement of symbols and the correct connection in Topology Diagrams is supported by **Snap Points**, **Ports** and special **Connector Symbols** working together with symbols for AC 800M and I/O modules.

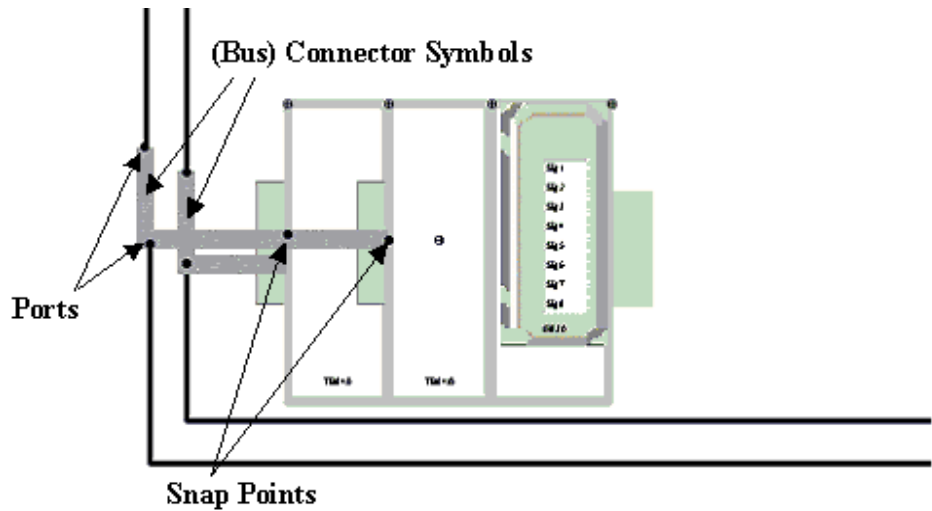


Figure 1. Connector Symbols Examples for Electrical Modulebus

Further standard **Skeletons** for Topology Diagrams (in Diagram view) on Controller and on Network level are available.

If the corresponding skeleton is opened on the Topology aspect of the Controller object then a Topology Diagram is automatically obtained displaying the Controller and its I/O as shown in [Figure 2](#).

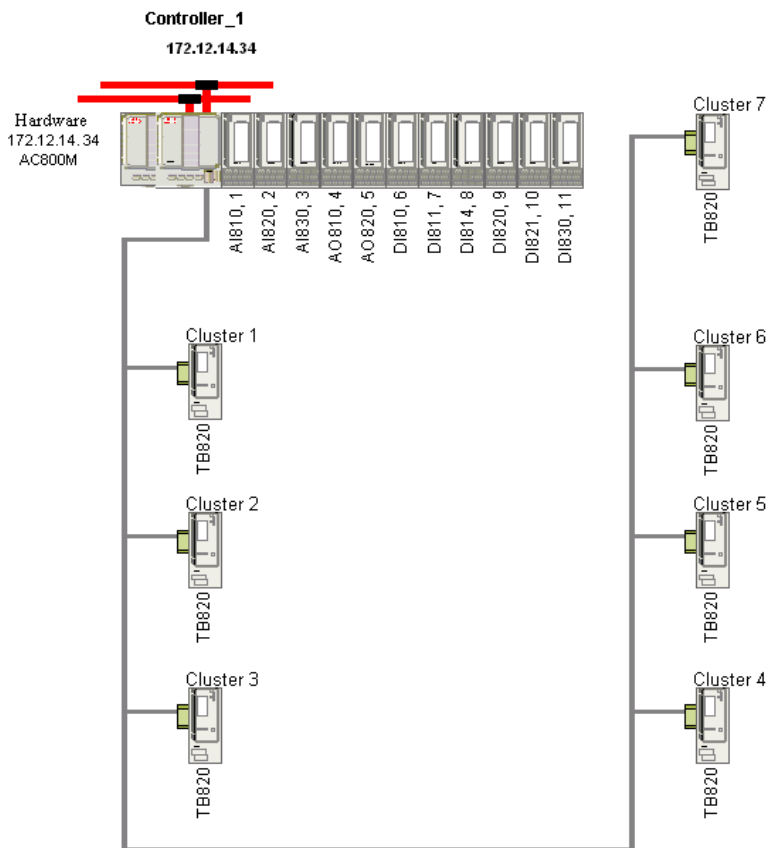


Figure 2. Topology Diagram on Controller Level



While opening the controller level diagram, the I/O hardware is not connected with the controller. Instead it appears as a separate hardware unit at the Controller level, Plant Network level, and Control Network level.

If it is connected manually at the Controller level, then it appears connected in other levels also.

If a Topology aspect is created and the corresponding skeleton is opened on the Control Network object then a Topology Diagram is obtained populated with the Controllers of the Control Network.

If a Topology aspect is created and the corresponding skeleton is opened on a higher level object, for example an additional Plant Network object created in Control Structure, the diagram can contain additionally the symbols for network objects like clients, servers, etc.



Prerequisite is that the objects representing the clients, servers and eventually other network components have been created in or inserted into Control Structure in the hierarchy below the Plant Network object and are prepared with Topology Components that provide corresponding symbols.

In the Control Network and Plant Network case, user can finalize the corresponding diagram by arranging and connecting the controller symbols and other symbols. From the Controller symbols user can call up the Controller Topology Diagrams.



The controller IP address does not appear in the Diagram view of Topology Diagram at controller level. It gets updated on manually updating the IP address in the **Aspect Properties** dialog at the controller level.

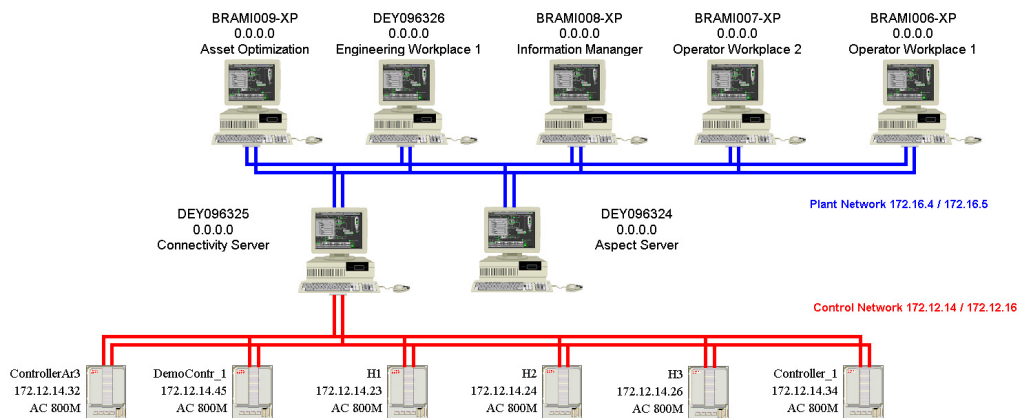


Figure 3. Topology Diagram on Plant Network Level

When the corresponding OPC server is operating and the controllers are running the live hardware status information of the Hardware Units is displayed in the Topology Diagrams.

In addition to using the pre-configured Topology components of corresponding object types and skeletons user can:

- add Topology aspects to objects and object types as required and configure the Component view with symbols specifically
- and build Topology Diagrams with free layout by manual arrangement of symbols and connecting lines.

If any Hardware Unit object types which are not supported in Topology Diagrams are to be used, such Topology components must be configured.

If the hardware unit and structure information is to be presented in a standardized layout with other purposes, then configure the skeletons. For example, I/O board connection diagrams for plant documentation.

Topology Status Viewer

To view and navigate Topology Diagrams (for example as shown in [Figure 2](#) and [Figure 3](#)) from a Graphic Display on Operator Workplaces, include an Aspect Link to the top Topology aspect in Control Structure into this Graphic Display.

As an operator or a maintenance person (with Operator Role) user can inspect the live status information in the diagrams and navigate in the hierarchy of diagrams:

1. Click the Aspect Link button in the Graphic Display to open the pop-up window with the Topology Diagram.
2. Set **Window > Workbook Mode** for the pop-up window. (Workbook mode is set by default.)
3. Switch on **View > Subscribe for Live Data**.
4. Use the object context menu item **Goto Child Diagram** (for example on a controller object shown in the diagram) to navigate to a child diagram.
5. Use the object context menu item **Goto Parent Diagram** (for example on an object shown in the diagram) to navigate to the parent diagram.

6. Navigate through the collection of opened Topology Diagrams using the Workbook tabs.

Additionally user can print the Topology Diagrams but the status of the hardware components does not appear in the printout.

Supported Hardware Libraries

Topology Designer currently supports the following AC 800M Connect Hardware Libraries using extension libraries:

- ABBProcPnlCI851HwLib
- ABBProcPnlCI854HwLib
- BasicHIHwLib
- BasicHwLib
- CI851PROFIBUSHwLib (CI only)
- CI852FFh1HwLib (CI only)
- CI853SerialComHwLib (CI only)
- CI854PROFIBUSHwLib (CI only)
- CI855MB300HwLib (CI only)
- CI856S100HwLib (CI only)
- CI857InsumHwLib (CI only)
- CI858DriveBusHwLib (CI only)
- CI860FFHSEHwLib (CI only)
- CI865SattIoHwLib
- CI868IEC61850HwLib
- CI871ProfinetHwLib
- S800CI801CI854HwLib
- S800CI830CI851HwLib
- S800CI830CI854HwLib

- S800CI840CI854HwLib
- S800IoModuleBusHwLib
- S900IoCI854HwLib
- S900IoCI851HwLib
- SerialHwLib

Prerequisites and Requirements

For more information on the installation prerequisites and requirements, refer to *System 800xA Installation and Upgrade Getting Started (2PAA111708*)*.

For more information on the post installation procedures (including system creation), refer to *System 800xA, Post Installation (2PAA111693*)*.



To get the **Topology Designer** functions in your system install the Topology Designer feature available as part of Engineering Workplace System Function.

Product Verification

User can verify the product version through **Control Panel > Programs > Programs and Features**. If the **Version** tab is not visible, then follow the steps to view the **Version** tab:

1. Right-click any available tab (such as **Name**, **Publisher**, etc).

2. Select **More...**, see [Figure 4](#).

Name	Publisher	Installed On	Size	Version
ABB 800xA History Connectivity	ABB		20.2 MB	6.0.0914.0217
ABB 800xA IEC61850 Connect SV 6.0	ABB		12.5 MB	6.0.0.33386
ABB 800xA Instructions	ABB		556 MB	6.0.0.3
ABB 800xA PLC Connect	ABB		55.1 MB	6.0.0.25
ABB 800xA RNRP 6.0.0-0 (5.4)	ABB		8.39 MB	6.0.5150.26778
ABB 800xA SoftPoint Server	ABB		29.1 MB	6.0.0.25
ABB 800xA System Installer	ABB		42.4 MB	6.0.140.8
ABB AC 800M Status Monitoring 6.0	ABB		1.47 MB	6.0.0.4
ABB AC800M Connect 6.0.0-0	ABB		247 MB	6.0.1.4
ABB AC800M HI Extension 6.0.0-0	ABB		12.4 MB	6.0.1.4
ABB ACM 6.0	ABB	2/21/2014	4.81 MB	6.0.0.18978
ABB Asset Optimization 6.0.0-0	ABB	2/21/2014	237 MB	6.0.0.8
ABB Base Software for SoftControl 6.0.0-0	ABB	2/21/2014	26.8 MB	6.0.1.4
ABB Basic HART DTM - HART DTM Builder 6.0.0.0	ABB	2/21/2014	18.2 MB	6.0.0.15
ABB Basic PROFIBUS DTM - PROFIBUS DTM Builder 6...	ABB	2/21/2014	45.4 MB	6.0.0.8
ABB Central Licensing System	ABB	2/21/2014	2.28 MB	6.0.0.10
ABB Control Builder M Professional 6.0.0-0	ABB	2/21/2014	150 MB	6.0.1.4
ABB Device Library Wizard - Client 6.0.0.0	ABB	2/21/2014	14.9 MB	6.0.0.8
ABB Device Management FOUNDATION Fieldbus 6.0...	ABB	2/21/2014	73.9 MB	6.0.8763.41108
ABB Diagnostics Collection Tool 6.0.0-0	ABB	2/21/2014	15.3 MB	6.0.0.7
ABB Diagnostics Collection Tool Plugins 6.0.0-0	ABB	2/21/2014	3.83 MB	6.0.0.7
ABB DTM S900-DP 6.0	ABB	2/21/2014	28.3 MB	6.0.5
ABB Engineering Studio 6.0	ABB	2/21/2014	279 MB	6.0.0.19172
ABB FDT Base Container 14.0.0.0	ABB	2/21/2014	25.5 MB	14.0.0.7
ABB FDT Shared Components 14.0.0.0	ABB	2/21/2014	62.7 MB	14.0.0.12
ABB Fieldbus Builder PROFIBUS HART with OPC Serv...	ABB	2/21/2014	224 MB	6.0.0.12
ABB HART Device Integration Library 6.0.0.0	ABB	2/21/2014	5.91 MB	6.0.0.8
ABB IEC61850 Operation Library for Substation Equip...	ABB	2/21/2014	7.46 MB	6.0.0.31777
ABB Inform IT - Application Scheduler 6.0.0-0	ABB	2/21/2014	16.9 MB	6.0.1114.0128
ABB Inform IT - Calculations 6.0.0-0	ABB	2/21/2014	6.50 MB	6.0.1114.0128
ABB MMS Server for AC 800M 6.0.0-0	ABB	2/21/2014	3.20 MB	6.0.1.4
ABB OPC Server for AC 800M 6.0.0-0	ABB	2/21/2014	16.5 MB	6.0.1.4
ABB PC, Network and Software Monitoring 6.0.0-0	ABB	2/21/2014	84.1 MB	6.0.0.8

Figure 4. Context Menu to Access More Information

3. Select the **Version** check box.
4. Click **OK**.

The version details are displayed below the **Version** tab.

Follow the above procedure to view other tabs such as **Support Link**, **Support Telephone**, **Help Link**, etc. User can also verify the product version from the Plant Explorer through **About IndustrialIT**.

Further, the specific product's version can be verified through its **Help > About** menu command. For example, Function Designer's version details can be verified through its **Help > About** menu command from the Diagram or Component view. The version details are displayed as shown in [Figure 5](#).



Figure 5. About Function Designer, Diagram View Window

Reporting Problems

User can report problems to the local ABB supplier. Ensure to report problems with the relevant information, such as the product version designation and build number, the description of the problem scenario, and the detailed description of the error messages that appear.

Section 2 Configuration

Getting Started

Application Start-up

Topology Designer runs integrated in Plant Explorer. Double-click the Plant Explorer Workplace or Engineering Workplace icon on the screen.



Engineering Workplace is the recommended workplace, as it adds useful engineering commands and functions to the **Advanced** context menu of aspect objects, for example Bulk Data Manager and I/O Allocation.

In Plant Explorer select the required aspect object in Control Structure, etc. Create or select a Topology aspect on this object, and Topology Designer appears as a preview window. If preview is not enabled right-click the Topology aspect, select Diagram view or Component view and Topology Designer appears as a popup window.

User Interface

The user interfaces available for Topology Designer are the preview window present within Plant Explorer and the **Topology** window. Indicator in any case is the **Topology** suffix in the drop-down list on top of the window area, respectively the corresponding window title.

Click the topology aspect of the required object to access the preview window that offers complete functionality for working with topology diagrams.

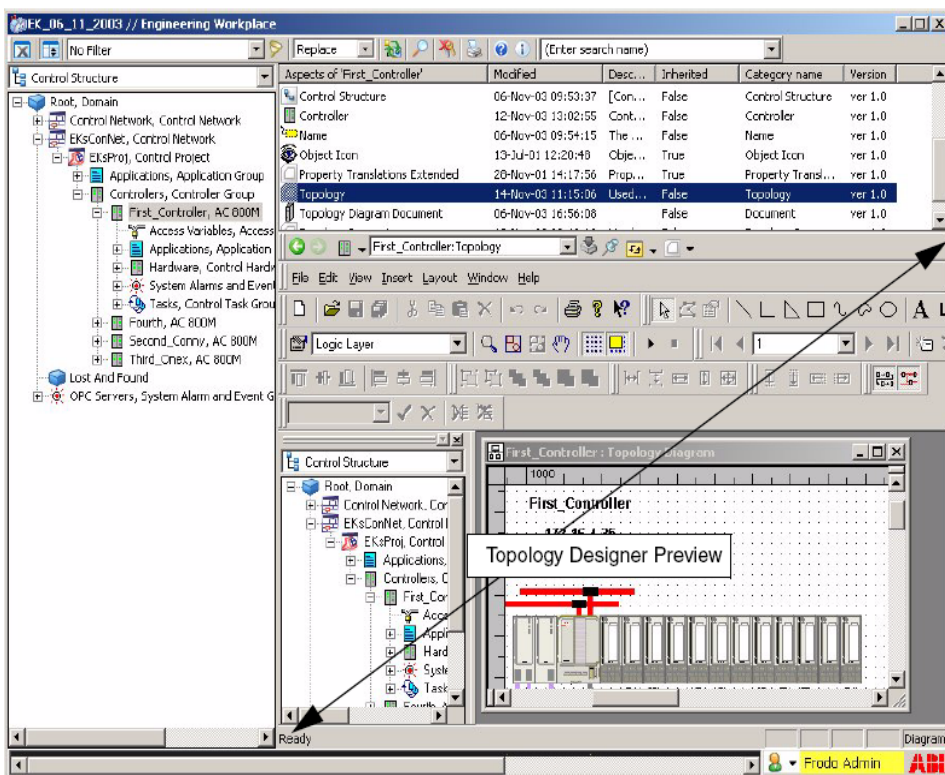


Figure 6. Topology Designer as Preview in Plant Explorer

Double-click the Topology aspect to access Topology Designer in a separate window, that can be maximized to use the complete screen. Alternatively, right-click the topology aspect and choose **Diagram** from the context menu. Choose **Component** from the context menu to directly open the topology aspect's Component view..

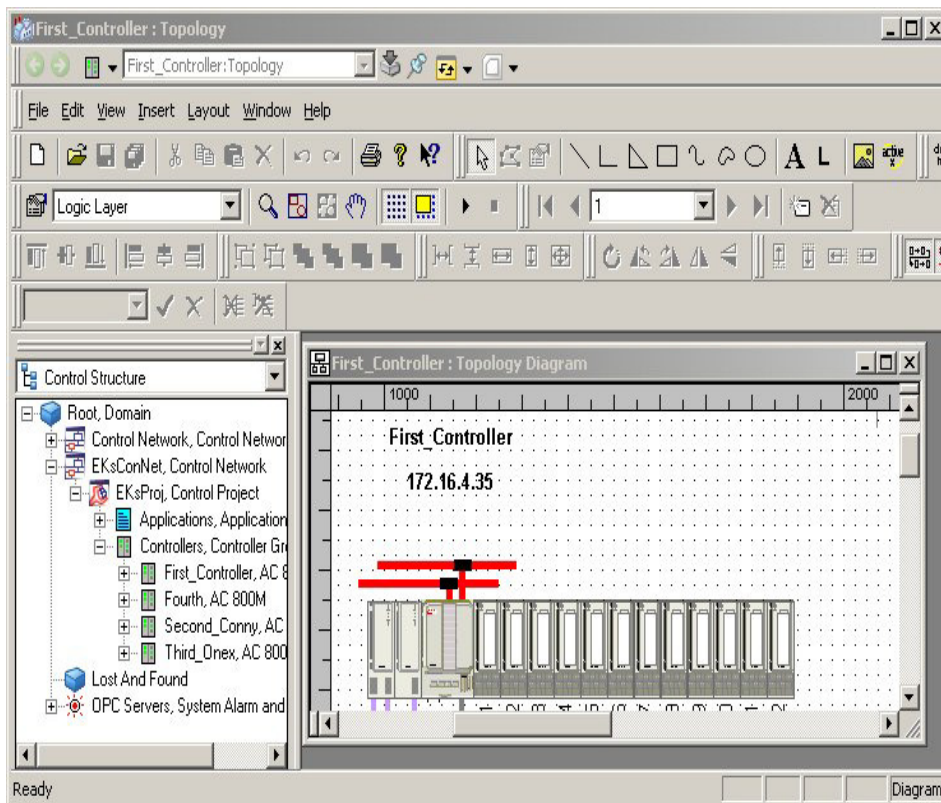


Figure 7. Topology Designer as Popup (Overlap) Window

Recommended User Interface Settings

Topology Designer menus, toolbars, and windows can be displayed within the preview window of Plant Explorer as well as in any Plant Explorer overlap window.

User can set Topology Designer user interface preferences (see [Preference Settings](#) below) such that inside the preview window only minimal set of menus, toolbars and windows is displayed, whereas within Plant Explorer popup window all user interface controls and windows are displayed.

Preference Settings

Topology Designer stores recent settings and preferences according to their scope:

- User interface preferences including customized toolbar settings and dockable windows are stored per user and per view in a workspace in the Windows registry. The first time that Topology Designer is run, none or only a minimum number of toolbars and no dockable windows are visible by default. The windows and toolbars can be arranged as desired. Next time Topology Designer is run on the same view, the window/toolbar workspace gets restored. There are four separate workspaces:
 - Plant Explorer preview window, Component View
 - Plant Explorer preview window, Diagram View
 - Plant Explorer popup window, Component View
 - Plant Explorer popup window, Diagram View

If a previous version is already installed, some newly added toolbar buttons may not be initially visible. To return to the default toolbars, and to make all toolbar buttons visible, use the menu command **View > Toolbar > Customize**. Select each toolbar and click **Reset**. Do this for the component view and the diagram view, both in preview and in popup window of Plant Explorer.



If some toolbar buttons are still not visible, open the Workplace Operating System / Server Operating System registry (run regedit) and delete the following keys:

```
HKEY_CURRENT_USER\Software\ABB Automation Products  
GmbH\EngineerIT\TDDiagramDesigner
```

```
HKEY_CURRENT_USER\Software\ABB Automation Products  
GmbH\EngineerIT\TDCComponentDesigner
```



Recent Topology Component / Diagram settings like zoom factor, grid properties, default component properties, are stored in the Topology Parameter aspect. These settings are maintained as per the Topology Component / Diagram.

Exiting Topology Designer

If a Topology Diagram is edited, the data is saved using **File > Save** or **File > Save All** before user closes Topology Designer.

Any attempt to exit Topology Designer before saving data will lead to a warning query message box like the one shown in the upper left area of [Figure 8](#).

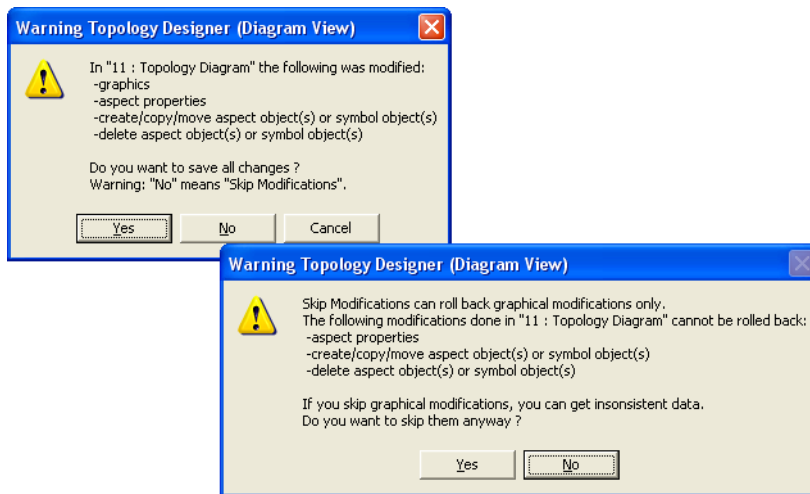


Figure 8. Attempt to Exit Topology Designer Without Saving Changes.

If user selects **No**, then a warning query message box appears as in the lower right area of [Figure 8](#).



Topology Designer can only rollback the graphic part of the changes.

To avoid possible inconsistencies always leave the second Warning box with **No** and the first query box with **Yes** or **Cancel**.

Creating a New Topology Aspect

To create a new topology aspect:

1. In Control Structure, either:
Right-click an Aspect Object in Plant Explorer to open its context menu and

select **New Aspect...**

Or:

Right-click the background of the **Aspects** list of the Aspect Object and select **New Aspect...** from the context menu.

2. In the **New Aspect** dialog, select the **List presentation** check box.
3. Navigate to and select Topology aspect.
4. Click **Create**.

Creating a New Topology Diagram

In general, newly created topology aspects have an empty Diagram view. To create a new Topology Diagram:

1. Right-click the topology aspect in the **Aspect** list.
2. Select **Diagram** to open the Diagram view.
3. In Topology Designer, click **File > New** to create a new topology diagram or to overwrite an existing diagram.
4. In the **Templates and Skeletons** dialog select either a template (copy or reference), a skeleton (copy) or a blank diagram, see [Templates and Skeletons](#) below.
5. Click **OK**.
6. Reserve and edit the diagram.

Templates and Skeletons

The **Templates and Skeletons** dialog offers the following options (see [Figure 9](#)):

- Copy or reference a predefined template for the master page layer with header and footer like A3, A4 portrait / landscape.
- Copy a predefined skeleton for the logic layer with snap ports for topology components.
- Blank diagram.

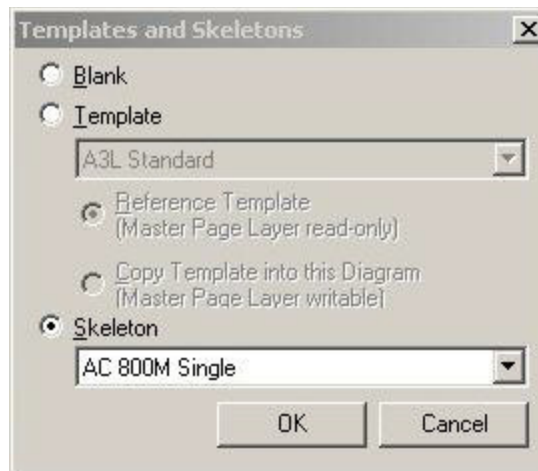


Figure 9. Templates and Skeletons Dialog

User can add additional templates and skeletons or customize installed ones in Object Type Structure under Object Types\Topology Planning\Diagram Templates and Object Types\Topology Planning\Diagram Skeletons ([Figure 10](#)).

Also refer to property Name.Description of that object type groups, [Creating a Template](#) on page 43, and [Creating a Skeleton](#) on page 48.

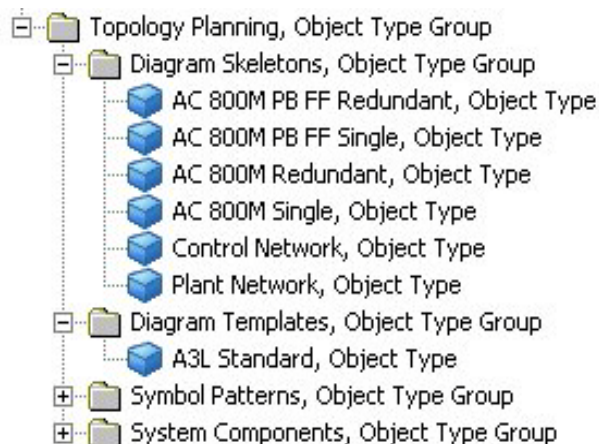


Figure 10. Diagram Skeletons and Templates in Object Type Structure

If user *references* a template, the diagram's master page layer is read-only.

- Header/footer entries like author, document number, cannot be edited inside the diagram, but are referenced as aspect properties from a Topology Diagram Document aspect in the Object Type Structure, see [Figure 11](#).
- Diagram instances with referenced templates get automatically updated when the template changes.

If user *copies* a template or skeleton, the diagram's master page layer is writable.

- Header/footer entries like author, document number, can be edited directly inside the diagram, but can also be referenced as aspect properties from another aspect, by default from a Topology Diagram Document aspect in the same object, see [Figure 11](#).

- Diagram instances with copied templates do NOT get automatically updated when the template changes.

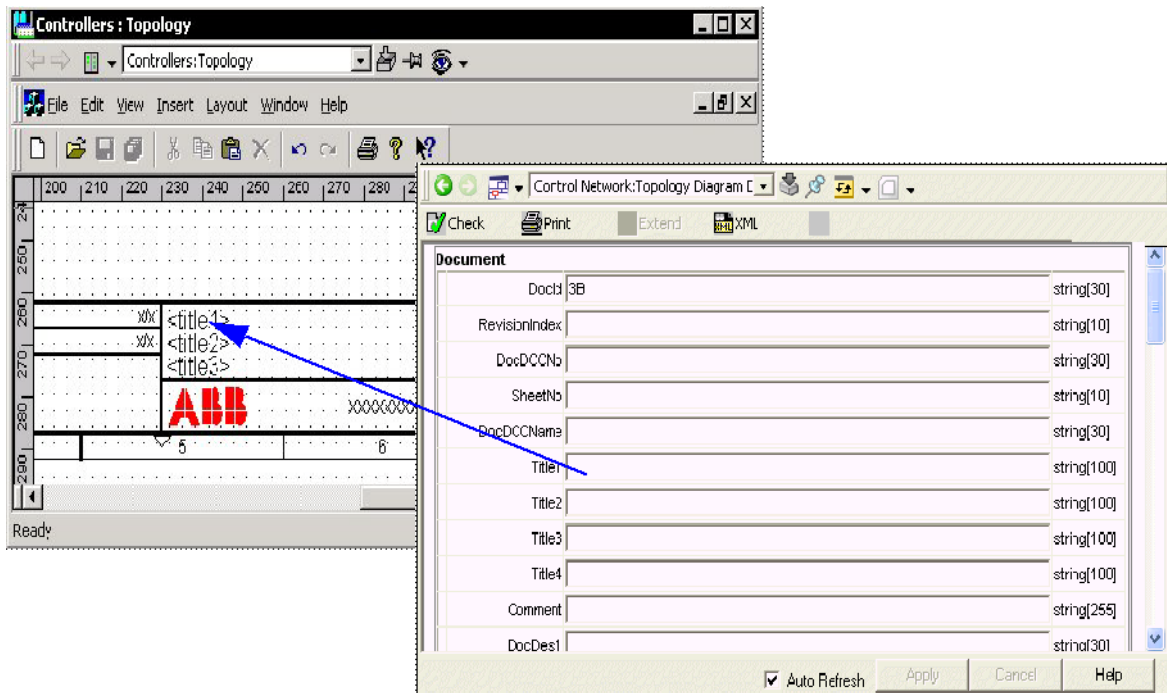


Figure 11. Footer Texts with References to Topology Diagram Document Properties

Application Tutorial

Topology Status Viewer

Perform the following steps to configure a Topology Diagram to view the status for the whole plant:

1. On every Controller object: Open the Topology aspect, open Diagram view and add a new Diagram based on the skeleton for the Controller level (AC 800M Single / AC 800M Redundant). Processor Modules and the Hardware Units below by default have Topology aspects with pre-configured Component

views. The symbols of these Topology components are placed by default on the diagram. Save the diagram.

2. To reserve an entity Controller or Project or Hardware Library from Topology Designer:

Click **File > Reserve <entity>**.

To release reservation of an entity:

Click **File > Release Reservation <entity>**.

3. Insert / create objects representing clients, servers and eventually other network components in the Control Structure above the Control Network level (refer to the hints in [Build upper Network Levels](#) on page 33).
4. Create Topology aspects and configure the Component view for the objects to be represented in the hierarchy above the controllers.
5. If applicable add texts/labels to the new Components with aspect property references that subscribe to status information. Or include other elements with access to and representation of status information, for example ActiveX controls.
6. On the object representing the plant add a Topology aspect and create a new Topology Diagram from the skeleton Plant Network. It is populated automatically with the Topology components in the Control Structure hierarchy below the plant object down to the Controller objects.
7. Arrange the symbols of the Topology components and connect them as required. Add additional labels/ texts / graphical symbols as required. Save the diagram.
8. Switch on **Subscribe for Live Data** in the **View** menu. Live Data status information appears. Prerequisites are: OPC servers are operating and Controllers are running.
9. To view and navigate such Topology Diagrams (as already shown in [Figure 2](#) and [Figure 3](#)) from a Graphic Display on Operator Workplaces, include an Aspect Link to the top Topology aspect in Control Structure into this Graphic Display.
10. Then operators or a maintenance persons (with Operator role) can inspect the live status information in the diagrams and navigate through the hierarchy of

diagrams as already described in [Features of Topology Designer](#) on page 14:

Build upper Network Levels

The following subsections provide additional hints to add the objects to the Control Structure and to apply the delivered skeletons on upper network levels.

Create Network Topology

Below the Root object of Control Structure the upper network topology with maximum levels can be modelled as:



The nodes (clients, servers, routers, etc.) can be added later at the corresponding level.

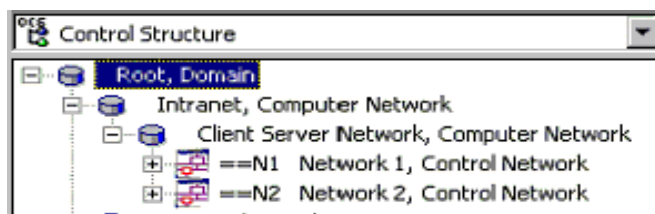


Figure 12. Example for Upper Network Topology

For 800xA client and server nodes user can do this by inserting the representing objects from the Node Administration Structure into the Control Structure below a corresponding parent object, for example Client Server Network or Plant Network object.

For objects that are not by default provided by the system structures user can create objects of generic object type or design own object types.

In both cases user must add a Topology aspect and configure it within Component view.

Add Topology Diagram on System Level

The topology diagram for upper network levels (down to Control Network) is recommended to be created on the topmost aspect object within Control Structure, which typically corresponds to the root object or in an own Client Server Network object or Plant Network object created below the root object.

Perform the following to add a topology diagram:

1. Add a Topology aspect to the Aspect Object.
2. Select **File > New** to assign a template or a predefined skeleton.

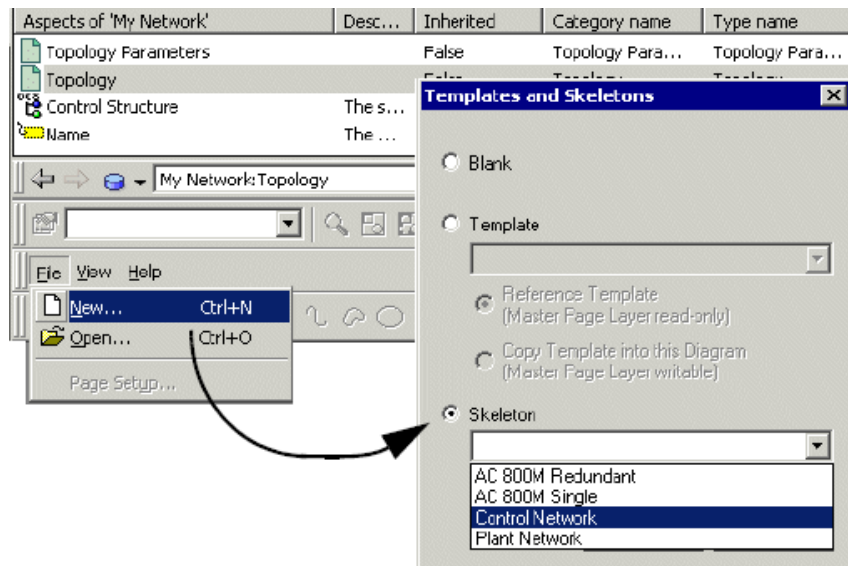


Figure 13. Create Topology Diagram on Control Network or Plant Network Level

Create Controller Clusters

The Control Network (according MMS specification) can be subdivided into several network areas, for instance to keep the most time-critical communications within smaller areas and thereby improve performance.

The CBM integration into Plant Explorer provides the concept to organize controllers into **Control Projects**. Those controllers working on the same application and/or having closer communication should be organized into the same project.

It is recommended to use the **Control Project** concept to define controller clusters working in same network area.

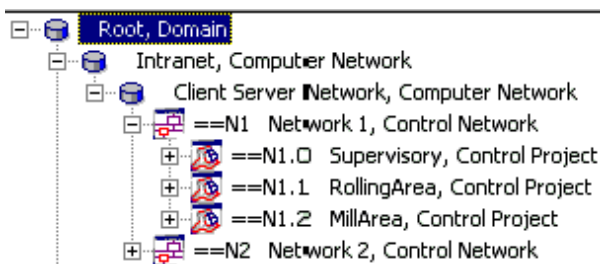


Figure 14. Use of Control Projects within Network Topology

Create Nodes

The nodes should be created below that network level it belong to. If a node serves a router between 2 network levels, it is recommended to create it below the lower level.

Figure 15 displays the nodes **ServerA** and **ServerB** have routing functionality between **Client Server Network** and **Network 1**. So the server nodes are created below **Network 1** object.

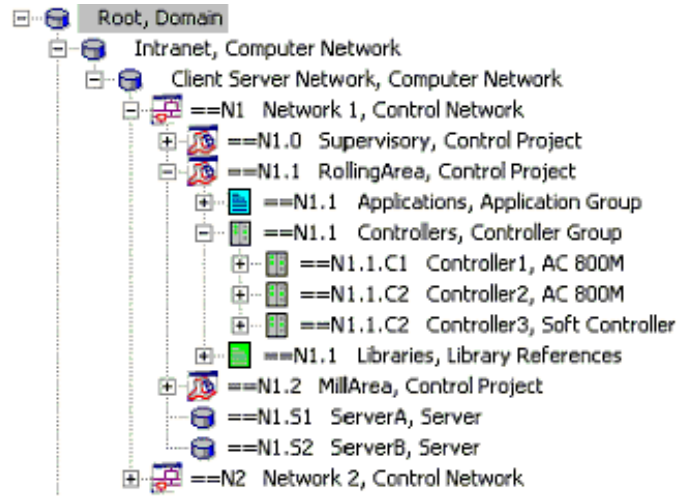


Figure 15. Example for Controllers within Control Structure

If there are several areas, all controllers collected in one area should belong to one Control Project (including those with router functionality to upper level).

Finalize Network Topology Diagram

When the Topology Diagram is opened for the first time, all network and node objects (having Topology aspects with configured Component view) will be pre-placed within the diagram and must be arranged manually (if no skeleton with predefined placement was used). For example, refer to Figure 3 in Features of Topology Designer on page 14.

Build I/O and Bus Topology for Controllers

The following subsections describes how to add objects to the Control Structure and how to apply the delivered skeletons at the controller level.

Create Topology Diagrams to Controllers

When creating the controllers, a **Topology** aspect is copied as default to the controller object.

Perform the following steps to add a Topology Diagram to controller:

1. Double-click the Topology aspect.
2. Select **File > Template** to assign the corresponding skeleton.

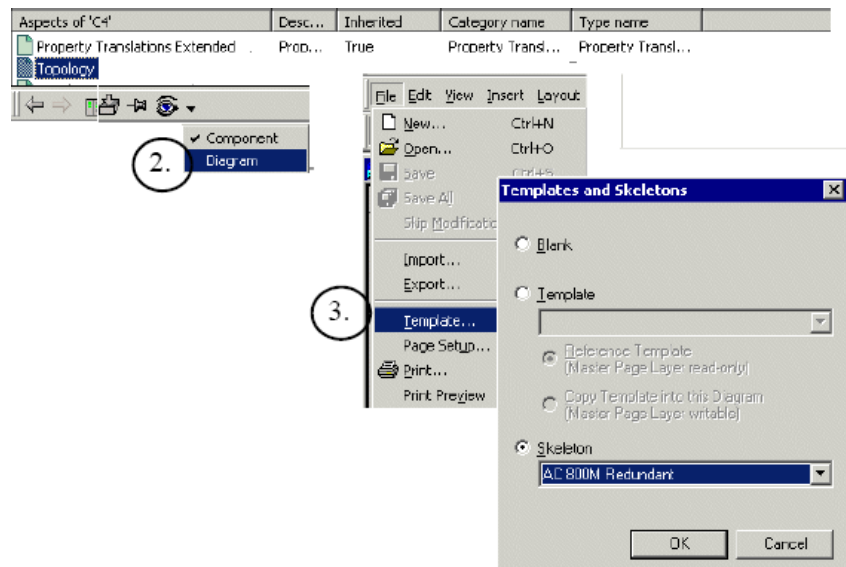


Figure 16. Assign Skeleton

Create I/O Modules

I/O modules can be created through the Plant Explorer, CBM (for few modules) or through BDM (for bulk modules). The modules are automatically updated into the Topology Diagram during next open (if placement was predefined within skeleton). If the Topology Diagram was open during creation, it can be synchronized, i.e. show and snap the modules, by pressing SHIFT+S.k

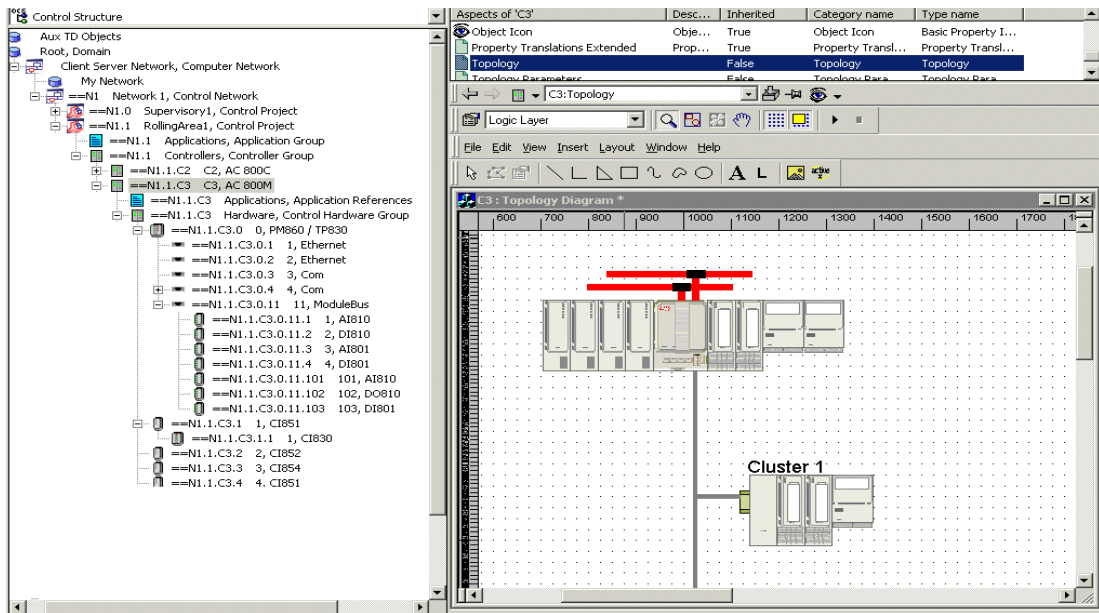


Figure 17. Update Modules into Controller Diagram



If the object type supports CBM - DTM Data Synchronization, the I/O-module configuration (parametrization) has to be done with the DTM. Otherwise configuration (parametrization) can be done in Plant Explorer, CBM or Bulk Data Manager.

Create Topology Diagrams for Fieldbuses

Topology Diagrams for fieldbuses must be defined on Topology aspects related to corresponding interface modules. (CI854 for PROFIBUS, CI860 for FOUNDATION Fieldbus, etc.).

The workflow corresponds to that for controller, but user should select skeletons *AC 800M PB FF Single/Redundant* instead. The fieldbus remote stations with their coupler (e.g. CI840) are placed at arbitrary positions on the template. The final positioning and adding of the bus lines has to be done manually.

Example of AC 800M with local I/O and 1 PROFIBUS station:

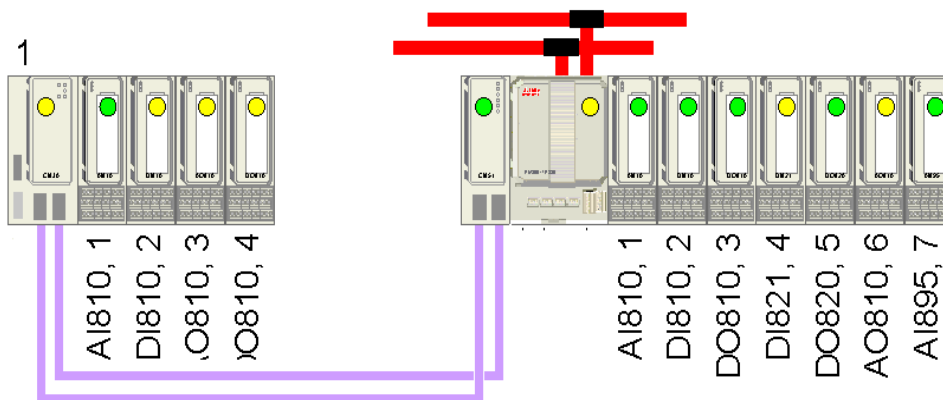


Figure 18. AC 800M PROFIBUS Configuration

Allocate Field Devices

Field Devices are assumed to be defined from the Functional Structure. They are allocated to fieldbuses (PROFIBUS, etc.) by assigning them in addition into the Control Structure. They are automatically updated at the correct location into the Topology Diagrams if placement is predefined within the skeleton.

Finalize Topology Diagrams

After having completed the Control Structure, it might be necessary to do some final adaptation within Topology Diagrams for controllers:

- Remove obsolete parts remaining from the skeleton.
- Re-arrange the placement of buses/modules/devices.

Build Topology Component Object Types

If user-defined Topology Component Object Types are required, for example if other Hardware Libraries that are currently supported shall be extended with Topology aspects, user should:

- analyze the delivered Topology Components for AC 800M and S 800 I/O (examine the corresponding object types of the Hardware Libraries in the Object Type Structure under Object Types / Control System / AC800M/C Connect / Libraries / Hardware)
- and follow the workflow given in [Creating a New Topology Component](#) on page 66.

Use library extensions to bring the Topology aspects into object types of the Hardware Libraries, as it is done for the supported Hardware Libraries [Supported Hardware Libraries](#) on page 19.

Topology Diagrams

Topology Diagrams are provided as Aspect Objects with a Topology aspect containing the diagram. They are edited in Topology Designer's Diagram view on the Topology aspect.

Refer to [Creating a New Topology Aspect](#) on page 27 and [Creating a New Topology Diagram](#) on page 28.

Topology Diagrams are based on [Diagram Templates](#) on page 43 or [Diagram Skeletons](#) on page 47.

Topology component object types are instantiated in the Diagram view of Topology Designer.

- User can do that through the menu command or through drag-and-drop. For details on inserting and creating components, refer to *System 800xA Engineering, Function Designer (3BDS011224*)*.
- When a new Topology Diagram is opened on a parent object the child Topology Component objects get inserted automatically in this diagram. Depending on the kind of diagram user might have to arrange the symbols of the Topology Components on the diagram.

User further configures Topology Diagrams connecting ports of the graphical symbols of Topology Components. For more details, refer to Topology Diagrams in *System 800xA Engineering, Function Designer (3BDS011224*)* manual.

For structured information access user can build a hierarchy of Topology Diagrams, refer to [Vertical Navigation](#) on page 42.



For details regarding the Connections/Networks, refer to *System 800xA Engineering, Function Designer (3BDS011224*)*. User needs to use the Topology aspect or Topology component symbol instead of the Function aspect or Function component symbol as applicable in the workflows.

Change Type

Changing Type of Component Instances

To change the type of an aspect object a function can be invoked by the object verb **Change Type** To support this functionality in Topology Diagrams as well a **Change Type ...** context menu entry is available when one single component instance is selected.

When invoking the Change Type function a dialog pops up that allows the user to select the new object type.

During the execution of the Change Type function the aspect properties of the component instance are exchanged keeping the values for matching property names. This ensures that connections between objects are preserved where possible.

The symbol of the changed component instance is updated in any open diagram.



It is possible to change the type of an aspect object to another aspect object type (in the Plant Explorer and Topology Diagrams) and the type of a symbol object to another symbol object type (in Topology Diagrams only).

Conversions from aspect object type to symbol object type or vice versa are not supported.



Be aware of the fact the Change Type covers all aspects of the object type and ensure that the user knows and can accept the changed behavior of all aspects.

Changing Number of Ports

Certain objects have an aspect property **NumberOfInputs** which controls the number of single ports (or port groups). The value of this aspect property is set by the user when creating an object instance in a Topology Diagram. When creating an object instance in the Plant Explorer (or through Bulk Data Manager, etc.) a default value for this parameter is used.

In order to change the value of the **NumberOfInputs** aspect property a new context menu entry **Number Of Inputs...** is introduced when a single component instance (which has this aspect property) is selected in a Topology Diagram.

When invoking the **Number Of Inputs** function the following dialog pops up:

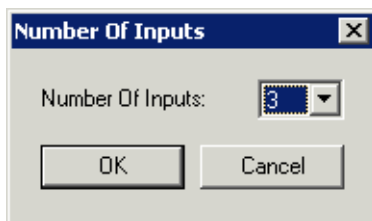


Figure 19. Dialog Number of Inputs

Changing the value of the **NumberOfInputs** aspect property is possible through the **Aspect Properties** dialog or through Bulk Data Manager.

When the value of the **NumberOfInputs** aspect property has been changed the symbol of the according component instance is updated in any open diagram. As the values of other existing aspect properties remain untouched port connections are kept when increasing the value. When decreasing the value of **NumberOfInputs** the superfluous dependent port related aspect properties (and according connections) are removed.

This functionality is not available in the Plant Explorer.

Vertical Navigation

For a better overview on topology diagrams, it is possible to build a hierarchical Control Structure with parent-child diagrams. Topology relevant units on a lower level can be summarized in a separate diagram and displayed on an overview diagram on higher level as a single topology component with input and output ports / parameters.

Diagrams on lower level are also called child diagrams. They can be opened from a (parent) diagram by choosing **View > Goto Child Diagram** or **Goto Child Diagram** from the context menu.

Diagrams on upper level are also called parent diagrams. They can be opened from an child diagram by choosing **View > Goto Parent Diagram** or **Goto Parent Diagram** from the context menu.

Navigation from the child to the parent diagram can also be achieved by using the Topology Designer window in Workbook mode or by opening the Parent Diagram view from the aspect context menu on the Topology aspect of the child diagram.

This is called vertical navigation - top down, bottom up, throughout the hierarchy in the Control Structure.

Diagram Templates

A template defines the diagram frame and footer including a logo. All the parts of a template are defined on **Master Page Layer** in diagram view of a Topology aspect.

Creating a Template

Create an Aspect Object Type within Object Type Group **Diagram Templates** of **Topology Planning** subtree.

Insert a **Topology** aspect and create a diagram view through **File > New**.

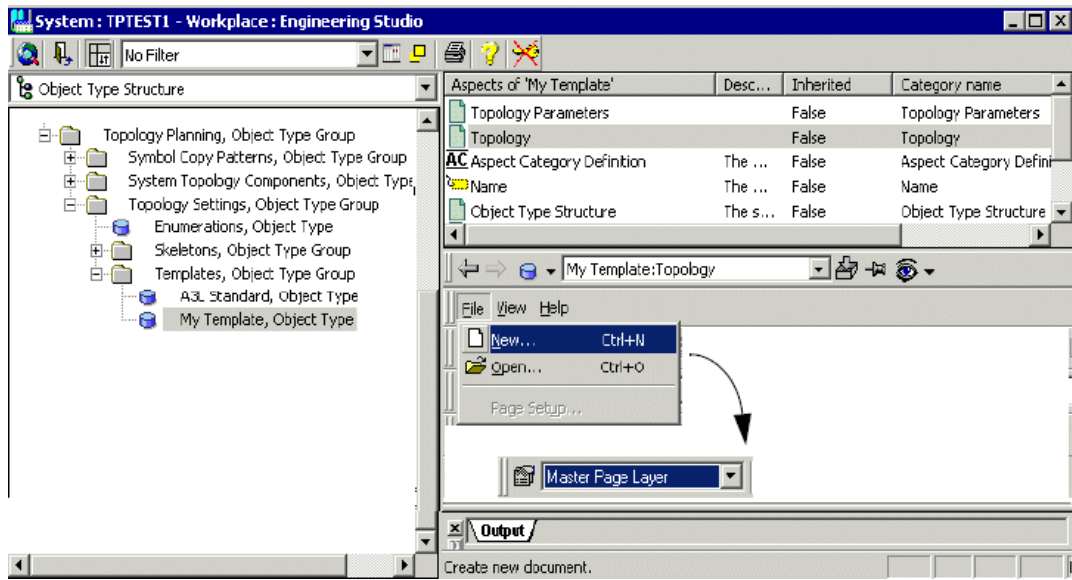


Figure 21. File > New to Create a Diagram View

Template Layout Guidelines

Recommendations for lines:

- For thick lines use 0.7 mm width (ISO 5457).
- For medium lines use 0.5 mm width.
- For thin lines use 0.35 mm width.
- Avoid using rectangle or polygon, use instead polyline
Reason: easy selection of included graphics.

Recommendation for text properties within A3L:

- For label texts use ARIAL, Bold, 10 points.
- For normal text use ARIAL, regular, 12 point.
- For titles use ARIAL regular, 16 points.
- For document number use ARIAL, regular, 22 points.

Property References used in Standard Template

The **A3L Standard** template is built according to definitions in **9ADA 354** (IEC layout) and **ISO 5457, second edition**.



The property naming is harmonized with those within Document Manager, refer to *System 800xA Engineering, Engineering Studio (3BDS011223*)*.

Following property references are used (pre-configured):

Table 1. Property References used in Standard Template

Aspect Property References	Description
Topology aspect properties	
DocId	Document identity number
RevisionIndex	Revision Index
DocDCCNo	Document kind classification code
SheetNo	Start number for first sheet in diagram
NextSheet	reference to first sheet in next diagram
DocDCCName	Document kind name
Title1	Document title 1
Title2	Document title 2
Title3	Document title 3
DocDes1	Document designation 1
DocDes2	Document designation 2
BasedOn	Based on
Replaces	Replaces
Owner	Name of legal owner
RespDept	Responsible department
Lang	Language code
Status	Status of document (Approved, Draft)
PrepName	Name of preparing person

Table 1. Property References used in Standard Template (Continued)

Aspect Property References	Description
PrepDept	Department of preparing person
PrepDate	Prepared date
ApprName	Name of approving person
ApprDept	Department of approving person
ApprDate	Approved date
RevIdx1,2,3	Revision index in revision list row 1,2,3
RevNote1,2,3	Revision note in revision list row 1,2,3
RevDate1,2,3	Revision date in revision list row 1,2,3
RevName1,2,3	Revision name in revision list row 1,2,3
Structure Aspect Properties	
Control Structure.ARD	Absolute control reference designation
Location Structure.ARD	Absolute location reference designation
Project.Customer Settings aspect properties	
Project Name 1	Project name 1
Project Name 2	Project name 2
Project Name 3	Project name 3

Diagram Skeletons

Diagram Skeletons are used as a pattern for a certain type of Topology Diagram, for example: AC 800M Controller (single or redundant), PROFIBUS, Control Network, etc.

Using *connector symbols* it can be enabled for fully automatic generation of a Topology Diagram.

Creating a Skeleton

Perform the following to create a Topology Diagram skeleton:

1. Create an Aspect Object Type within Object Type Group **Diagram Skeletons** of **Topology Planning** subtree (use optionally sub-groups to organize skeletons).

Note: It is recommended to set the object type to **Explicit Object Type** within **Object Type Definition** aspect.

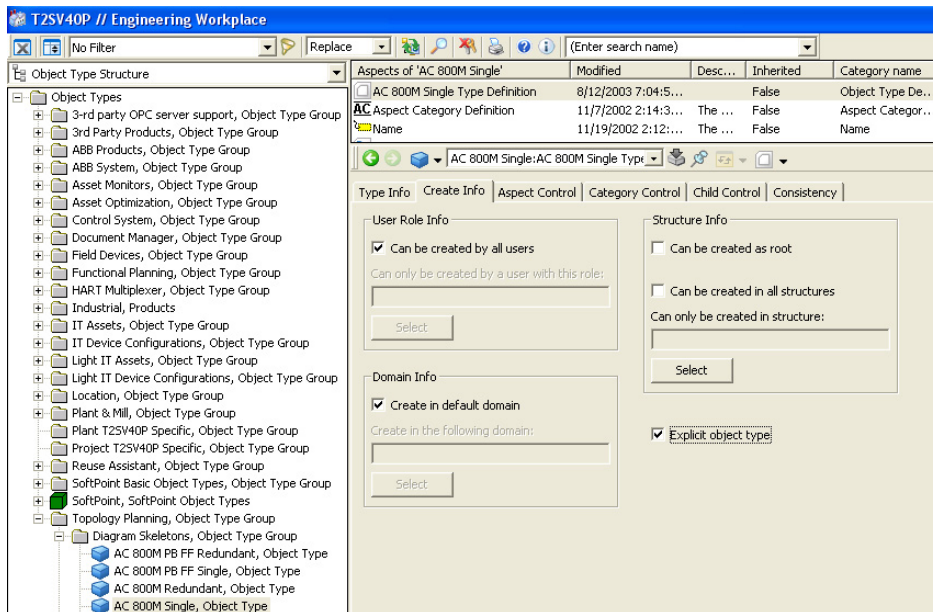


Figure 22. Explicit Object Type within Object Type Definition Aspect

2. Create a **Topology** aspect at Object Type.
3. Create diagram view through **File > New** and add template.



Insert the template by reference, so that late adaptations to the template can be made and all diagrams based on that template are adapted automatically.

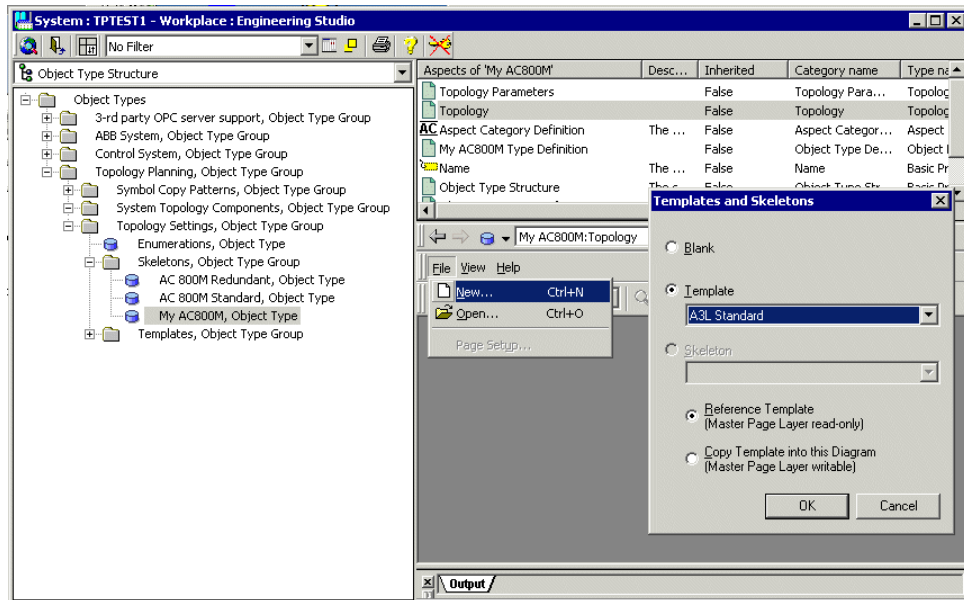


Figure 23. Create Diagram View through File > New and Add Template

Use of Connector Symbols

Connector symbols are used within skeletons:

- to predefine the insertion points for components (modules, computers, devices...) into diagram through snap ports and
- to allow definition of connecting lines representing buses and nets through connect ports at connector symbol.

Connector symbols are only inserted into the diagram and do not have a direct relation to aspect objects within Plant Explorer. They may graphically represent (for example) modems, which are not available as aspect objects within Control Structure.

The following figures show the use of connector symbols within any type of skeletons:

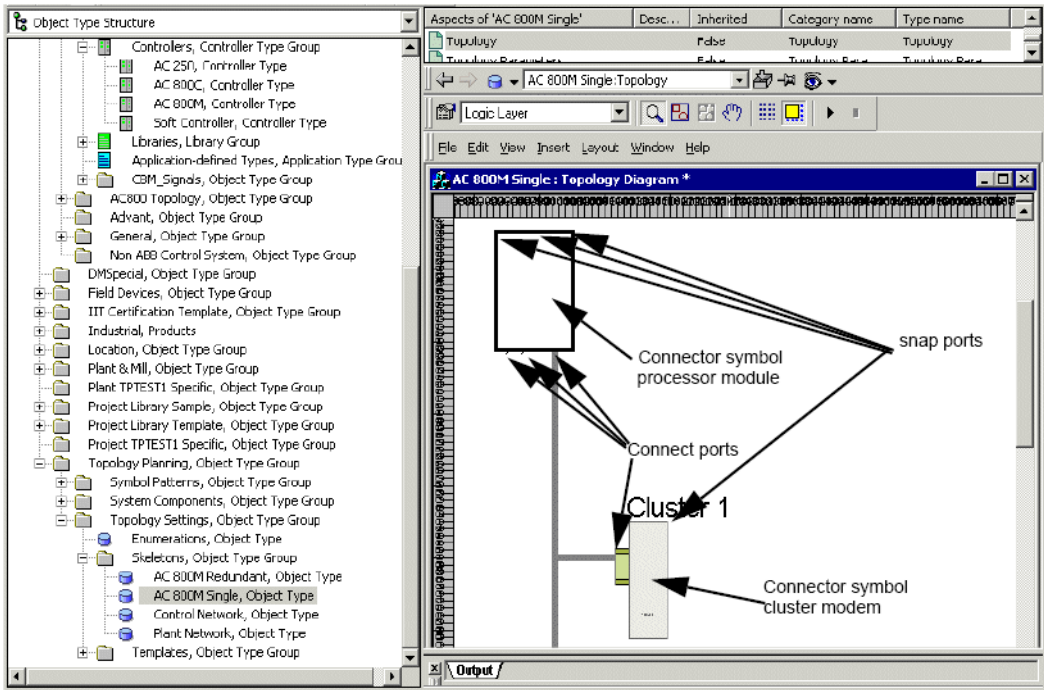


Figure 24. Connector Symbols within AC 800M Controller Skeleton

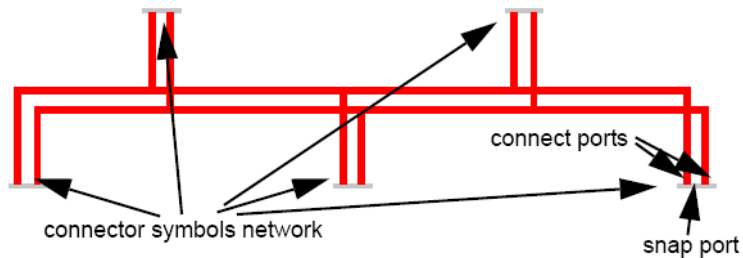


Figure 25. Connector Symbols within Control Network Skeleton

Creating Connecting Lines

Connecting lines are drawn by pointing to a connect port of a symbol and dragging the line to another connect port. As default the connecting lines are adjusted by an auto routing algorithm. The auto routing parameters can be configured through **Autorouting** tab within **Options** dialog (called through **Edit > Options**)

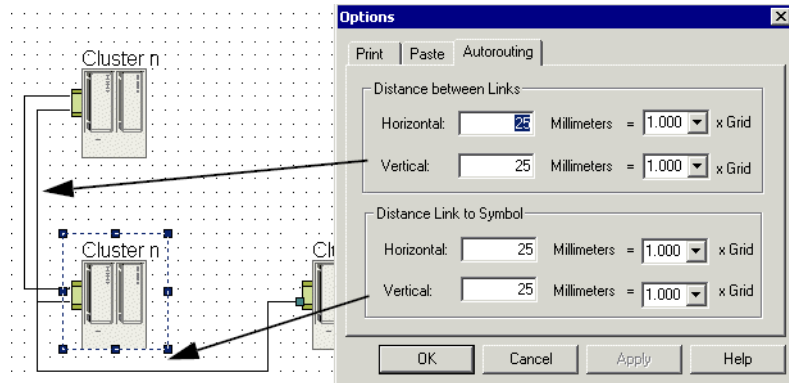


Figure 26. Configuration of Autorouting

In some cases the auto routing algorithm may not work as required. In such cases the vertices of a connecting line can be pinned.

To pin a vertex:

1. Select a connecting line.
2. Move the cursor to a vertex.
3. Press CTRL+SHIFT and click to the vertex.

A pinned vertex is colored with red. Move the pinned vertex as required. A vertex can be unpinned similarly.

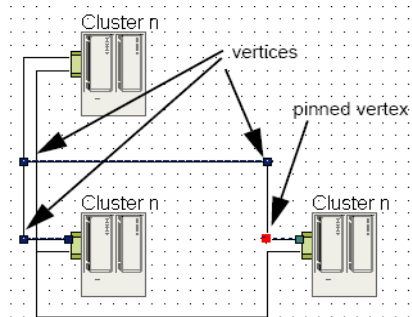


Figure 27. Use of Pinned Vertices on Connecting Lines

Perform the following steps to move the selected line in the above example to the final location:

1. Add an auxiliary vertex to the selected line (use CTRL+ALT and click to the required location).
2. Drag the line on the auxiliary vertex to the final position.
3. Fix the line by an additional pinned vertex.

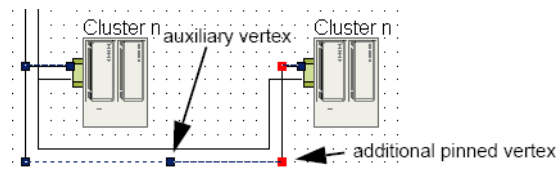









Figure 28. Use of Auxiliary Vertex to Move Line

Layout of Connecting Lines

Depending on Connection Type (see [Properties for Snap Ports](#) on page 76) different line settings should be used:

- Intranet settings
 - color: (light grey)
 - width: 1 mm (10 mm for 1:10 scale)

- Client Sever Network settings
 - color:  (blue)
 - width: 1 mm (10 mm for 1:10 scale)
- Control Network settings
 - color:  (red)
 - width: 1 mm (10 mm for 1:10 scale)
- Optical Modulebus settings
 - color:  (dark grey)
 - width: 1 mm (10 mm for 1:10 scale)
- PROFIBUS settings
 - color:  (R:204, G: 153, B:255)
 - width: 1 mm (10 mm for 1:10 scale)
- FOUNDATION Fieldbus settings
 - color:  (R:0, G:204, B:153)
 - width: 1 mm (10 mm for 1:10 scale)
- LON settings
 - color:  (R:204, G:0, B:153)
 - width: 1 mm (10 mm for 1:10 scale)
- HART I/O settings
 - color:  (black)
 - width: 0.5 mm (5 mm for 1:10 scale)

Aspect Properties

Aspect properties can be defined in Component view and in Diagram view for the selected topology component or topology diagram. User can define properties that get inherited from the object type, or properties that get copied on object

instantiation. Inherited properties are stored within the topology aspect, and copied properties are stored within the Topology Parameter aspect.

Use the **Aspect Properties Dialog** to create, edit, or delete aspect properties. Their scope depends on the selection:

Table 2. Scope of Aspect Properties

View	Object	Scope
Component view	Selected port	Aspect properties for the selected port
	Any other selected object	Aspect properties for the whole component
Diagram view	Selected port	Aspect properties for the selected port
	Selected topology component	Aspect properties for the selected component
	Any other selected object	Aspect properties for the whole diagram object

Adding an Aspect Property

Perform the following to add an Aspect Property:

1. Select the object to which an Aspect Parameter (for example a symbol's port) is to be added.
2. Open the (Aspect) **Aspect Properties Dialog**:
 - Either right-click and select **Aspect Properties** from the context menu.
 - Or select **Edit > Aspect Properties** menu command.
3. Right-click the free background of the **Parameters** dialog and select **Add Property** from the context menu.

A new empty row is inserted.
4. Enter the required values into the fields using the drop-down lists provided for the fields **Access Type** and **Data Type**.
5. Click **Ok/Apply**.

Removing an Aspect Property

Perform the following to remove an Aspect Property:

1. Select the object from which the required Aspect Property is to be removed.
2. Open the (Aspect) **Aspect Properties Dialog**:
 - Either right-click select **Aspect Properties** from the context menu.
 - Or select **Edit > Aspect Properties** menu command.
3. Right-click the row containing the Aspect Property that is to be deleted.
4. Select **Remove Property** from the context menu.
5. Click **OK/Apply**.

Aspect Properties Dialog

Use this dialog to display, add or remove aspect properties of an object, with scope diagram, component, port.

Access this dialog through **Edit > Aspect Properties** menu command or through **Aspect Properties** from the context menu of the object.

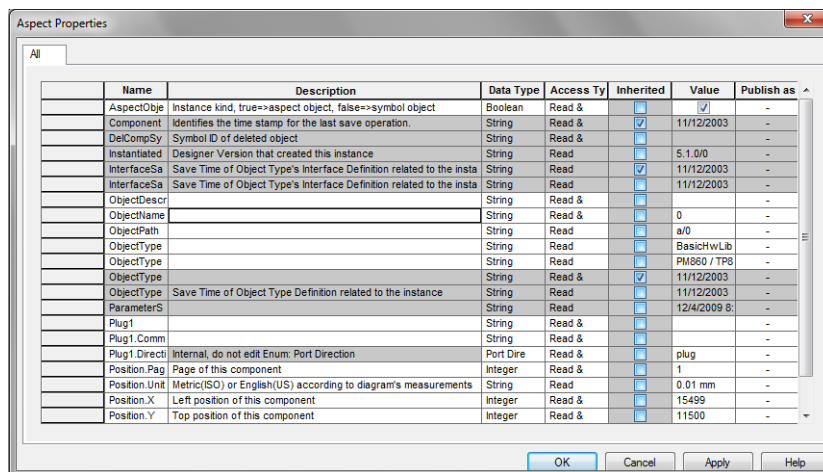


Figure 29. Aspect Properties Dialog

- **Name**

Defines the name of the property/parameter. User can edit the name directly in the Name cell. Copied and inherited properties/parameters share the same name scope. Do not use a dot ‘.’ in the name, as a dot is used as a separator for structured properties.

- **Data Type**

Defines the data type of the property/parameter. User can select the data type from a drop-down list.

In addition to the default data types Integer, Real, String, and Boolean two additional enumerations are listed:

- **Port Direction** (noDirection, in, out, inout, plug, socket)
- **Data Type** (only used for compatibility with old diagrams)

The enumerations are defined on the Topology Aspect category as Topology Enumeration aspect, refer to [Figure 30](#).

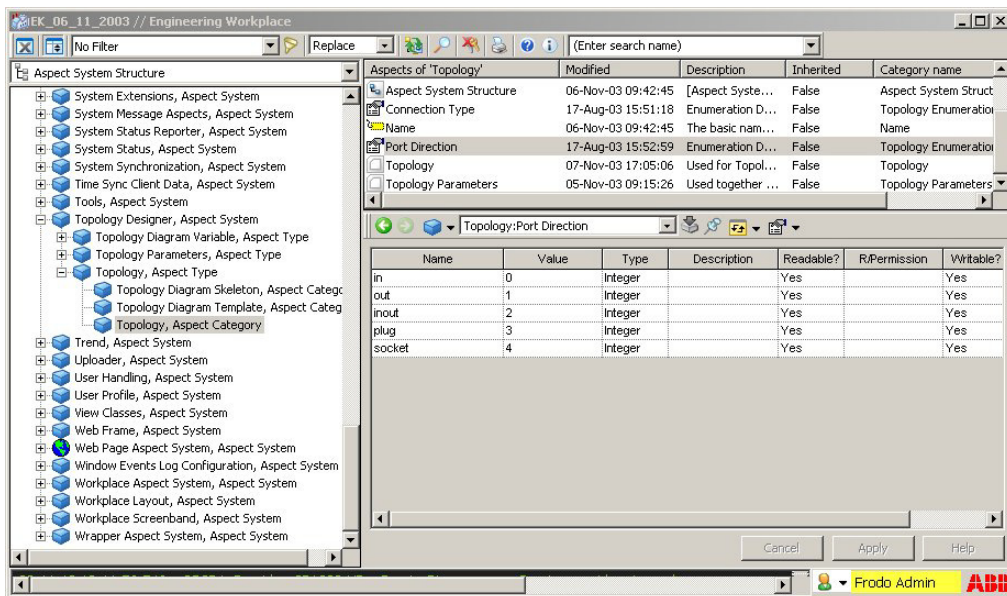


Figure 30. Enumeration Definition on Aspect Category

Port Direction defines the direction of a port parameter:

- **noDirection**: general port parameter with no specific direction.
- **in**: Input parameter in the sense of a IEC61131-3 Var_Input.
- **out**: Output parameter in the sense of a IEC61131-3 Var_Output.
- **inout**: In-Out parameter in the sense of a IEC61131-3 Var_InOut.
- **plug**: snap port, provides direct connectivity to socket of other symbols.
- **socket**: snap port, provides direct connectivity to plug of other symbols.

Data Type is no longer used, but needed to upgrade topology diagrams created with former versions of Topology Designer.

Additional enumeration data types can be added by adding further ‘Topology Enumerations’ aspects to the Topology aspect category, i.e. to [Aspect System Structure]Topology Designer/Topology/Topology.

- **Access Type**

Defines the access type for the property/parameter. User can select the access type from a drop-down list.

- **None**: Property/parameter is neither readable nor writable from other aspect systems or Bulk Data Manager. Used internally in Topology Designer only.
- **Read**: Property/parameter is readable from other aspect systems and from Bulk Data Manager, but not writable.
- **Write**: Property/parameter is writable from other aspect systems and from Bulk Data Manager, but not readable.
- **Read & Write**: Property/parameter is readable and writable from other aspect systems and from Bulk Data Manager.

Read and write permission of individual properties/parameters equals the read/write permission of the Topology aspect or Topology parameter aspect.

- **Inherited**

Defines whether the property/parameter is inherited or not.

- Inherited properties/parameters are stored within the Topology aspect which is typically inherited from an object type.


- Copied properties are stored within the Topology Parameter aspect which gets typically copied from an object type.
- **Value**
Defines the value of the parameter.
- **Publish via Parent Diagram**
This is an enhanced setting allowing to read/write component properties/parameters through the parent diagram. Mainly used when copying diagrams or setting diagram parameters through Bulk Data Manager.

Aspect Property/Parameter References

Instead of setting static text into a text or label component, user can define references to any aspect property / parameter. By that, the text or label subscribes to and displays dynamic data, e.g. live data from an OPC data provider, a PID gain factor, or some document property field defined in a Document aspect.

The text or label components on a topology diagram are automatically updated when the subscribed aspect property changes. So, always consistent and up-to-date topology diagrams are obtained.

Perform the following to set a parameter reference in a text or label component:

1. Open the **Component Properties** dialog and click the **Field** page.
2. Choose **Property Reference** option in the **Field Code** group box.
3. Click  to open the **Aspect Property Reference** dialog.
4. Select **Structure**, **Select Object**, **Aspect**, and **Property** from the corresponding list box. The **Reference String** text box displays the selection.
5. Select the Reference Type and click **OK/Apply**. The **Aspect Property Reference** dialog is closed.
6. Click **Add** to enter the selected parameter reference into the **Field** text box.
7. Click **OK**.

Aspect Property Reference

Use the **Property Reference** dialog to define the **Reference String** for the required aspect property.

Open this dialog from the **Component Properties' Field** page by clicking the button behind the **Aspect Property Reference** text box:

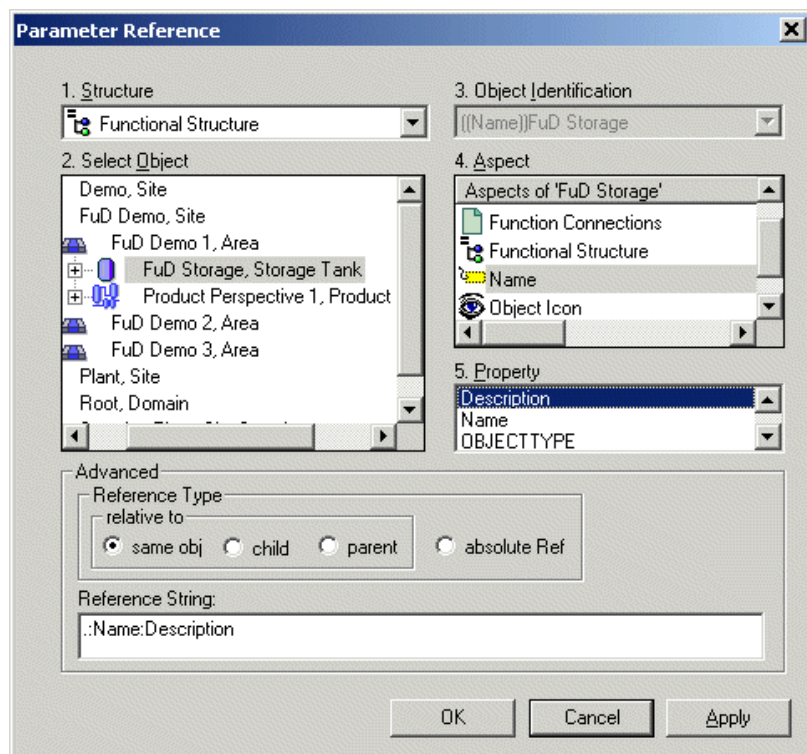


Figure 31. Aspect Property / Parameter Reference Dialog

For more information on usage of Parameter References in Topology Designer, refer to [Property References](#) on page 60.

For details on the syntax for aspect property references, refer to *System 800xA Engineering, Engineering Studio (3BDS011223*)*.

Property References

Application Scope

Property references are used within Text and Label elements to obtain the aspect data through property referencing mechanisms. Property references can be added to the levels:

- Components.
- Templates.
- Skeletons (within labels).
- Diagrams (within labels) Property references are added to Text/Label elements through **Component Properties** dialog

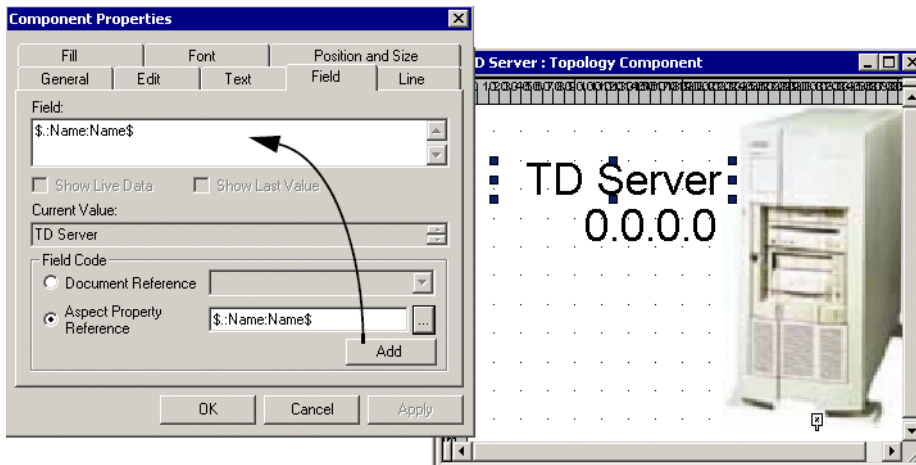


Figure 32. Property Reference for a Text/Label Element

Property References to Aspect Properties

Property references can be defined through **Aspect Property Reference** dialog. On Topology Designer side property references must be encapsulated by “\$”

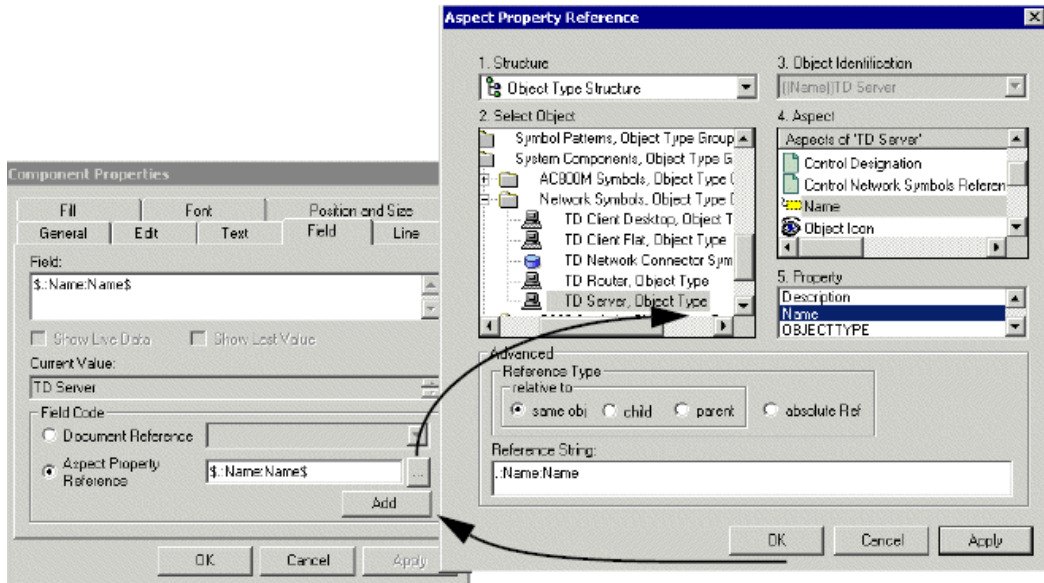


Figure 33. Calling Property Reference Dialog

It is possible to add several property references to same Text/Label element or to mix it with static text:

Example: **Object Name: \$.:Name:Name\$**

Property References to Topology Aspect Properties

When referencing from component/diagram to properties belonging to same Topology aspect, use the short syntax **\$<name>\$**
(Example: **\$IP_Number\$**)

This is faster than using **\$.:IP_Number\$**

Using Visual Basic Script Expressions

It is possible to use VB Script expressions together with property references. A VB Script expression must be encapsulated with `<vbs> expression </vbs>`

Example using VB Script expression

The example consists of a property references (enclosed by '\$' characters) that addresses the object name and takes only the 5 left most characters

```
<vbs>Left("$.:Name.Name$", 5) </vbs>
```

Within VBScript expressions only functions, operators and constants can be used. For a detailed description on how to write VBScript expressions visit Microsoft website. Within VBScript expressions all function for the object with name **DM** (= VB Extensions of Document Manager) can be used. Currently the following functions are available:

- Function **FormatDate**(*expression, format*)
The **FormatDate** function has the following parameters
expression: Any valid string expression.
format: A valid name or user defined-format
The function takes the string **expression** and formats it according the format specified in the **format** parameter.
Refer to the example above for how to use the **FormatDate** function of the object **dm**.
For a detailed description on what formats are valid, visit Microsoft website and look for the VisualBasic **Format** function.
- Function **Matches**(*text, pattern*)
The **Matches** function has the following parameters
text: Any string.
pattern: Any string which can additionally contain wildcards
Wildcards
? - Any single character.
* - Zero or more characters.
- Any single digit (0–9).
[*charlist*] - Any single character in *charlist*.
[!*charlist*] - Any single character not in *charlist*.
The **Matches** function takes the **text** parameter and checks whether it is like the

pattern parameter.

For more details, visit Microsoft website to get a description of Visual Basic like operator.

- Function **IfThenElse**(condition, if-case, else-case)

The **IfThenElse** function has the following parameters

condition: Any valid boolean expression.

if-case: Any valid expression of either type

else-case: Any valid expression of either type

The function **IfThenElse** evaluates the condition and return the **if-case** expression if the condition is true and returns the **else-case** expression if the condition is false.

For more details, visit Microsoft website to get a description of Visual Basic **if** function.

- Function **FormatSignal** (name, cut-app-flag, cut-ext-flag)

Function **FormatSignal** uses parameters

.....name: variable name according CBM and I/O allocation needs

.....cut-app-flag: Boolean, cuts application from name if TRUE

....cut-ext-flag: Boolean, cuts “_VAR” extension from name if TRUE.

- Function **OnError** (prop-ref, error-text)

Function **OnError** uses parameters

.....prop-ref: any property reference

....error-text: text to be returned instead, if property reference fails.

Example using DM Functions

```
<vbs>DM.OnError("$.:Location Structure:ABS$", "+")</vbs>
```

returns “+”, if Location Reference Designation does not exist.

System Status Display

Property references can be used within any element to hide it.

This functionality is selected through the **Component Properties** dialog

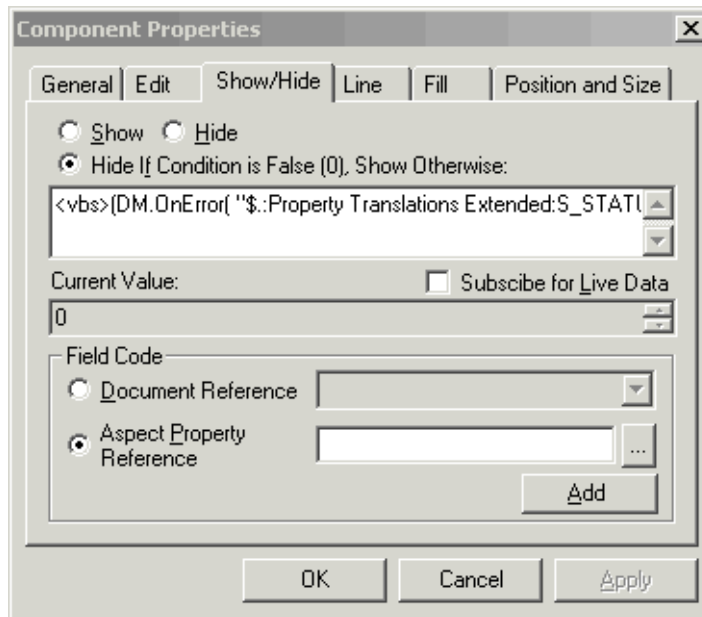


Figure 34. Component Properties Dialog

The condition

```
<vbs>(DM.OnError( "$.:Property Translations  
Extended:S_STATUS$" , "-1" ) = "0" </vbs>
```

shows this graphical element only, if the value of Property Translations Extended:S_STATUS is 0.

If Property Translations Extended:S_STATUS can not be evaluated (e.g. OPC status is Bad), the value is forced to -1 by DM.OnError... and therefore the element is hidden as well.

The status display of CPU and IO-modules is done by colored circles in the graphical symbol:

- RED : F failure (S_STATUS = 1)
- YELLOW : W warning (S_STATUS = 2)
- GREEN : R run (S_STATUS = 0)

Example of PM module with status display.

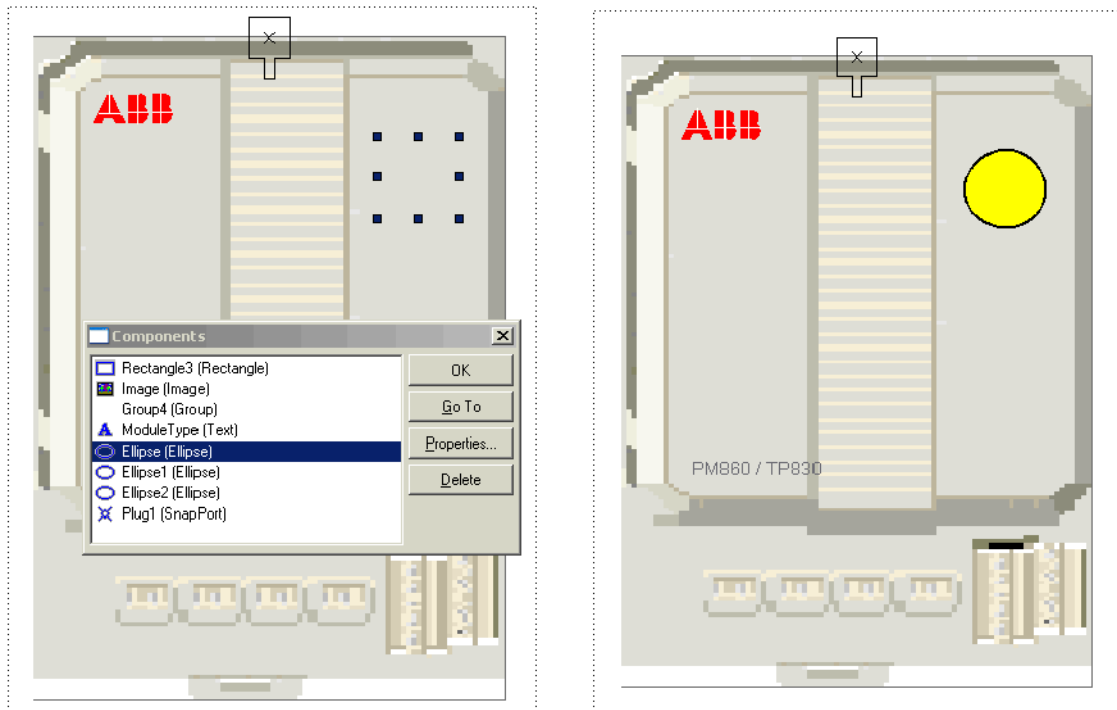


Figure 35. PM Module with Status Display

The left picture shows the component in Object Type Structure, the right picture in the Control Structure with online status display.

It is difficult to select these circles by mouse for editing because they are invisible and positioned at the same place. Use menu **Edit > Components...**, then select one of them (they are mostly named Ellipse, Ellipse1 and Ellipse2) and continue with **Properties...**

Topology Components

Topology Components are provided as Aspect Objects with a Topology aspect containing the component. They are edited in the Component view of the Topology aspect in Topology Designer. Typically Object Types are used to provide Topology components.

Topology component object types can be instantiated in the Diagram view of Topology Designer.

- User can perform that through menu command or through drag-and-drop. For details on inserting and creating components, refer to *System 800xA Engineering, Function Designer (3BDS011224*)*.
- When user opens a new Topology Diagram on a parent object the child Topology Component objects are inserted automatically in this diagram. Depending on the kind of diagram user might have to rearrange the symbols.

Creating a New Topology Component

1. Select a topology aspect from the Aspect list of Plant Explorer or create a new Topology aspect and open its Component view. In general, newly created topology aspects have an empty Component view.
2. Use the **File > New** menu command to create a new topology component or to overwrite data from an already existing one.
3. Reserve the diagram and create a fixed graphical symbol with ports, and a fixed parameter set.
4. Select **File > Save**.

Defining Topology Component Object Types

Perform the following to define a topology component Object Type:

1. Choose the Object Type Structure from Plant Explorer of the Engineering Studio Workplace window.
2. Browse to the location where the new topology component Object Type is to be located.
3. Create a new object type using **New Object** dialog which is opened through the corresponding context menu command.
4. Create a new Topology aspect using the **New Aspect** dialog. Select the topology aspect from the aspect list and click Create.
5. Open the Component view on this aspect.
6. Use **File > New**.
7. Design the symbol of the topology component using the graphical editor facilities.
 - a. Draw the required shape (refer to [General Symbol Design Rules](#) on page 72).
 - b. Add Texts/Labels, if needed with Property References (refer to [Property References](#) on page 60).
 - c. If required add Connection Ports (refer to [Definition of Connect Ports](#) on page 73).
 - d. If required add Snap Ports (refer to [Definition of Snap Ports](#) on page 76).
8. Add aspect properties for the ports and other elements. For general information refer to [Adding an Aspect Property](#) on page 54, specific information is given in [Definition of Connect Ports](#) on page 73, and [Definition of Snap Ports](#) on page 76.

9. Configure the Object Type Definition of the Topology Component object type accordingly, refer to [Object Type Definition and Usage](#) on page 68.



To define Topology Components for hardware units or modify existing ones take special care of the information given in [Topology Aspects for Controllers, I/O and Interface Modules](#) on page 78, [Topology Aspects for Client/Servers](#) on page 80, and [Topology Aspects for Connector Symbols](#) on page 81.

User should further analyze the delivered Topology Components for AC 800M / S 800 I/O in the Object Type Structure under Object Types / Control System / AC800M/C Connect / Controller Hardware.

10. Select **File > Save**.

Object Type Definition and Usage

Aspect Control

If an Object Type is created with a Topology aspect (a Topology Component Object Type or a Topology Diagram Object Type) there are three options that determine how the Topology aspects behave at creation of an instance Aspect Object from an Object Type.

- The Topology aspect is *inherited*:
This is the recommended way for objects using only the Component view of Topology aspects and/or the object can be combined with various skeletons.
Note: This is used as standard setting within object type groups provided with Topology Designer.
- Or the Topology aspect is *copied*:
This is the recommended way for objects using always (also) the Diagram view of Topology aspects and a specific skeleton (at least as default) should be assigned.
- Or the Topology aspect can be *used as template*:
This is the recommended way for objects having optional Topology aspects (and are therefore optionally shown in diagrams).

For more information on how to create object types, refer to *System 800xA, System Planning (3BSE041389*)* and *System 800xA, Configuration (3BDS011222*)*.

Topology Component Object Type instances typically comprise both inherited and copied data. User might inherit e.g. the symbol and interface definition from an object type, but store component properties including connections in a separate, copied aspect. So Topology Designer uses two aspects:

- The Topology aspect, which is typically inherited for most object types.
- The Topology Parameters aspect, which must be copied, because it is the container for all instance specific parameter values.

User can define a Topology aspect as default aspect, refer to *System 800xA Operations, Operator Workplace Configuration (3BSE030322*)*.

Inherited Topology Components

If a new topology component object is created in a topology diagram, the settings of the **Object Type Definition** aspect defines how the topology component instance gets updated if its type changes.

- To inherit properties from the object type to the object instance, the option **Inherit when object is created** has to be set. Then, modifications of this aspect will automatically result in updating all object instances, which includes all inherited components in topology diagrams.
- To copy properties, set the option **Copy when object is created**. Then, aspect properties will be copied on creating the object but modifications will not have any effect on the object instances.

Perform the following to adjust/modify the Aspect Control properties:

1. Open the **Object Type Structure** dialog by selecting the **Goto Type** command from the context menu of the component whose object type aspect controls shall be changed.
Alternatively, user can open the Object Type Structure in the Engineering Studio Workplace and select the required object type.
2. Click/Double-click the Aspect Object type Definition to open the **Object Type Definition** dialog/preview.
3. Open the **Aspect Control** page and select the required **Aspect**.
4. Set the **Copy/Inherit** options as required.

The following figure displays indicators for a inherited component:

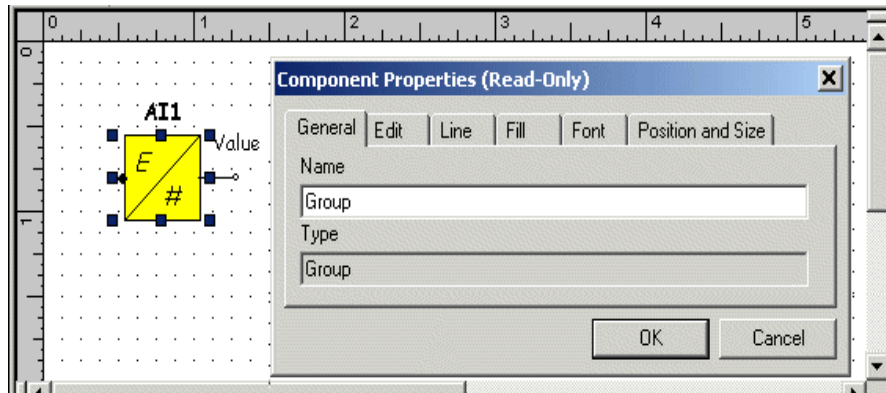


Figure 36. Indicators for Inherited Components: Read Only, READ Status

- **Read Only** within the brackets in the **Component Properties** dialog.
- **READ** flag in the status bar of the **Engineering Studio Workplace**.

Overridden Components

User can prevent inheritance on components by disabling the corresponding option **Inherit when object is created** on the **Aspect Control** page of the **Object Type Definition** dialog.

To interrupt the inheritance for a topology component, user can override the setting done for the topology component type (object type) by doing as follows:

1. Select the topology component object instance from the Control Structure.
2. Click right on the topology aspect from the aspects list to open the aspect context menu.
3. Choose **Override**.



After having executed **Override**, the inheritance link to the topology component type can be restored using **Delete Override**.

Create Info

User can define if a topology component (Aspect Object type) is instantiated as Aspect Object in the Control Structure, or as symbol object in the topology diagram only. For it, set the corresponding **Create Info** options in the **Object Type Definition** Aspect:

1. Open Plant Explorer of Engineering Studio Workplace.
2. Select the object type from the Object Type Structure.
3. Choose the object type's aspect with the category name **Object Type Definition** (for example, PID Type Definition).
4. Choose the page **Create Info**.
5. Check the options **Can be created as root**, **Can be created in all Structures** and **Explicit Object Type** of the **Structure Info** group box and modify them in the following way:
 - To define a topology component Aspect Object, the first two options must be set (selected) and Explicit Object Type must not be set (cleared).
 - To define a topology component symbol object, the first option must not be set (must be cleared) and the two other options must be set (selected). See [Figure 37](#).

For simple layout objects like adapters, connectors and so on, the **Create Info** options are not set, so these topology component symbol objects are created and stored on topology diagram only.

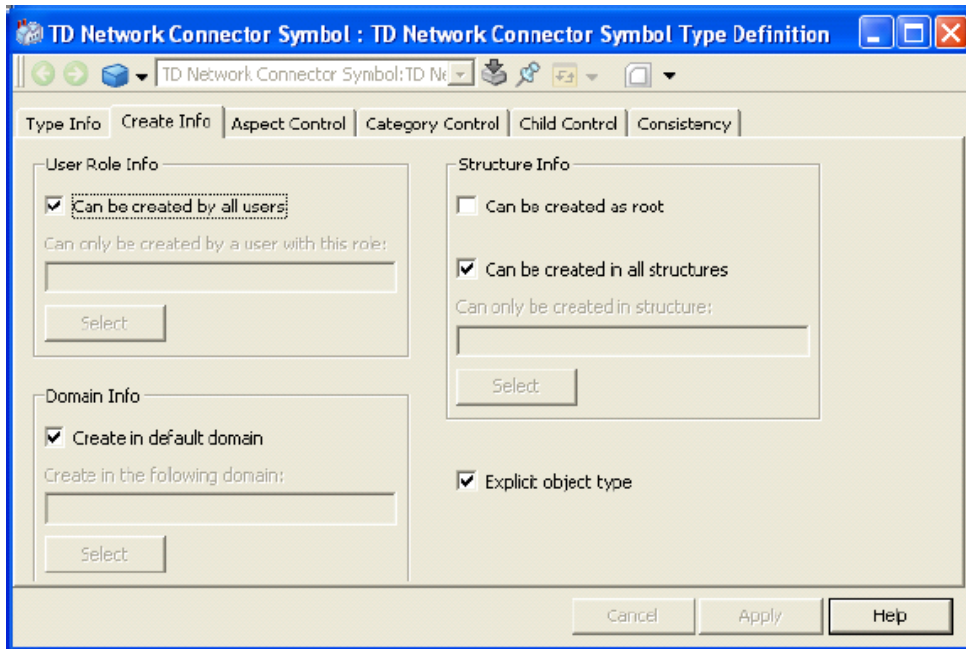


Figure 37. Create/Structure Info for Topology Component Symbol Objects

General Symbol Design Rules

For good appearance and visibility of symbols of Topology Components in Topology Diagrams some general design rules must be considered:

- The symbols should be designed in way, that it can be used in a 2.5 mm grid system (25 mm grid system for 1:10 scaled drawings). So if applicable the upper and left borders of the symbol should be on multiples of 2.5 mm (resp. 25mm).
Note: the optimal placement of connect ports must be considered with higher priority than symbol borders.
- On top of the symbol 5mm (50 mm for 1:10 scale) should be reserved text (attribute or label).

- Insert an invisible rectangle at 0,0 to fix the 0 point as origin of the symbol (important for snap to grid).
- Designations and technical information must appear at symbol with 2.5 mm size. Therefore use **Arial** font with 12 point size (resp. 120 point for 1:10).

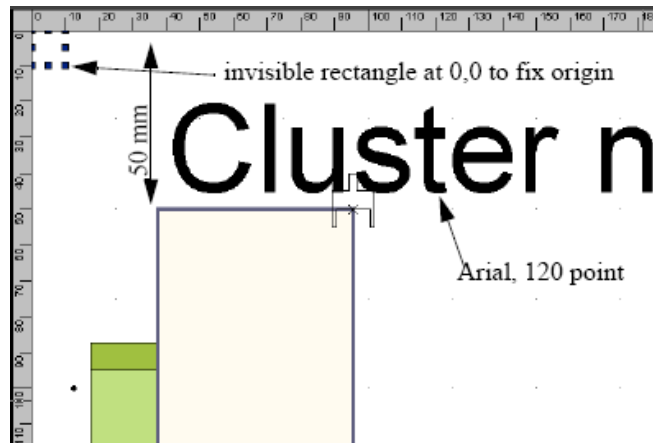


Figure 38. Size of Designations and Technical Information

- Within symbol the color black (for lines, areas and even text) should be avoided (creates too much contrast in printouts. Use instead dark grey (100, 100, 100).

Definition of Connect Ports

Ports can be added to symbols and provide connectivity to other symbols through connecting lines.

Following rules must be considered for naming and property settings:

- Connect ports can be defined as input and output. As criteria (what is input and what is output) must be considered:
 - Ports placed on right hand or bottom side of a symbol are regarded as output.
 - Ports placed on left hand side or top side of a symbol are regarded as input.

- To a net only one output should be connected, but several inputs can be connected (actually not checked).
- Use the **Component Properties** dialog of the Port, General page, to enter the names.
 - Input ports should be named IN1, IN2, IN3, etc.
 - Output ports should be named OUT1, OUT2, OUT3, etc.
- For each port 2 properties on aspect level must be defined. Use **Edit > Aspect Properties**:
 - <portname> : will be used later for linking must be of type **STRING** and must not be inherited.
 - <portname>.Direction : specifies the port direction, has to be of type **Port Direction** and set to **in** or **out**.

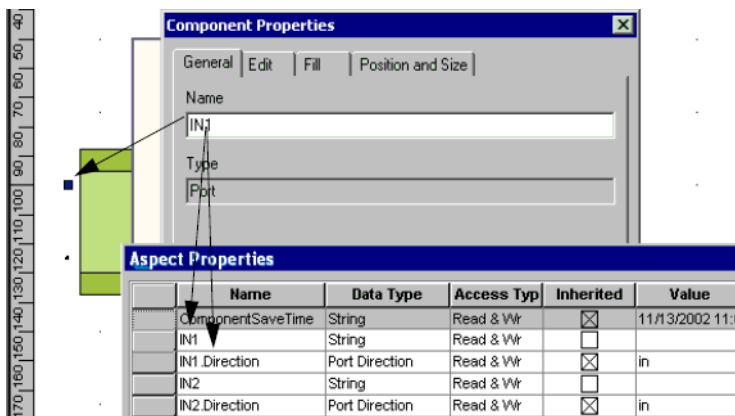


Figure 39. Specify Port Direction

Following rules need to be considered for placement of connect ports:

- Connecting lines within diagram should be drawn within 2.5 mm grid system. To achieve this purpose within symbols inserted with 1:10 scale:
 - At horizontal symbol borders it has to be placed on multiples of 25 mm in x direction.
 - At vertical symbol borders it has to be placed on multiples of 25 mm in y direction.
- Parallel buses/nets need to be drawn within 2.5 mm distance (relative to middle of line) (25mm for 1:10 scale).
- Bus/net lines should appear with thickness between 1 mm and 1.5 mm. To get no overlapping between line and symbol, the ports must have a distance of around 0.5 mm to symbol border (5 mm for 1:10 scale).

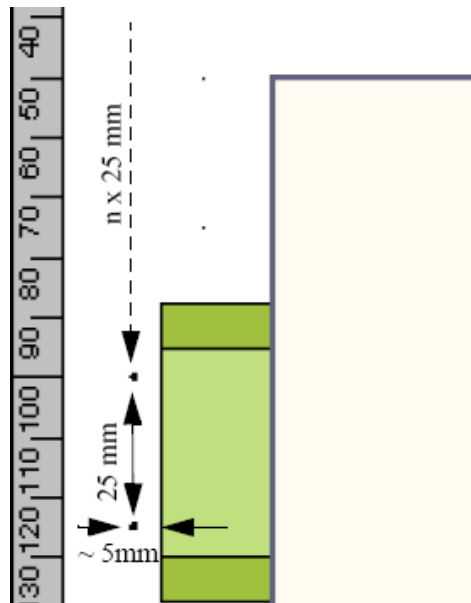


Figure 40. Bus/Net Lines Thickness

Definition of Snap Ports

Snap Ports can be added to symbols and provide direct connectivity to other symbols (without use of connecting lines). This provides also the functionality to place symbols automatically within a Topology Diagram skeleton.

Type of snap ports

It is distinguished between:

- **Socket** - provides optional symbol connectivity to plug (need not to be connected).
Example: Processor module provides sockets to local I/O and interface boards.
- **Plug** - provides symbol connectivity to socket. Must be connected when diagram is finished.
Example: I/O module must be connected to processor, modem or previous I/O module.

Naming conventions for Snap Ports

Snap Ports are identified by a **Name**, which is composed by an alphabetical and numerical part.

- Sockets should be named **Socket1, Socket2, Socket3**, etc.
- Plugs should be named **Plug1, Plug2, Plug3**, etc.
- If several plugs/sockets exist it should be numbered beginning with topmost and left most ports, continuing in clockwise sense.

Properties for Snap Ports

For each snap port some properties on aspect level must be defined.
Use **Edit > Aspect Properties**.

Mandatory properties:	
<port>	must be identical to name of snap port (Example: Socket1). must be of type STRING, not inherited

<port>.Command	<p>Specifies the rule associated to snap port</p> <ul style="list-style-type: none"> • Find: referenced object is snapped when opening diagram (through “Parent”, “Child”). • PrevSibling: previous object on same level is snapped (only for “Plug”). • NextSibling: next object on same level is snapped (only for “Socket”). • Parent: object is snapped to parent (only for “plug”). • Child: referenced child object is snapped (through “<port>.Parent”, “<port>.Child”).
<port>.Direction	Must be set to “plug” (if plug) or “socket” (if socket).
Optional/depending properties	
<port>.Parent	<p>Identifies the parent of object, if <port>.Command = “Find”</p> <p>It includes just the name path in Control Structure for addressing. User can use</p> <ul style="list-style-type: none"> • <Diagram> to address relative to diagram relate object and • <Component> to address relative to component relate object. <p>Example: “<Diagram>.Hardware.0.11” addresses processor module within controller diagram</p>
<port>.Child	<p>Identifies object relatively to parent object to be inserted on snap port, if <port>.Command = “Find” or “Child”.</p> <p>Example: “101” addresses module 101 below parent.</p>
<port>.ConnectionType	<p>specifies type of connection/interface. Only snap ports with same value for connection type can be connected to each other. Examples:</p> <ul style="list-style-type: none"> • ControlNet. • PROFIBUS. • ModuleBus.

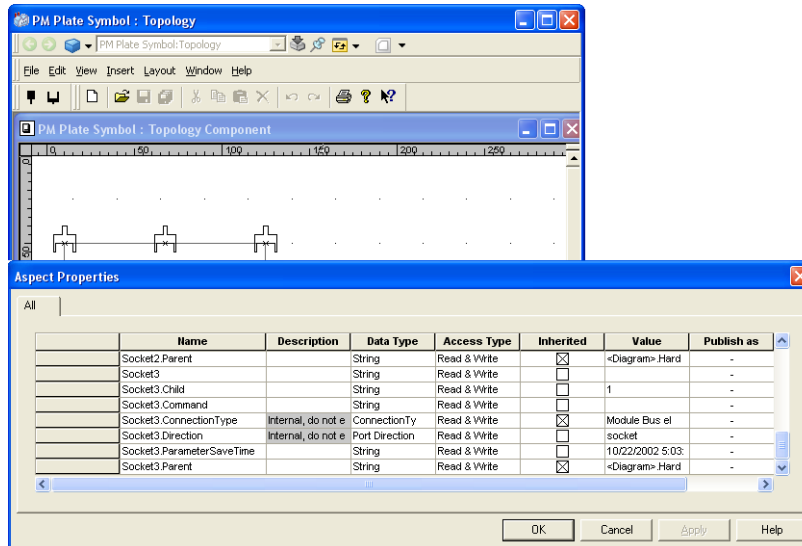


Figure 41. Snap Port Properties Definition

Topology Aspects for Controllers, I/O and Interface Modules

The corresponding Topology aspect are installed to related object types within **AC 800M Connect** subtree of the Object Type Structure.

The aspects are actually inherited from object type.

For interface and HART I/O modules a default diagram view may be added already in object type. In this case the Topology aspect must be set to Copy.

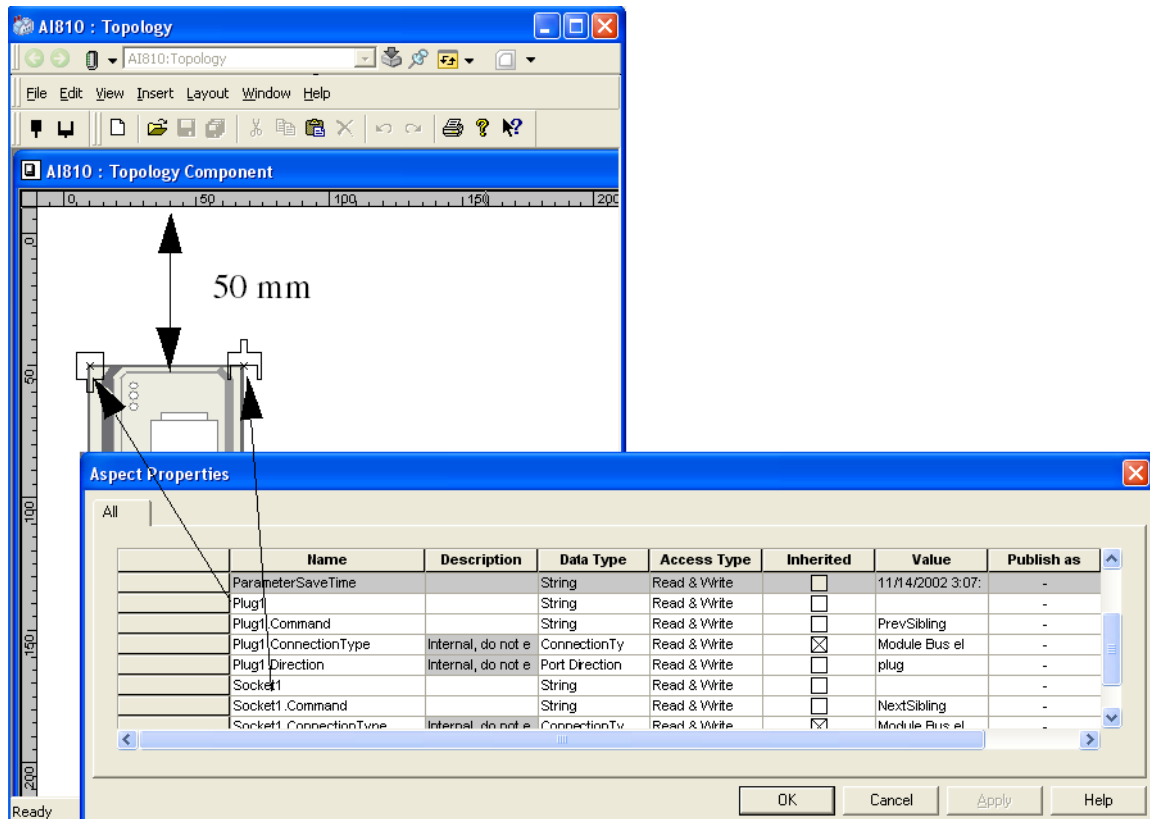


Figure 42. Design Principles for I/O Module Symbols

Following rules apply to symbol layout related I/O module components:

- Symbols are drawn with original size.
- For S800 I/O:
 - The symbols include also the MTU (Mounting Terminal Unit) graphic part.
 - Connections to previous/next module are defined through the plug/socket snap ports using <port>.Command = “PrevSibling” resp. “NextSibling”.

Topology Aspects for Client/Servers

The corresponding Topology aspect is added to related object types provided with Topology Designer. The aspects are inherited from object type for nodes like clients or servers.

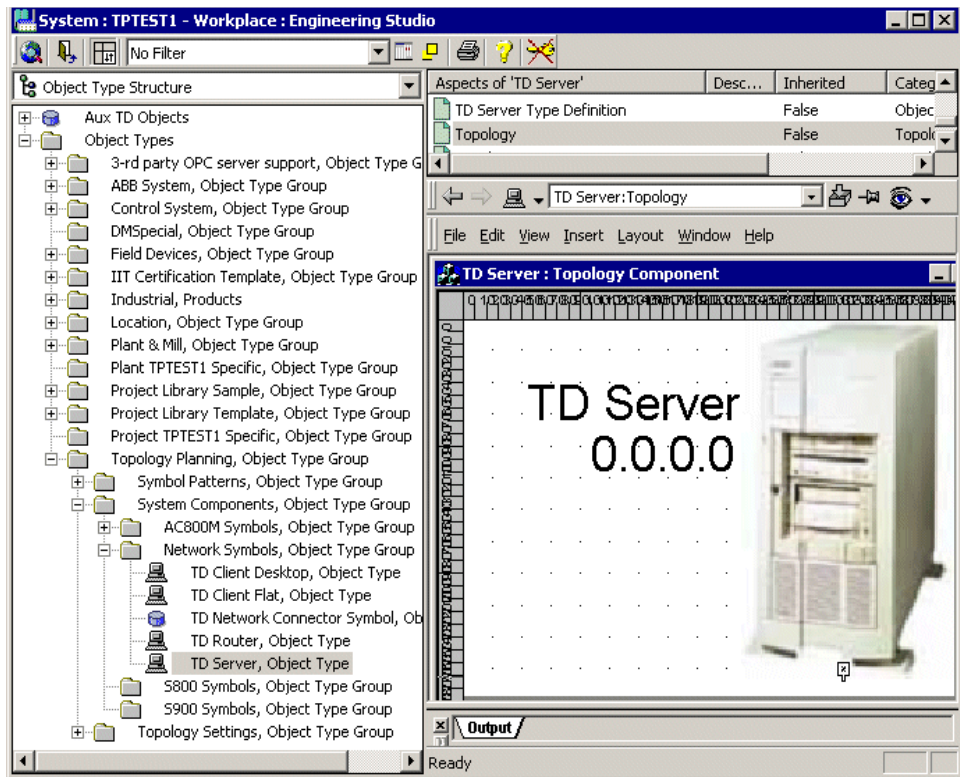


Figure 43. Object Type for Server

Following rules apply to symbol layout related client/server Component view:

- The size of the symbol should be between 150 mm (for “light” components) and 300 mm (for “heavy” components), which corresponds to a downscale between 1:2 and 1:4.
- Insertion point to connector symbol is made through snap port of type plug.

Topology Aspects for Connector Symbols

Connector symbols are used to:

- define within diagram skeletons the insertion points for Topology Components related to Aspect Objects within Control Structure.
- and pre-define connecting lines (representing net/bus topology) within diagram skeletons.

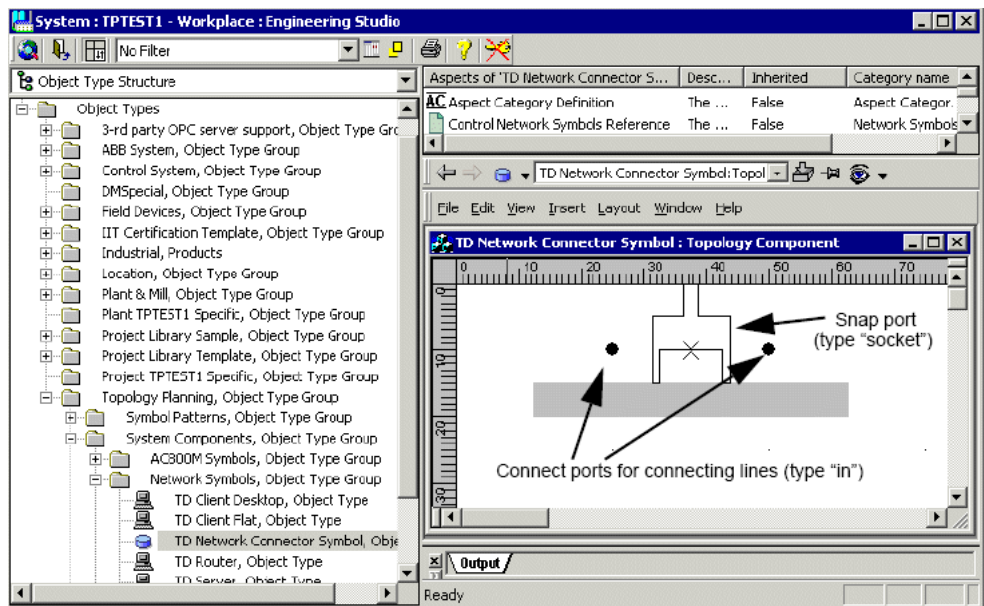


Figure 44. Connector Symbol used within Plant Networks

The corresponding Topology aspect is added to related object types provided with Topology Designer.

Because those symbols are instantiated only within Topology Diagram (and not as Aspect Objects), it must be set to **Explicit Object Type** within **Object Type Definition** aspect

Bulk Data Manager Support

Bulk Data Manager is described in detail in *System 800xA Engineering, Engineering Studio (3BDS011223*)*. This section addresses some functionality useful when copying topology diagrams or topology components, or when setting property values through Bulk Data Manager.

Topology Designer publishes its internal properties through the Topology aspect, the Topology Parameters aspect. Few of the internal properties are listed below:

- Internal properties like **DiagramSaveTime**, **ComponentSaveTime**, **ObjectTypeSaveTime** that are used internally to subscribe to changes and to update open diagrams.
- Diagram properties like **DiagramIsBad** and **DiagramSize**.
- Component name properties like **ObjectName**, **ObjectDescription**, **ControlBuilderName**, **ControlBuilderDescription**.
- Component properties like **AspectObject** and **NumberOfInputs**.
- Component positioning properties like **Position.Page** or **Position.X**.
- Port parameter properties like **In1**, **In1.Direction**, **In1.DataType**, **In1.initVal**, **In1.Inversion**, and **In1.Visible**.
- Variable properties like **VariableDataType** and **VariableAttributes**.

All copied and inherited diagram properties are published through the Topology aspect of the diagram. All copied and inherited component and port properties including connect strings are published through the Topology aspect of the component- even if the data is physically stored inside the Topology Parameters aspect, refer to [Table 3](#).

Table 3. Properties get published through...

Property	... gets published via
Copied diagram property	<ul style="list-style-type: none"> • Diagram's Topology aspect • Diagram's Topology Parameters aspect
Inherited diagram property	<ul style="list-style-type: none"> • Diagram's Topology aspect

Table 3. Properties get published through... (Continued)

Property	... gets published via
Copied component/port property	<ul style="list-style-type: none"> • Component's Topology aspect • Component's Topology Parameters aspect
Copied component/port property marked as "Publish as"	<ul style="list-style-type: none"> • Parent diagram's Topology aspect • Parent diagram's Topology Parameters aspect • Component's Topology aspect • Component's Topology Parameters aspect
Inherited component/port property	<ul style="list-style-type: none"> • Component's Topology aspect
Inherited component/port property marked as "Publish as"	<ul style="list-style-type: none"> • Parent Diagram's Topology aspect • Component's Topology aspect

The number and kind of published properties varies for each Topology aspect.

Preparation of bulk data sheets to modify or copy complete Topology diagrams can be a time consuming task. It is necessary to add Topology aspects from different components, and to filter out relevant properties which should be modified during copy, e.g. initial values for set points.

This is improved by the **Publish via Parent Diagram** setting in the Aspect Properties / Parameters dialog, see [Figure 29](#). All component and port properties marked as "**Publish as**" are additionally published through the Topology aspect of the parent diagram. So user can quickly define the most important properties/parameter of a diagram (template), add just the diagram's Topology aspect to a bulk data sheet, and copy them through Bulk Data Manager while setting individual properties/parameter.



The IAfwBulkData (XML) interface is not supported by Topology Designer.

Revision History



The revision index of this User Manual is not related to the 800xA 6.0 System Revision.

The following table lists the revision history of this User Manual.

Revision Index	Description	Date
A	Updated for 800xA System Version 6.0	December 2014
B	Updated for 800xA System Version 6.0.1	October 2015
C	Updated for 800xA System Version 6.0.3	September 2016

Updates in Revision Index A

The user manual has been updated for 800xA 6.0 release, based on PRCs.

Updates in Revision Index B

The following table shows the updates made in this user manual for 800xA System Version 6.0.1.

Updated Section/Sub-section	Description of Update
Section 1, Prerequisites and Requirements	Added the following information: For more information on the installation prerequisites and requirements, refer to <i>System 800xA Installation and Upgrade Getting Started (2PAA111708*)</i> .
About this User Manual, Released User Manuals and Release Notes	Changed the user manual name from: <i>System 800xA Released User Manuals and Release Notes (3BUA000263*)</i> To: <i>System 800xA Released User Documents (3BUA000263*)</i>

Updates in Revision Index C

The following table shows the updates made in this user manual for 800xA System Version 6.0.3.

Updated Section/Sub-section	Description of Update
Section 1, Introduction, Prerequisites and Requirements	Changed the note from: To get Topology Designer functions for AC 800M in your system, the system extensions Topology Designer and Topology Designer for AC 800M have to be loaded. To: To get the Topology Designer functions in your system install the Topology Designer feature available as part of Engineering Workplace System Function.

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