Design Architect
Training Workbook

Software Version 8.5

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About This Training Workbook

Introduction

This *Design Architect Training Workbook* is for users of Design Architect who have some knowledge about schematic drawing and electronic design and are familiar with the UNIX environment. This training workbook is designed to provide you with concepts and instructions on how to use Design Architect to create schematics and symbols and how to use the Design Viewpoint Editor to create and configure design viewpoints. Some instruction on customizing the Design Architect user interface is also include.

Installing the Training Data

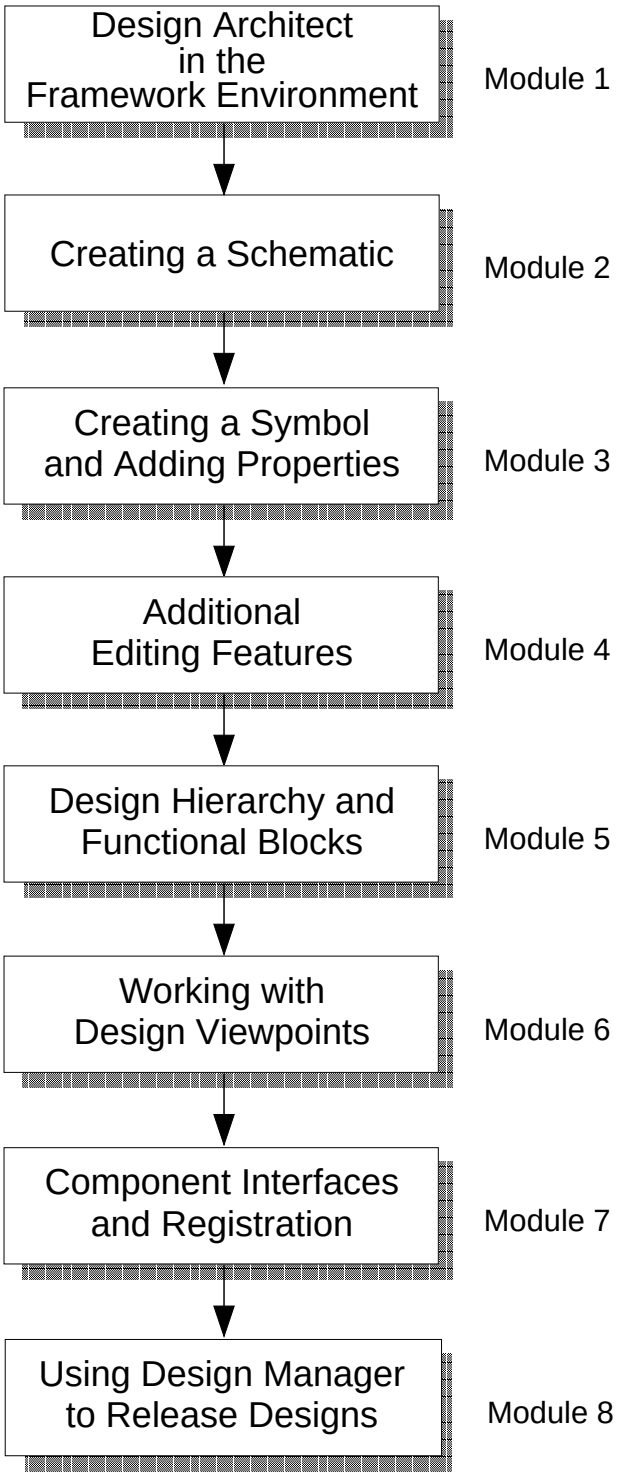
Before attempting to perform the lab exercises in this module, make sure that the design data for this Design Architect training program has been installed on your network. The training data should be at the following path: *$MGC_HOME/shared/training/da85nwp*.

If you can't find the design data, contact you system administrator for assistance or refer to the Mentor Graphics manual titled *Installing Mentor Graphics Software for Falcon Framework Products.*

Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Course Overview



Course Overview

1. Design Architect and the Falcon Environment. Introduces the Electronic Design Data Model (EDDM), explains common elements in the Falcon Framework User Interface, covers how to reference and relocate design objects and introduces the editors within Design Architect.

2. Creating a Schematic. Describes how to invoke the Schematic Editor and create a schematic using the most efficient entry methods.

3. Creating a Symbol and Adding Properties. Describes how to create a symbol for a new component and annotate the symbol and associated schematic with common properties and property values.

4. Creating Design Hierarchy. Covers how to create layers of design hierarchy. The more advanced editing features are also covered, such as: how to set the pin and grid spacing, create buses and bus rippers, frames, selection sets, and comment text and graphics.

5. Creating Functional Blocks. Shows how Design Architect supports top-down design methodology by drawing functional blocks on a schematic sheet, then converting the blocks into symbols and new components structures for lower-levels of the design hierarchy.

6. Working with Design Viewpoints and Back Annotation. Covers design viewpoints and back annotation in more detail. Explains how to create and configure a viewpoint along with how to use Design Architect to selectively merge back annotation information on to source sheets.

7. All about Component Interfaces and Registration. Explains the control center for the component structure, the Component Interface, in more detail. This module covers methods for registering and selecting from multiple functional models and symbols in the same component structure, plus how different functional models and symbols are selected for use through a labeling mechanism.

8. Using Design Manager to Release Designs. Describes how to create configurations of design objects and release whole designs to an achieve.

Training Workbook Goals

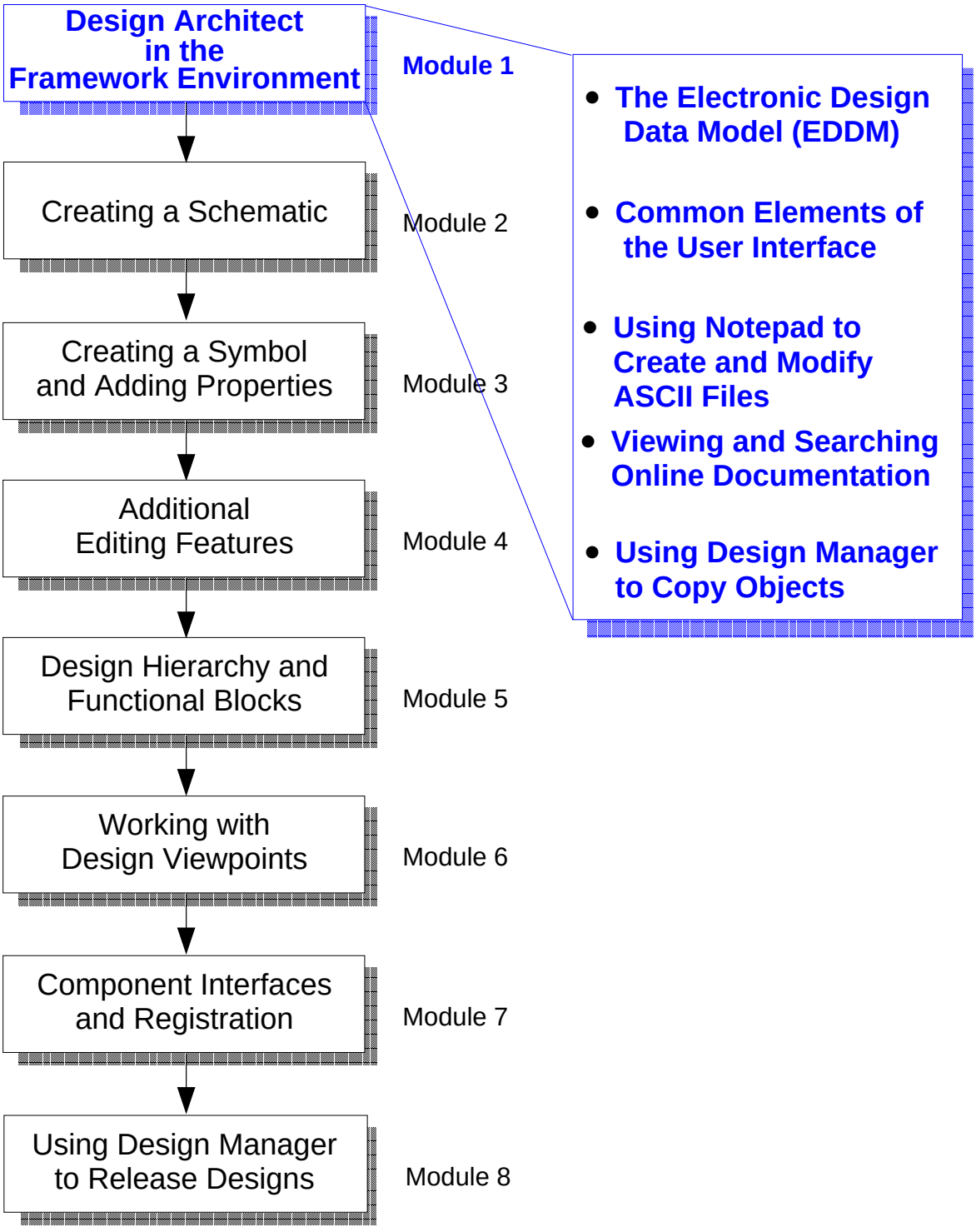
- Introduce Design Architect, the Electronic Design Data Model (EDDM), and the Falcon Framework design environment
- Use the Design Architect editors to create schematics and symbols
- Create a design bottom-up with several levels of hierarchy
- Create a design top-down using functional blocks
- Create design viewpoints, then manage and selectively merge back annotations to source sheets
- Use Design Manager to release whole designs to an achieve

Timeline for Course Completion

	DAY 1	DAY 2
9:00 – 10:00	Design Architect in the Falcon Framework	Design Hierarchy and Functional Blocks
10:00 – 11:00	Creating a Schematic	Working with Design Viewpoints
11:00 – 12:00	LUNCH	
1:00 – 2:00	Creating a Schematic(cont)	Working with Design Viewpoints(cont)
2:00 – 3:00	Creating a Symbol and Adding Properties	Component Interfaces and Registration
3:00 – 4:00	Additional Editing Features	Using Design Manager to Release Designs
4:00 – 5:00		

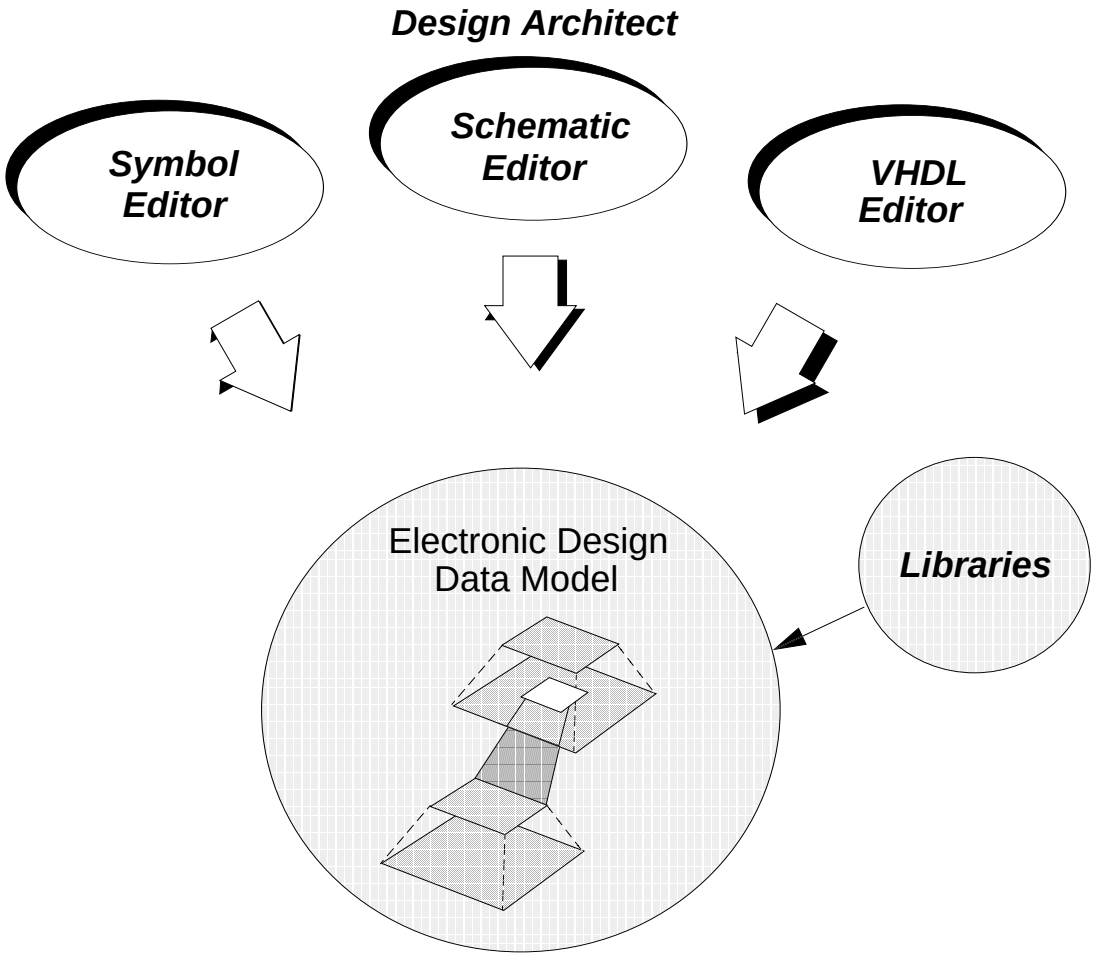
Module 1
Design Architect in the Framework Environment

Module 1 Overview



Lesson 1
The Electronic Design Data Model

Design Architect and the EDDM

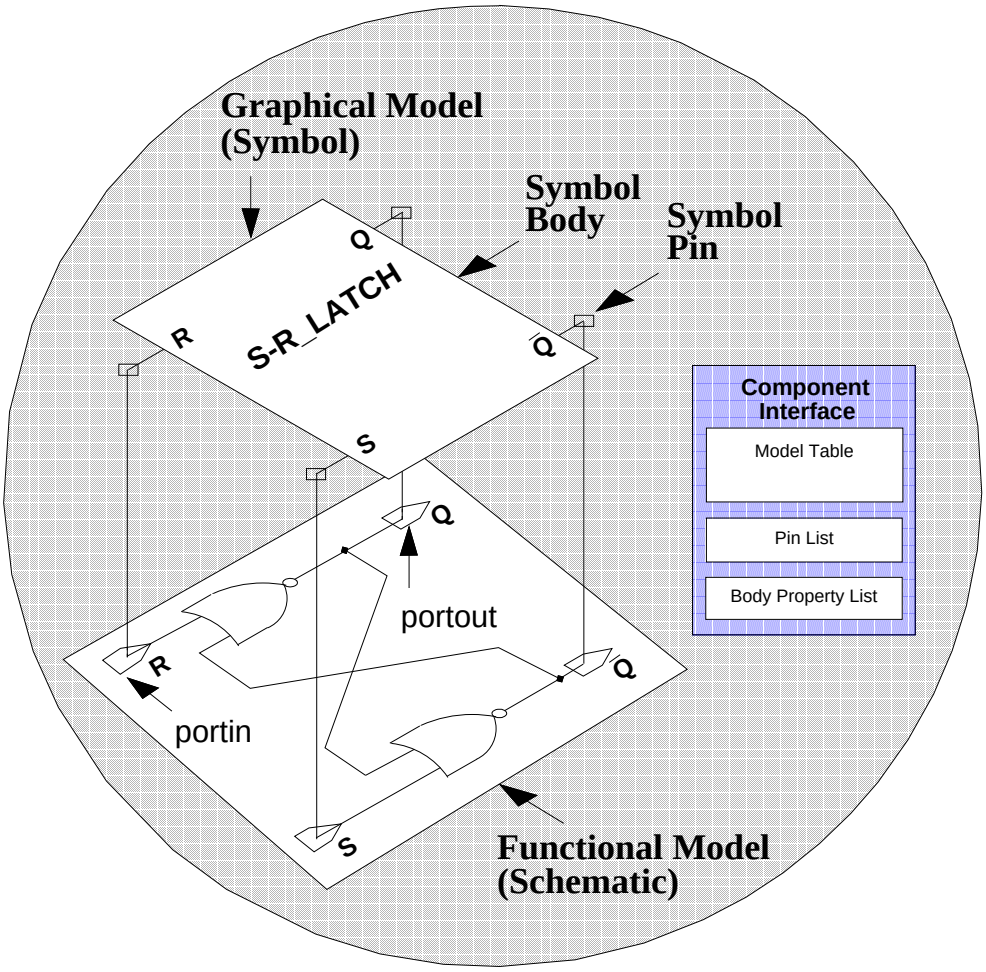


Design Architect and the EDDM

Design Architect - a Tool Box You can think of Design Architect as a tool box containing a collection of tools (graphic and text editors) that are used to create and modify the data that is modeling your design. The three primary tools in Design Architect are the Symbol Editor, the Schematic Editor, and the VHDL Editor. Many other optional tools can be added to Design Architect through the use of Personality Modules.

The Electronic Design Data Model (EDDM) When you use the editors in Design Architect to enter a design, a set of design files and directories is created called the Electronic Design Data Model (EDDM). Typically, the basic building blocks of your design will be pre-built components that reside in libraries located somewhere in your file system.

Component Structure (Conceptual View)

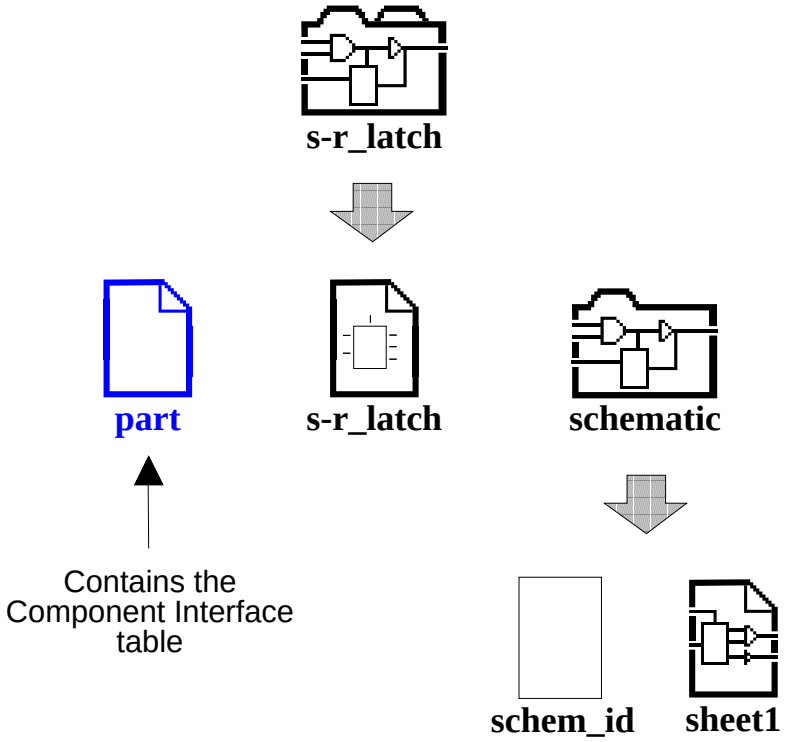


Simple Component Structure (Conceptual View)

The basic unit structure of the EDDM is called a component. In other systems, this unit structure might be called a cell. A component can be thought of as a sphere containing a collection of models that represent a “chunk” of electronics. The simple structure illustrated on the facing page shows a component that models an S-R latch. The component contains a graphical model called a symbol and a functional model in the form of a schematic. The control center of the component is called the “component interface” and may be thought of as the “nucleus” of the cell.

- **Graphical Model (symbol).** Composed of symbol body graphics, symbol pins, and properties. A component may have more than one symbol model associated with it.
- **Functional Model (schematic)**. Describes the functional behavior of the electronics being modeled. More than one functional model may be present. A non-schematic functional model is called a “primitive”. Each functional model must have input and output “ports” that match the input and output “pins” on the symbol.
- **Component Interface.** Acts as the control center for the component structure. This design object takes the form of a table that collects and retains information about the symbol pins, symbol body properties and each functional and timing model associated with the component. Placing a model in the model table of the Component Interface “registers” the model with the component.

Component Structure (Iconic View)



- **Component Icon - represents the directories and files in a component structure**
- **Design Object Icons - represent other objects within the component structure (symbols, schematics, sheets**
- **Part Object - a binary object that contains the Component Interface table**

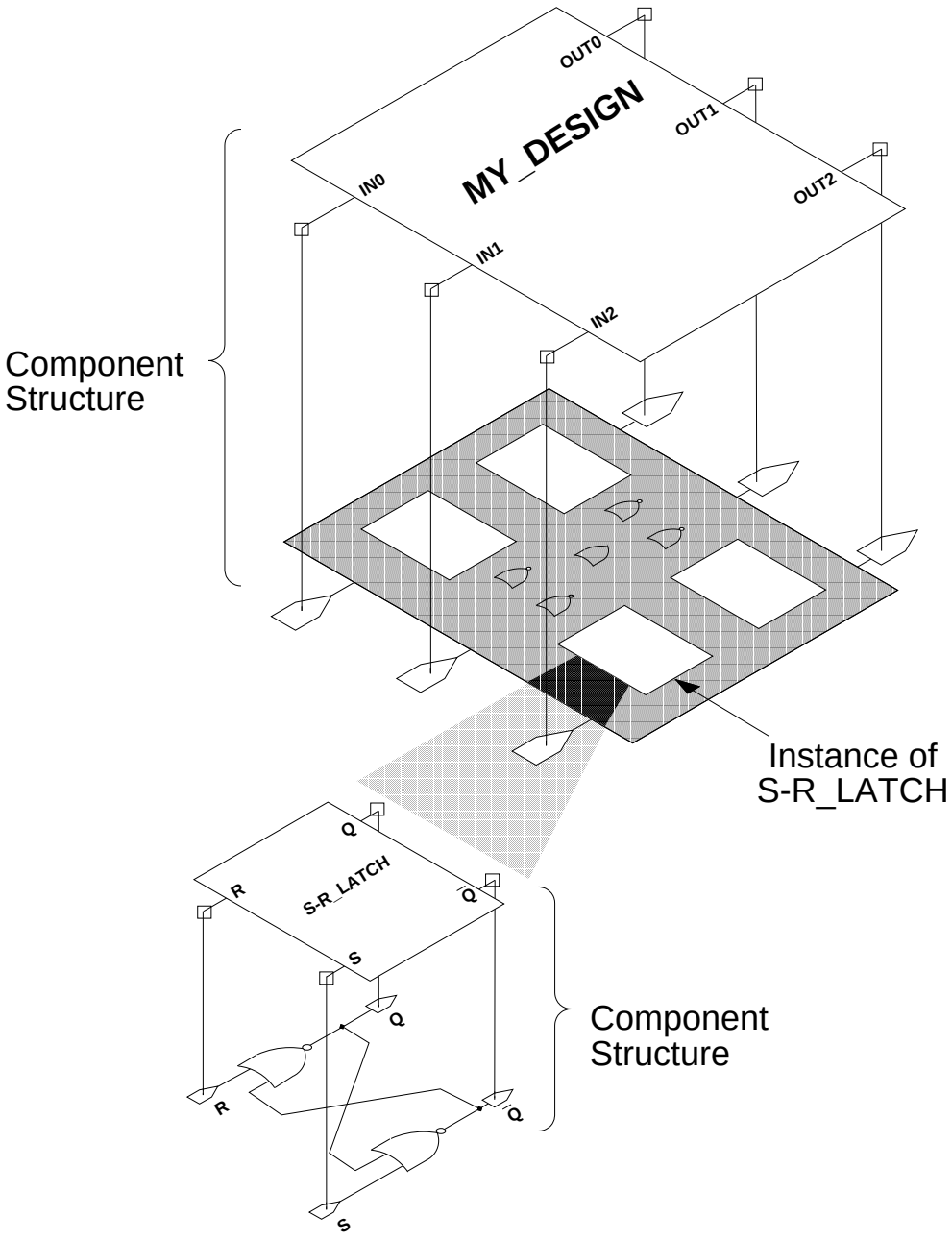
Component Structure (Iconic View)

Your design data is modeled by an object-oriented database and each “object” is represented by one or more directories or files in the Unix file system. To make things simpler, these objects are represented by icons when you view them through a window such as the Navigator.

If an object is really a Unix directory in the file system, it is called a “container.” A container can contain other objects. The icon at the top of the illustration on the facing page shows the icon for a component structure. Because a component is a container, it contains several other objects such as the part object, the symbol object, and the schematic object. The schematic object is also a container and can contain one or more “sheet” objects. The “schem_id” object is a special object that helps the system manage the assignment of system identifiers (handles) to various objects on the schematic sheets. (The subject of handles will be covered in a later module.)

The part object is a special object that contains the Component Interface table. Remember that this table acts like the control center of the component where information about the symbol pins, symbol body properties and each model is collect and retained.

Component Within a Component



Component within a Component

The picture on the facing page illustrates how a new design is created by placing components within a component. Two component structures are shown: one named *S-R_LATCH* and the other named *MY_DESIGN*. The component named *S-R_LATCH* contains a symbol model and a functional model and is typical of a component that might be found in a library.

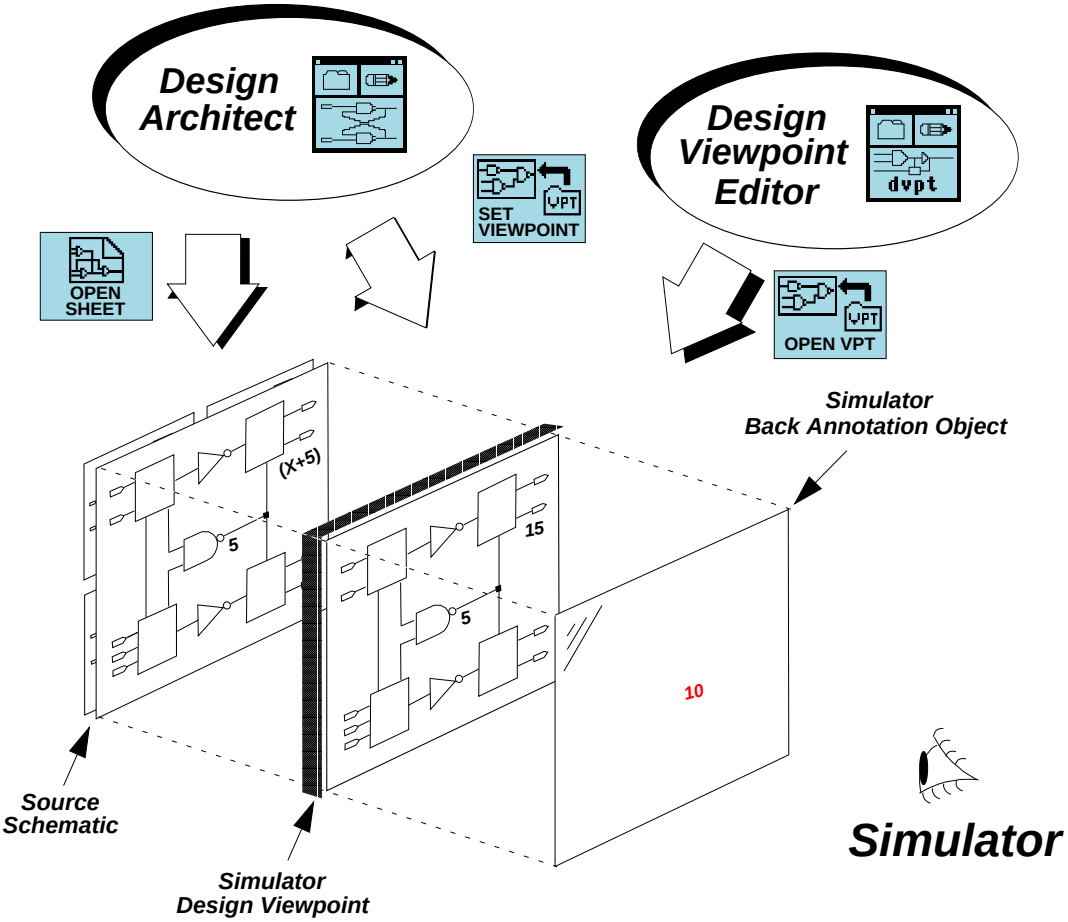
A new component structure is created when you open a new schematic sheet with Design Architect. The new component in the picture is called *MY_DESIGN*. In this case, the image of the *S-R_LATCH* component symbol is placed on the new schematic. Each image is called an “instance” of the *S-R_LATCH* and can be thought of as an active reflection of the *S-R_LATCH* symbol located in the library.

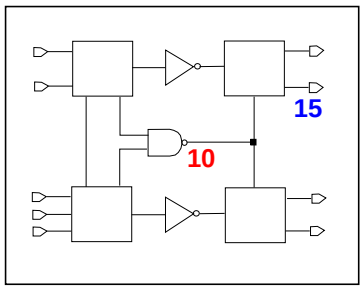
Each instance of the *S-R_LATCH* is considered different than the symbol body, because some of the characteristics of each instance can be changed once the instance is placed on the new sheet. Additionally, each instance can also be viewed as “linked” to the symbol body, which allows each instance to be collectively or individually updated after changes are made to the symbol body in the library.

Once you create a new schematic design, you can create a symbol to represent it. In this case, the symbol *MY_DESIGN* is created with the Design Architect symbol editor and registered with the *MY_DESIGN* component structure. Notice that the new symbol contains three input pins and three output pins to match the three input ports and three output ports on the schematic.

The new *MY_DESIGN* symbol can now be instantiated on a new higher-level schematic sheet that may represent the electronics of a more complex system.

Design Viewpoint (Conceptual View)





What the Simulator Sees

Design Viewpoint(Conceptual View)

Schematics are represented by files and directories in a software environment, so they can take on some of the characteristics of a software program. For example, a timing value can be represented by a numeric expression such as (X + 5) as shown in the figure on the left. This expression must be evaluated to a constant before a downstream tool like a simulator can operate on it. The object in the data model that allows a downstream tool to view the source schematic as fully evaluated data is called a *design viewpoint*.

You may conceptually think of a design viewpoint object as a picture frame through which the downstream tool views the schematic. In your mind's eye, think of the image of the source schematic as being reflected onto the back of the glass in the picture frame. Notice in the diagram that the simulator sees the fully evaluated data through the viewpoint (15 in this case) even though the expression on the source schematic (X + 5) doesn't change. The value of X can be defined elsewhere on the schematic or defined in the viewpoint itself.

Because the glass in the viewpoint protects the source schematic, you can't change the source schematic from the downstream tool. You can appear to change the schematic, however, by selecting a property in the simulator Schematic View Window and making a change. The change is recorded in a Back Annotation object, which is conceptually represented as a transparent sheet laid over the top of the glass in the viewpoint. In the figure, the timing value in front of the center **and** gate is changed from 5 to 10 nanoseconds. The simulator sees 10 ns, as shown in the lower figure, even though the source schematic is unchanged.

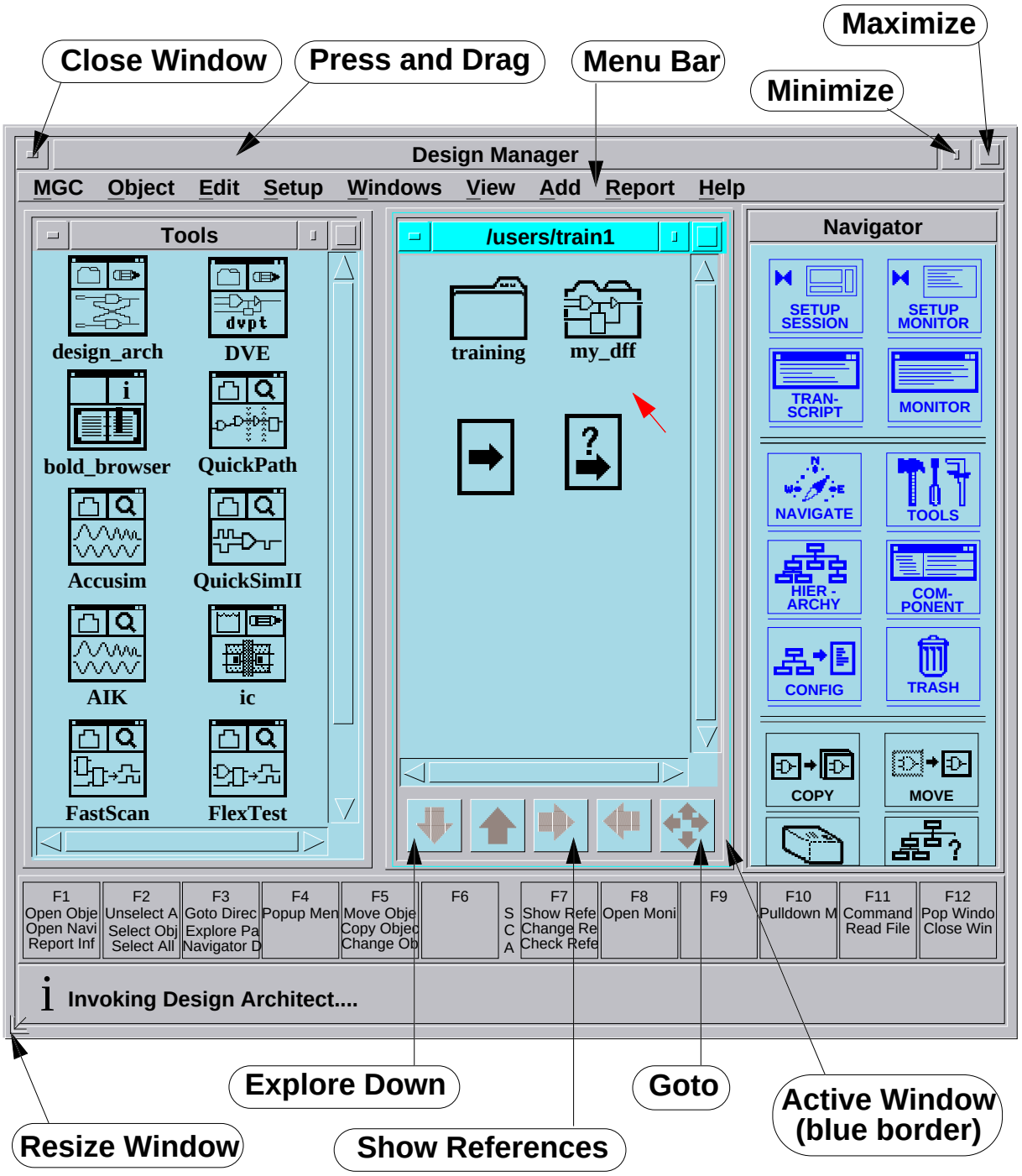
All downstream tools must view the source schematic through a viewpoint. Typically, if a schematic doesn't have a viewpoint, the downstream tool creates one automatically when the tool is invoked on the design.

Viewpoints can be created and modified with a tool called the Design Viewpoint Editor. Design Architect can also invoke on a design viewpoint (using the SET VIEWPOINT icon) as well as a source schematic (using the OPEN SHEET icon). When you invoke Design Architect on a design viewpoint, you may selectively merge back annotation information from the Back Annotation object onto the source schematic.

Lesson 2
Common Elements of the User Interface

Many applications in the Mentor Graphics environment share common elements. This lesson introduces you to these common elements.

Window Buttons and Navigator Controls



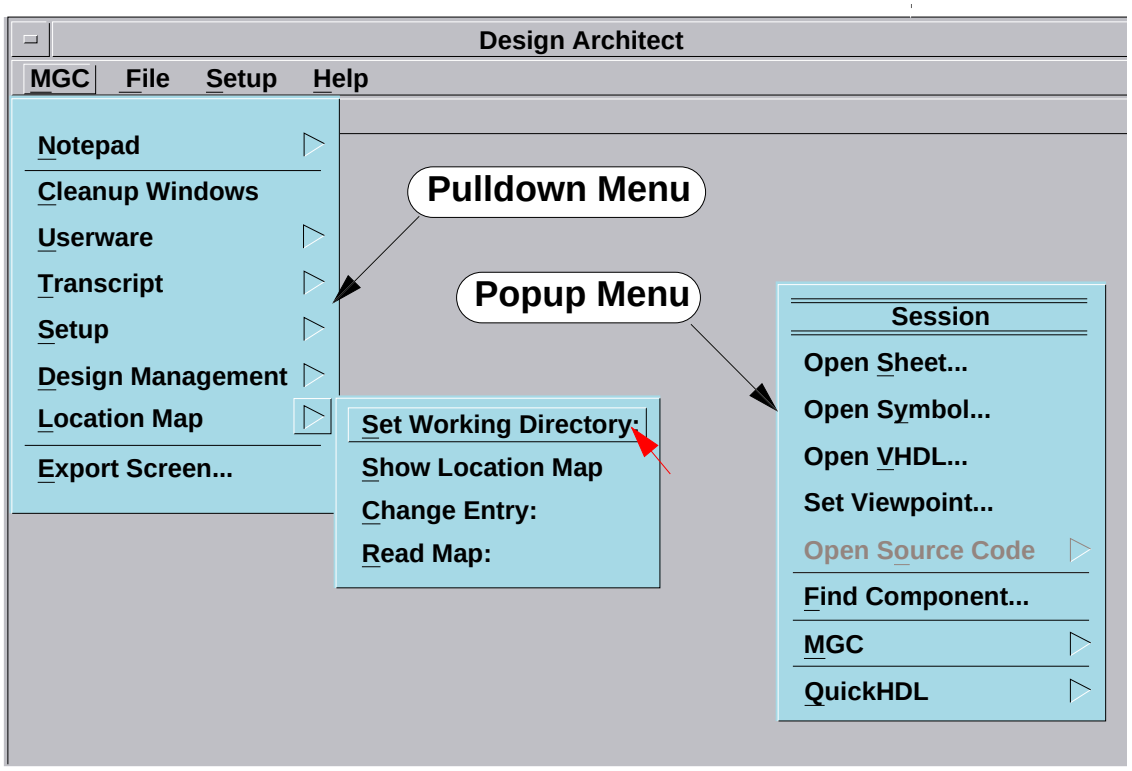
Window Buttons and Controls

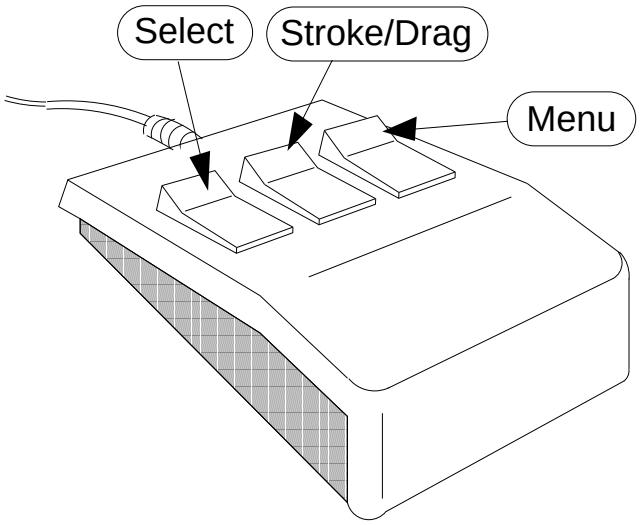
The illustration on the left show how the Design Manager appears when it is invoked from a shell. The title bar on the window has several important controls. When you click the Maximize button, the window expands to fill the whole screen. Click Maximize again and the window returns to its original size. When you click on the Minimize button, the window turns into an icon. When you double click on the Close Window button(on the far left), the window goes away. Finally, if you place the mouse pointer on the title bar and press the left mouse button, you can reposition the whole window to any place on the screen. When you move the pointer to a window corner, a Resize cursor appears, as shown in the lower-left corner, and you can press the left mouse button to resize the window.

You can navigate, or move around in, directories and files by using the Navigator window. The Navigator contains the following areas and controls:

- **Iconic Area.** Displays icons represented by icons.
- **Scroll bars.** Scroll iconic area vertically and horizontally.
- **Navigation buttons.** Navigate the file system. These buttons correspond to the following actions:
  - **Explore Down.** Navigates into the selected directory and displays the objects in that directory.
  - **Explore Parent.** Navigates up one directory or reference level.
  - **Show References.** Replaces the current display with the references of the selected design object.
  - **Explore Back to Parent.** Closes the report window of the references currently displayed.
  - **Go To.** Displays a dialog box into which you can enter a pathname and then moves directly to that destination. You may also type a Unix change directory command like "**cd /user/train1/training/da_n**" and the Navigator will move to that location.

Menus and Mouse Buttons





Menus/Mouse Buttons

Pulldown Menus Place the mouse pointer on the Menu Bar item and press the Left or Right mouse button.

Popup Menus Place the mouse pointer in the window area and press the Right mouse button.

Graphic Elements in Menus:

- **Menu items.** Represent a specific task or a category of tasks. The examples shown on the facing page are Notepad, Cleanup Windows, Userware, Transcript, Setup, Design Management, Location Map, and Print Screen menu items from the **MGC** pulldown menu.
- **Cascade arrow.** Indicates that a cascading menu is present.
- **Separator.** Divides a related group of menu items from the rest of the menu items.
- **Cascading menu.** Displays to the right of the parent menu item.
- **Prompt bar indicator.** A colon indicating that the menu item displays a prompt bar for additional command or function information.
- **Dialog box indicator.** An ellipsis indicating that the menu item displays a dialog box for additional information to the system.

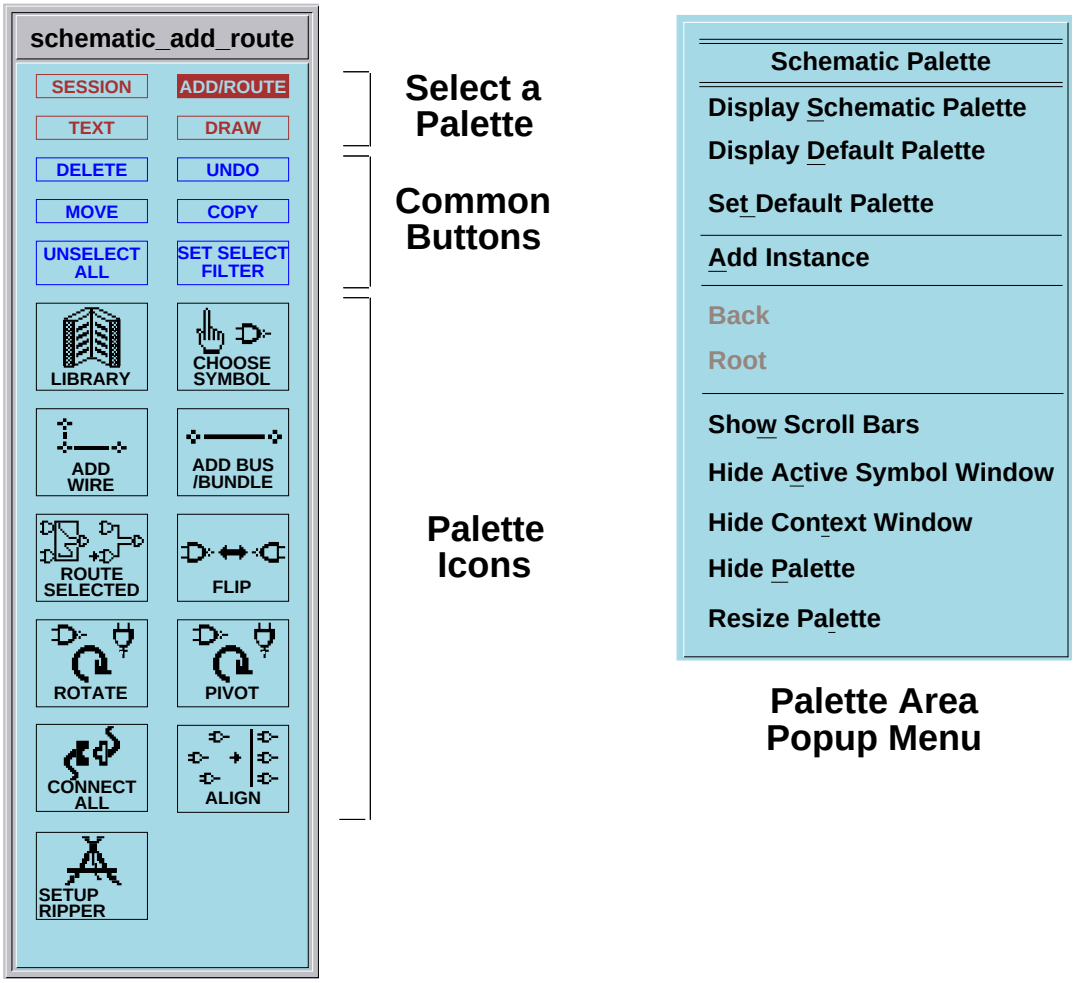
A cascading menu represents a group of tasks related to the parent menu item. On the facing page, the cascading Location Map menu item has four tasks:(1) Set the Working Directory, (2) Show the current location map, (3) Change an entry in the location map, and (4) Re-read the location map from disk.

To choose the menu item that you want, you slide the mouse pointer over the menu cascade arrow and on top of the desired menu item before releasing the mouse button.

Palettes

- **Default palette: displayed on invocation**
- **Name of palette depends on the application**

Three palette areas:



Palettes

A palette is a convenient way to execute commands without having to traverse menu paths. You click the Select mouse button to execute a palette item. These items fall into three categories, depending on the area of the palette.

- **Palette Selection.** A palette is really a group of palettes all in one area. The top part of each application palette is identical and contains several choices, each representing a different palette. The button for the palette that is currently being view is highlighted in red, so if you click on it, nothing happens. When you click on any other button, you can access the corresponding palette. The new palette replaces the existing one.

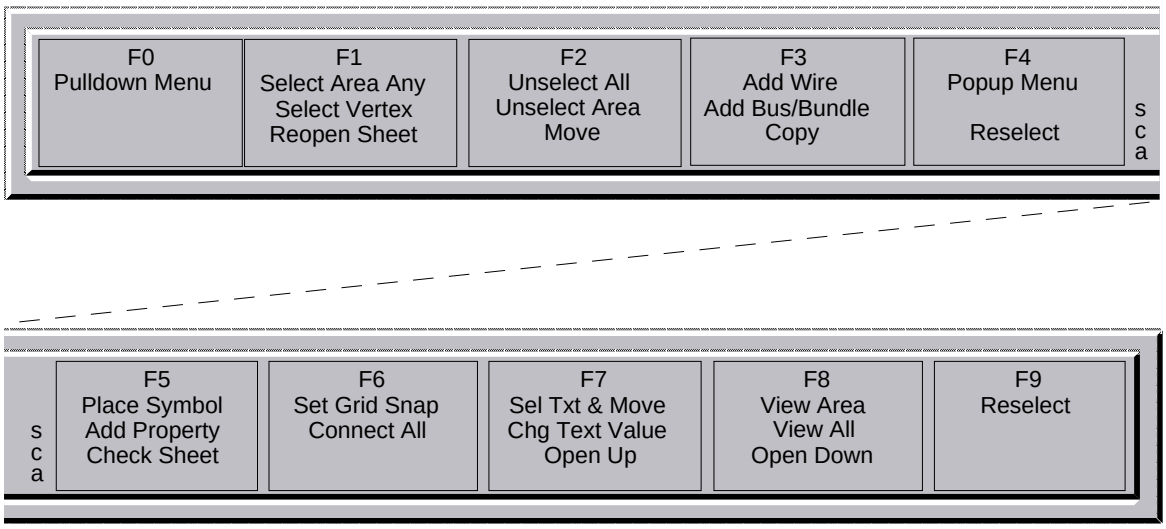
- **Common Palette Buttons.** The middle area of each palette contains a common area of buttons that perform the same function on each palette. Many of these functions can also be found in the session popup menu.

- **Palette Icons.** These buttons form a subset of the total icons available and are grouped on a palette according to function. For example, the palette on the left contains icons that allow you to add instances to a schematic sheet and route nets between the instance pins.

Palette selections work much the same as menu choices; that is, you may be prompted for additional information in a dialog box or a prompt bar. In addition, palette buttons may be grayed to indicate that the choice cannot be made. Some buttons may require design objects to be selected before they become available, while other buttons require that a type of window be present.

Softkeys

- **Indicate the operation of each function key**
- **They change from window to window**
- **They do not function as buttons (only visual)**



Softkeys

Softkeys are not buttons like the ones you see in a palette. Instead, the softkey area is presented to give you a visual representation of the function keys. To execute a softkey action, you "look up" the action you want to perform in the softkey area, and then press the appropriate function key combination.

There are four key combinations for each function key.

- **Function key alone.** Several common user interface operations, such as "Pulldown menu" and "Popup menu," are reserved for this mode. Press the function key by itself.
- **Shifted function key.** The second row of operations, which are in line with "s" in the key, are executed by first pressing and holding the shift key while pressing the function key. The View All function (F8) is accessed this way.
- **Control + function key.** The third row of operations, which are in line with "c" in the key, are executed by pressing and holding the Control (Ctrl) key while pressing the function key. For example, this is how you access the Move command (F2).
- **Alt + function key.** The last row of operations, which are in line with "a" in the key, are executed holding the Alt key while pressing the function key.

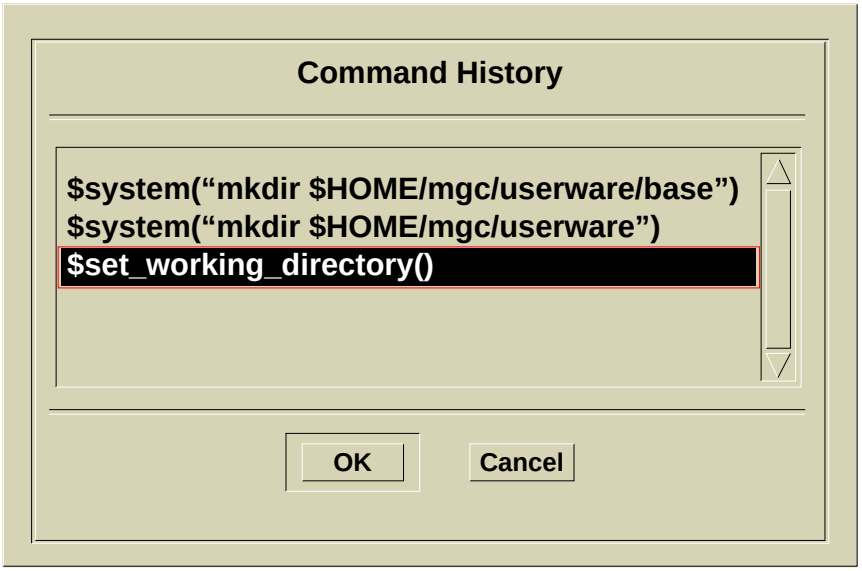
To remove the softkey area, use the Hide Softkeys menu item in the Softkey menu, or the **Setup > Hide Softkeys** menu from the pulldown menu bar. To show the softkey area, you access the **Setup > Show Softkeys** menu item from the pulldown menu bar.

Command Window

CTRL P ← Returns the previous entry to the window.

CTRL N ← Moves forward in the History List and returns that entry.

CRTL H ← Displays a complete History List. Select the entry you want.



ALT **Back Space** ← Returns the previous entry to the window.

Pre-V8.4 Behavior

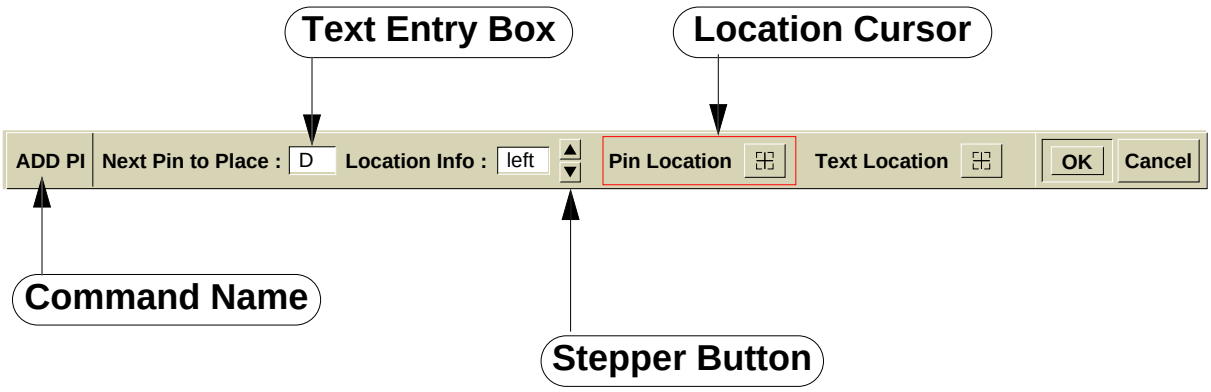
Command Window

When you start typing in a window, the command window automatically pops up with your entry. You may enter commands or functions in this fashion. The name of the active window is shown on the left side of the Command window and the command or function you type must be defined within a scope that is visible to this window.

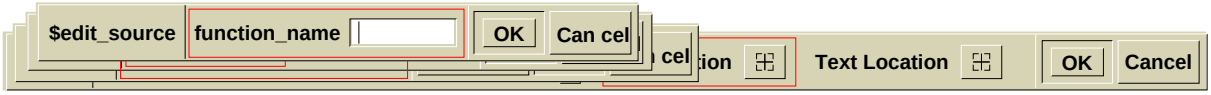
A history list is keep for this window. With the Command window displayed, type **Ctrl P** (for previous) to bring the last entry back into the window, type **Ctrl N** to move forward in the history list, and type **Ctrl H** to bring up a form with all the entries listed. Select one and click OK.

For software versions prior to V8.4, type **Alt BackSpace** to bring back the previous entry.

Prompt Bars



Mid-Command Freedom



Lets you execute an additional function before you complete the previous one

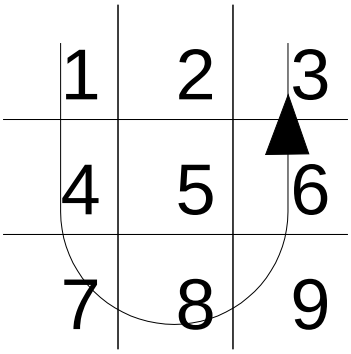
Prompt Bars

A *prompt bar* is a graphic aid that is displayed when you need to supply additional information to a command. When the prompt bar is displayed, you supply the additional information by typing in text or clicking a stepper button. Sometimes you must supply a coordinate location by clicking on a point in a window. When you have supplied all the necessary information, the prompt bar goes away. Sometimes, you execute a function like ADD WIRE in the Design Architect Schematic Editor and the prompt bar means that you are in the ADD WIRE mode. You can keep adding wires to the schematic until you exit the mode by clicking the Cancel button on the prompt bar.

Mid-command freedom is a feature that allows you to execute another command before you finish executing the current command. In the bottom illustration on the facing page, the stacked prompt bars indicate that three commands were suspended in mid-command while a fourth command $edit_source is being executed. Once the current command is finished executing, the system returns to the previous command. At any time, you can click the Cancel button on the prompt bar to clear it from the screen, but it must be the prompt bar on the top of the stack.

Strokes

- **You use the Middle mouse button**
- **A strokes pattern is converted to a number sequence from the grid**



Unselect All

$stroke_1478963()

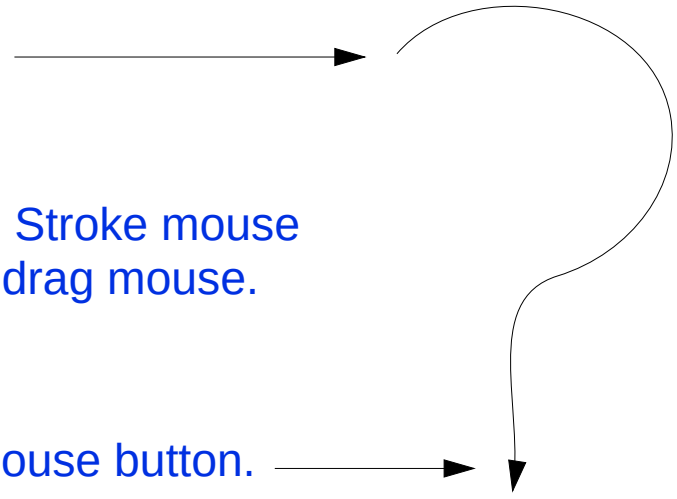
- **To get help on strokes:**

Draw the “Question Mark” stroke:

1. Start here.

2. Hold down Stroke mouse button and drag mouse.

3. Release mouse button.



Strokes

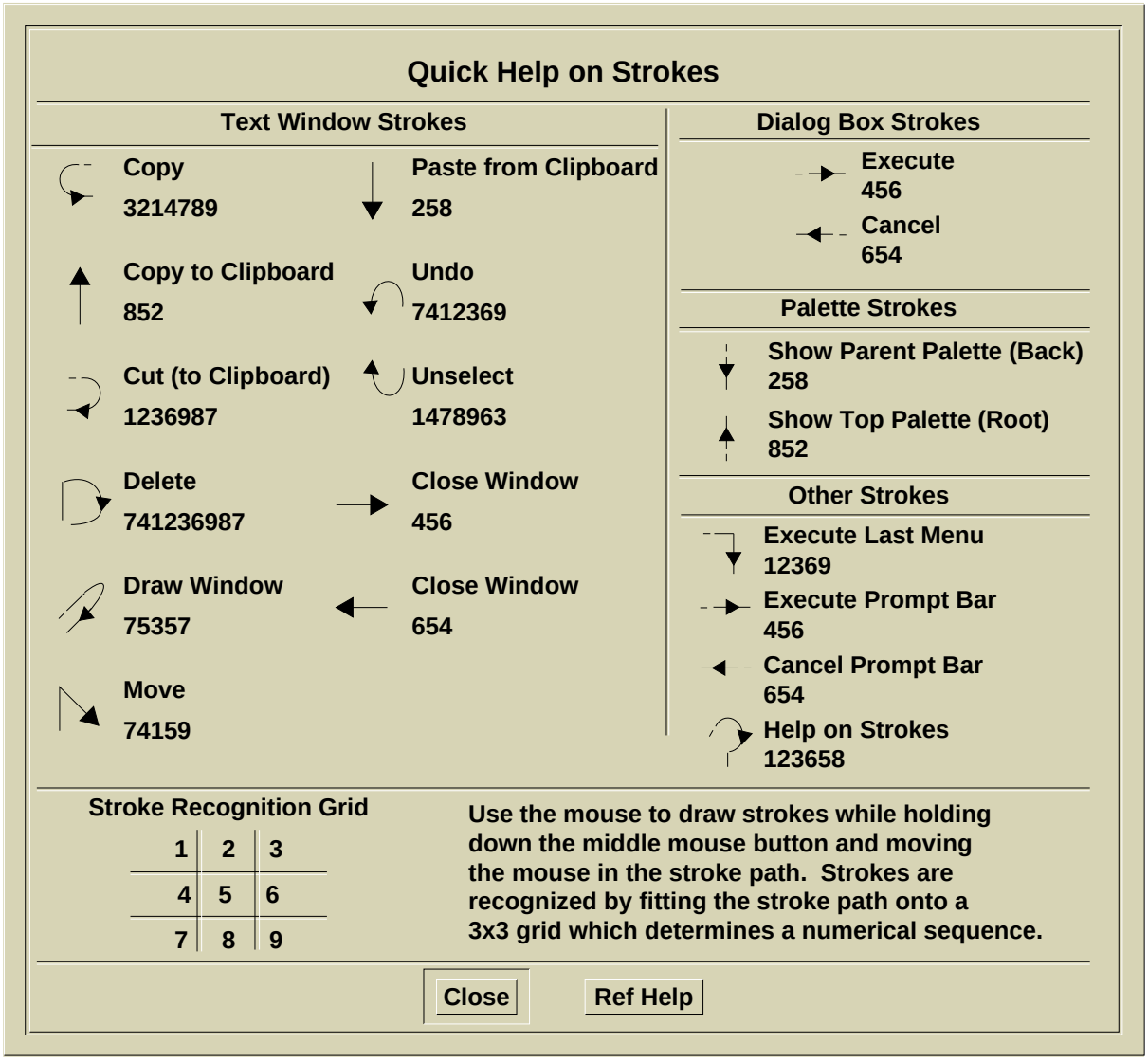
Strokes are another way of issuing commands within applications. You can activate stroke mode by pressing the Drag/Stroke mouse button (usually the middle button), and then you use the mouse to graphically “draw” the command.

For example, to unselect all objects in many applications, you press and hold the Drag/Stroke mouse button and then draw a “U” on the screen. The “U” will show graphically on the screen in the default stroke style and color, normally a narrow red line. When you have finished drawing the “U,” release the Drag/Stroke mouse button. The command executes immediately and all objects are unselected.

A stroke is defined by a sequence of grid coordinates, as shown in the figure on the left. This grid is called the *stroke recognition grid*. When you draw a stroke, the pattern is overlaid on the recognition grid, and a sequence of numbers is derived. If this sequence matches an existing defined sequence, the command for that sequence is executed. If the sequence is not defined, you get a “not defined” message.

In the example on the left, if you draw the “U” stroke, the pattern is interpreted as the number sequence 1478963. This is mapped to the function $stroke_1478963() which is defined as Unselect All. If you draw a “?” stroke, a quick help chart on the available strokes appears as shown on the following page.

Quick Help on Strokes

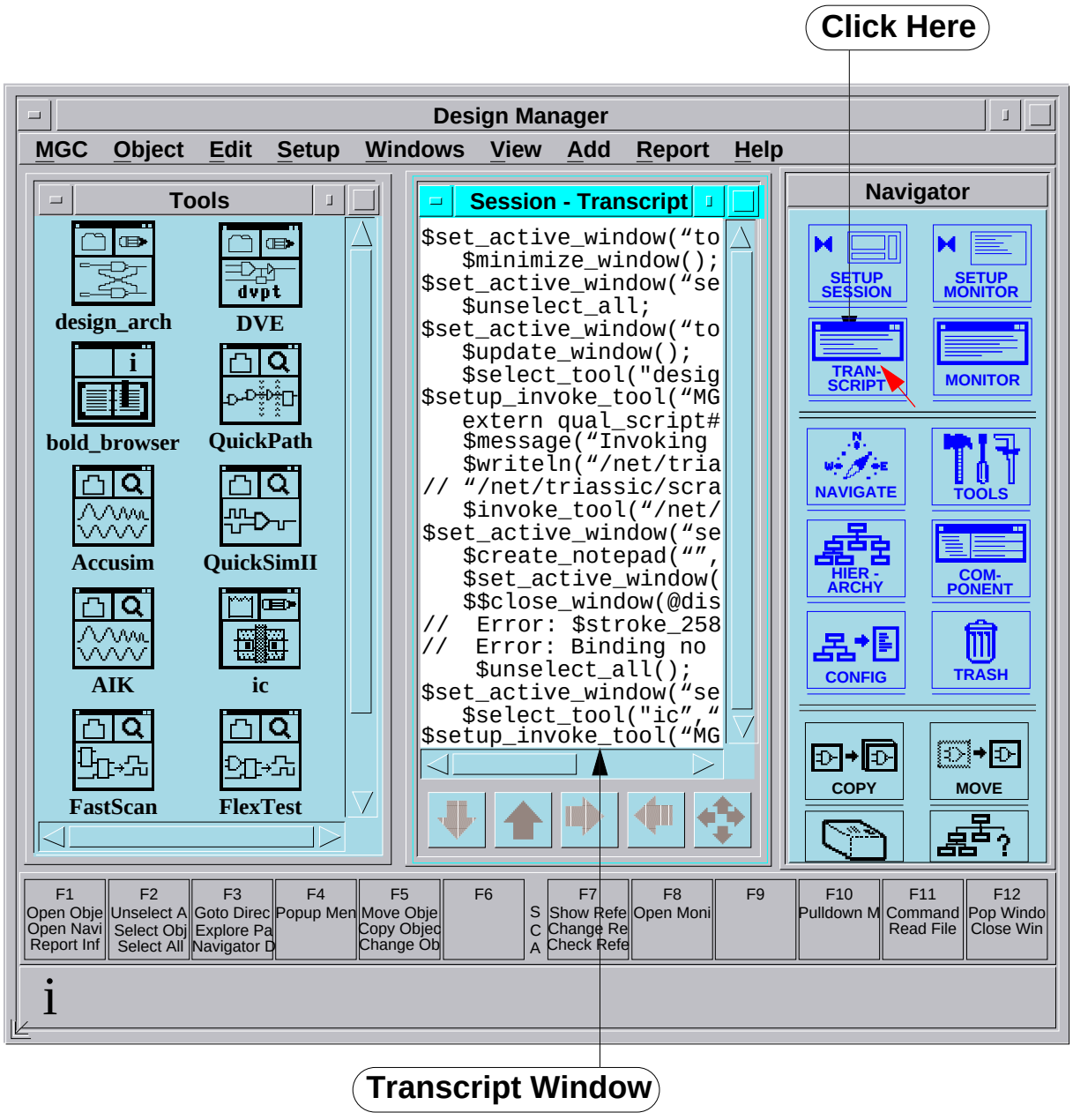


Quick Help on Strokes

If you draw a question mark stroke “?” in a Design Manager window, the Quick Help on Strokes chart appears as shown on the facing page. This chart defines the strokes that are available to you in that active window. Strokes are one of the most productive methods for executing commands, because all you have to do is wiggle the mouse in small patterns, instead of moving the pointer half way across the screen to click a palette icon or reach a pulldown menu..

It is often helpful to make a photocopy of this form, cut it up into strips and tape the strips on the edges of your display until you learn the strokes. After you use the strokes over time, you will remember them and they will come to you naturally, almost without thinking. Many of the strokes that you will learn from this chart will carry over to other applications, so they are well with the effort to learn.

Transcript Window

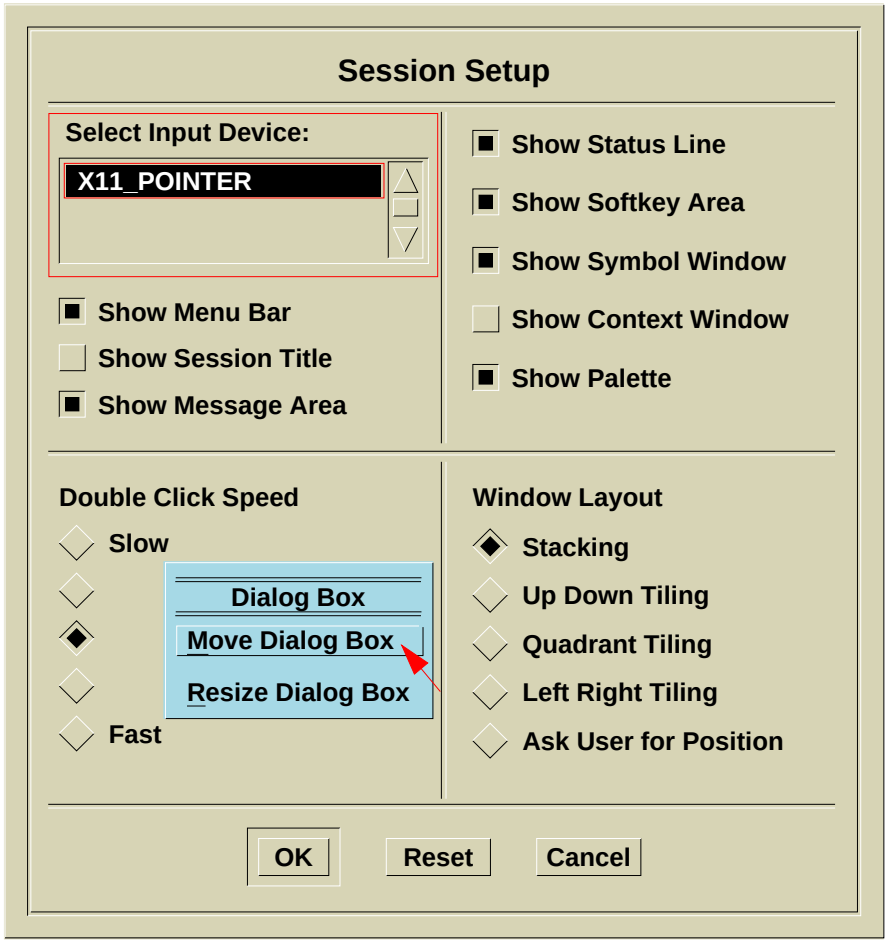


Transcript Window

A transcript is a record of the events that occur during a session. Although you can trigger events in a variety of ways such as clicking an icon or choosing a menu item, the actions taken are taken by executing a series of AMPLE functions. The transcript is a record of the AMPLE functions. Other information, such as a warning or error messages, are also recorded in the transcript.

It is possible to select text from a Transcript, then copy and paste the text to an ASCII file using the Notepad Editor. The ASCII text can then be saved as a macro file for later execution. This is a handy feature for creating application startup files and custom userware files.

Session Setup



Session Setup

When you click on a Session Setup icon or execute the pulldown menu **MGC > Setup > Session**, the form to the left appears. You can hide any number of out lying window areas, such as the palette and softkey area in order to gain more work space in the session area. In addition, you can set the speed of the mouse click and specify how you want the working windows in the session area to be displayed.

If a dialog box appears in an area that blocks your view of information, you can easily move the dialog box by taking the following steps:

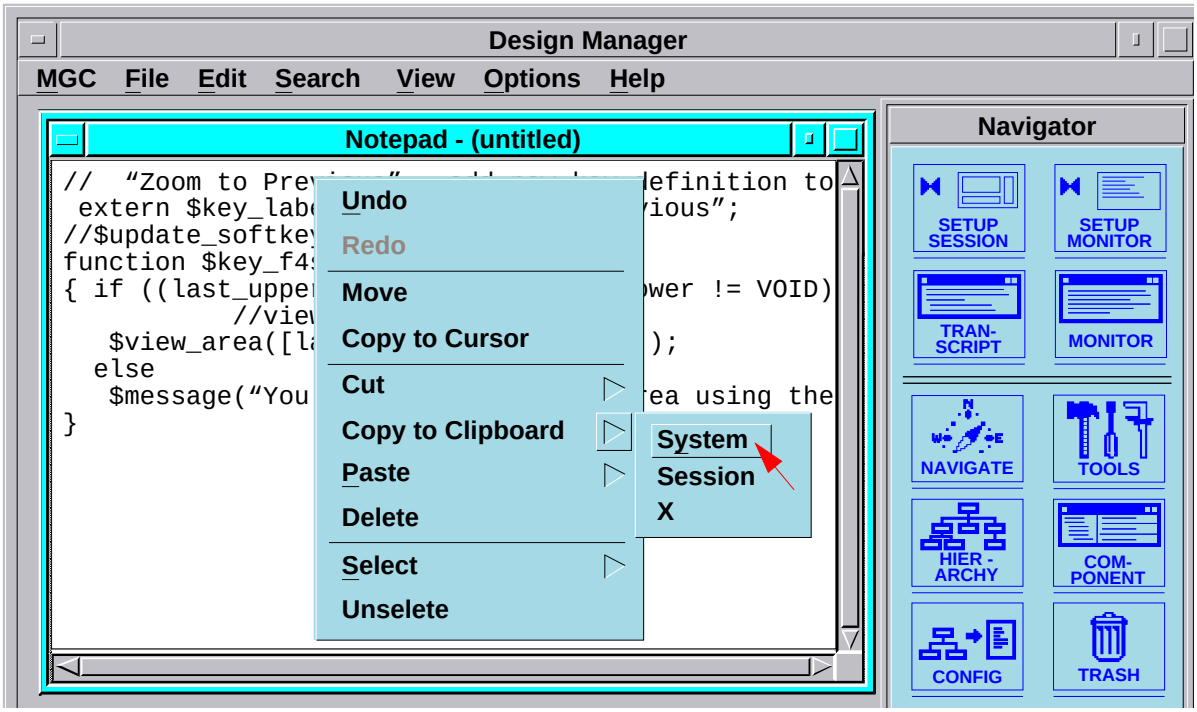
1. From any where in the Session area, press the right mouse button and click on **Move Dialog Box** as shown in the illustration on the left page:

2. Move the “shadow box” to a new location, then click the select mouse button.

Lesson 3
Using Notepad to Create and Modify ASCII Files

The Mentor Graphics environment provides a simple text editor that you can use to create and modify ASCII text files. In this course, you will use this editor to create and modify files that will customize the user interface.

Editing Files with Notepad



The following editing actions can be done:

- **Move, duplicate, and delete selected text**
- **Copy selected text into a system clipboard**
- **Insert text from a system clipboard**
- **Undo or redo editing actions**

Editing Files with Notepad

The Notepad editor enables you to accomplish several types of actions on text contained within a Notepad window. You can do any of the following from the Notepad popup menu, which is illustrated in the figure on the facing page.

- **Undo or redo editing actions.** If you want to reverse the effects of an action, you can use the **Undo** popup menu item to return the file to the way it was before the last action. If you decide you want that last action after all, you can use the **Redo** popup menu item.

- **Move, duplicate, and remove selected text.** You can use the **Move** or **Copy to Cursor** popup menu items to move text to a different location or to copy it to the cursor location. You can delete selected text into either a System paste buffer or into a Notepad Session paste buffer using the **Cut** popup menu items; the System buffer is the default.

- **Copy selected text into a clipboard.** If you have text that you want to transfer to another location, you can copy it into either the Session clipboard, the System clipboard, or the X window cut buffer using the **Copy to Clipboard** popup menu item. A clipboard essentially acts as a paste buffer within the Notepad session or between applications you have active on your workstation; the System clipboard is the default.

- **Insert text from a clipboard.** If you have text copied to a Session clipboard or a System clipboard, you can copy the text into the file you are editing using the **Paste** popup menu item; the System clipboard is the default.

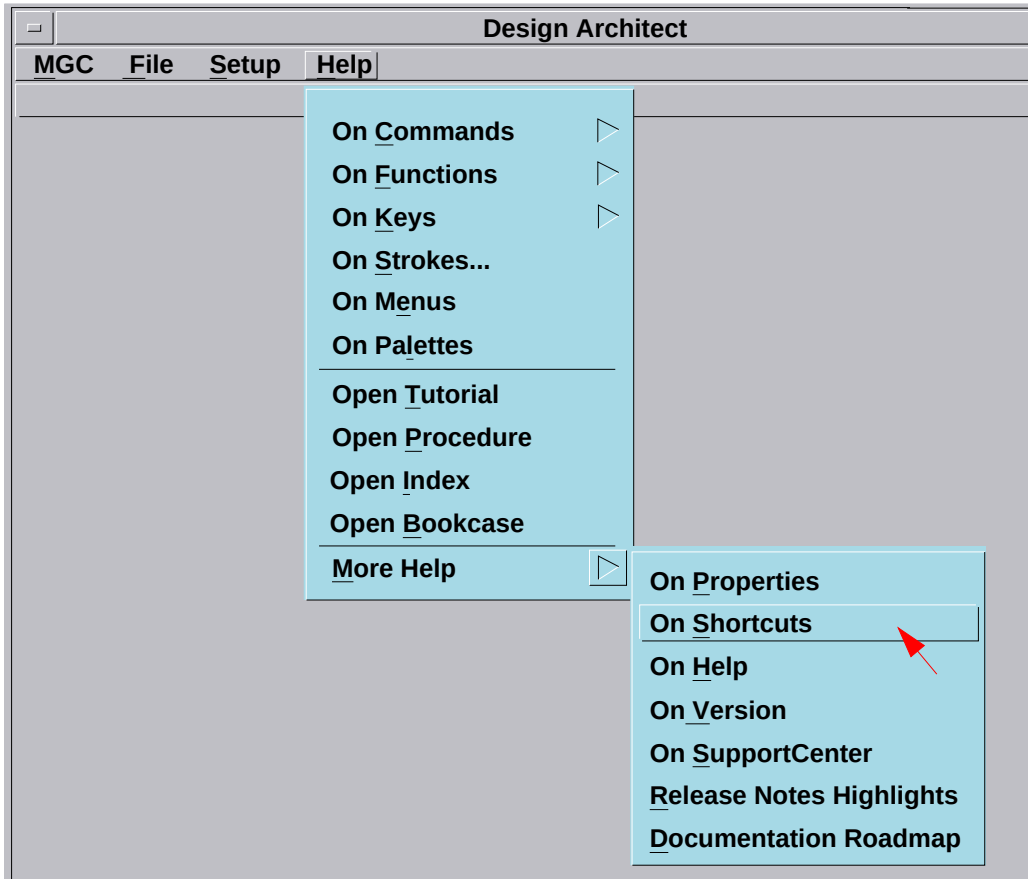
- **Select and unselect text.** You can use the **Select** popup menu item to select text on which you want to do other editing actions. You can also select text by pressing the Select mouse key, dragging the cursor to the end of the required text, and releasing the Select mouse button. If text is highlighted, you can remove the highlighting using the **Unselect** popup menu item.

Lesson 4
Viewing and Searching Online Documentation

A large resource of online documentation can be accessed through the BOLD Browser. This lesson shows you how to view the vast array of online documentation and perform a full text search on any given topic.

Online Help

- **Help menu options:**

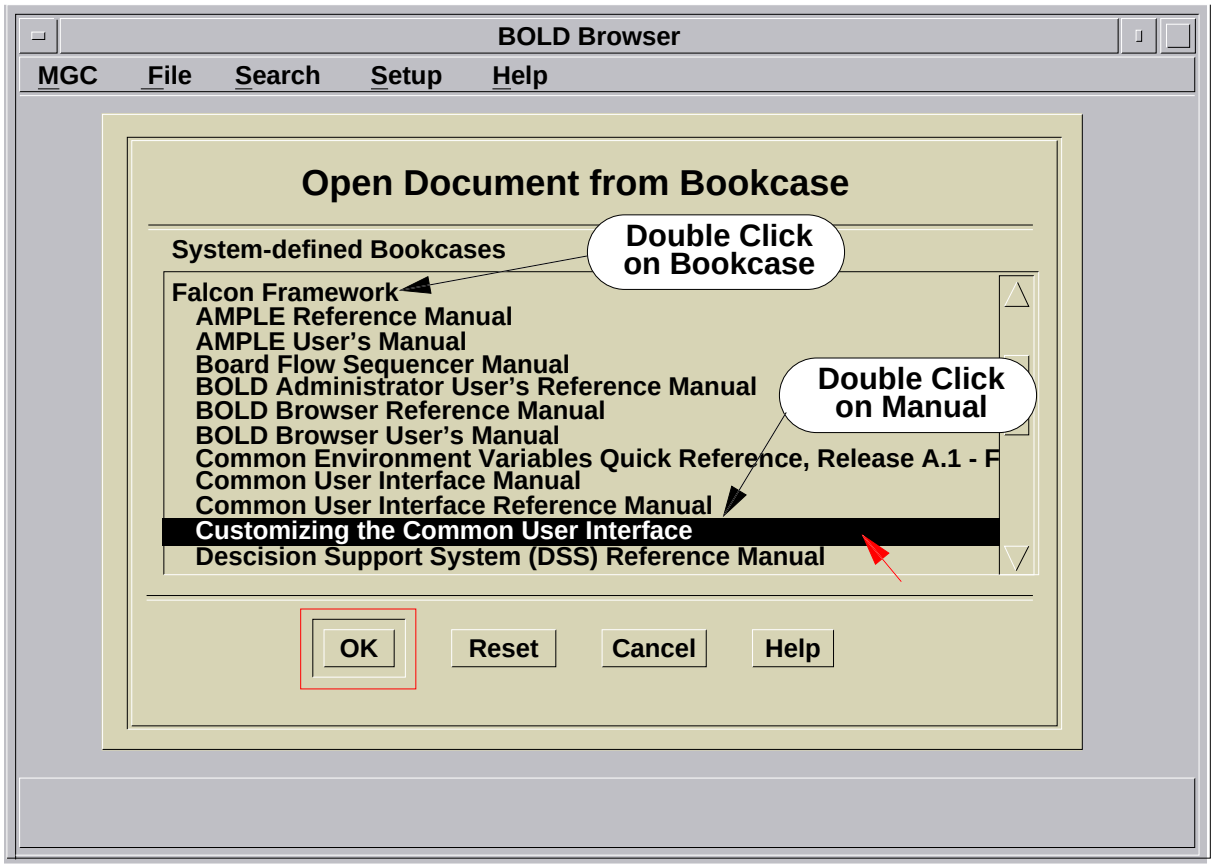


Online Help

You can access Design Architect online help through the Help menu in the menu bar. The following list describe what you can access from online help:

- **On Commands**. Provides Quick Help or Reference Help of Design Architect commands or a summary table of commands and functions. For a list of commands in the active window type ***** then **Ctrl-SHIFT ?**
- **On Functions**. Provides Quick Help or Reference Help of Design Architect functions or a summary table of commands and functions.
- **On Keys**. Provides help on predefined keys or a table of logical function key name mappings.
- **On Menus**. Provides help on the types of menus and the contents of each Design Architect menu.
- **On Palettes**. Provides a description of the Design Architect palette menus.
- **On Strokes**. Provides a dialog box on strokes for the active window.
- **Open Tutorial**. Brings up a BOLD Browser window that displays the *Getting Started with Design Architect Training Workbook.*
- **Open Procedure**. Brings up a BOLD Browser window that displays the Operating Procedures section of the *Design Architect User's Manual*.
- **Open Index**. Brings up a BOLD Browser window that contains the index of the *Design Architect User's Manual*.
- **Open Bookcase**. Brings up a BOLD Browser window that contains the list of documents that compose the Design Creation documentation set.
- **More Help**. Information on properties, short cuts, customer support, release notes, documentation roadmap, on help, and current version.

Opening Online Documents



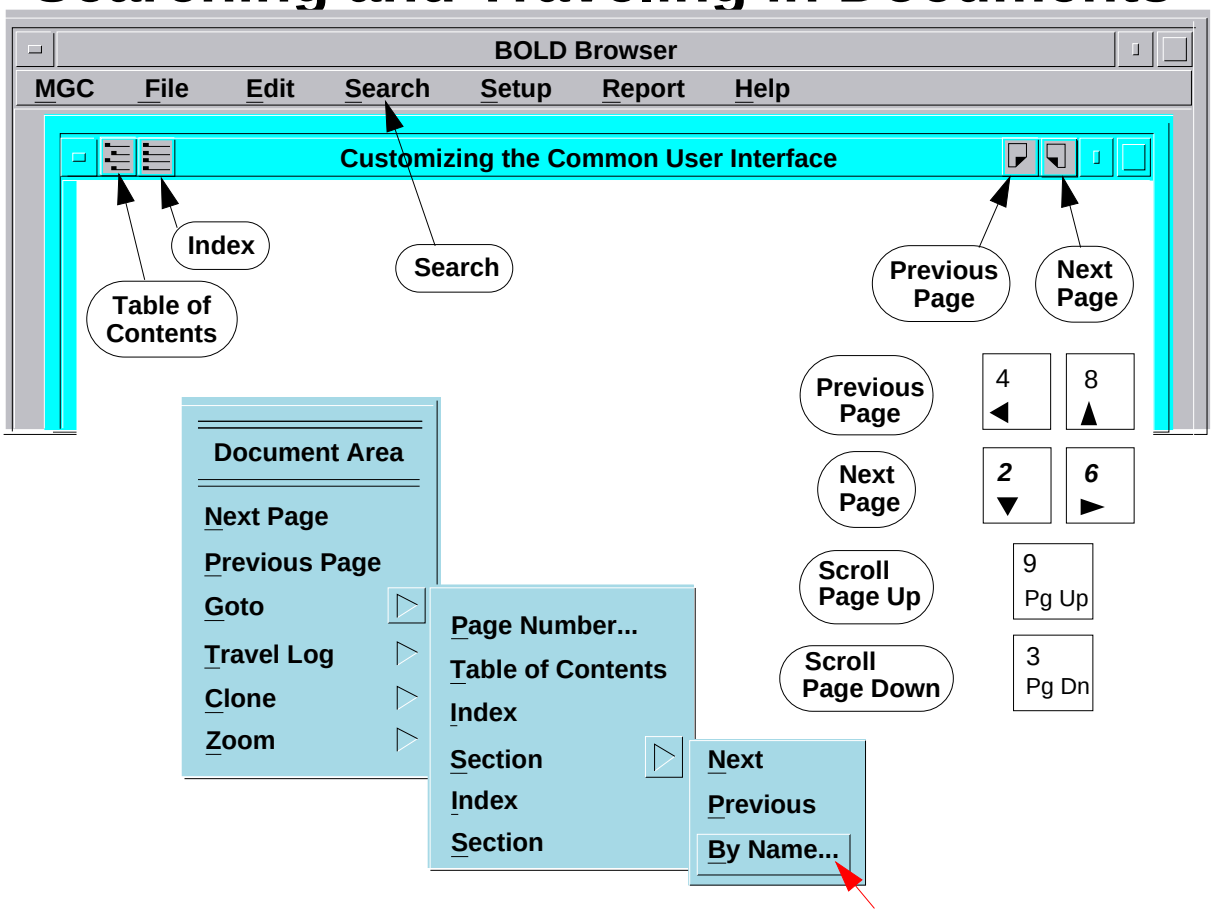
- **Double click on a bookcase to list the manuals within**
- **Select the manual and execute the form to open the document**

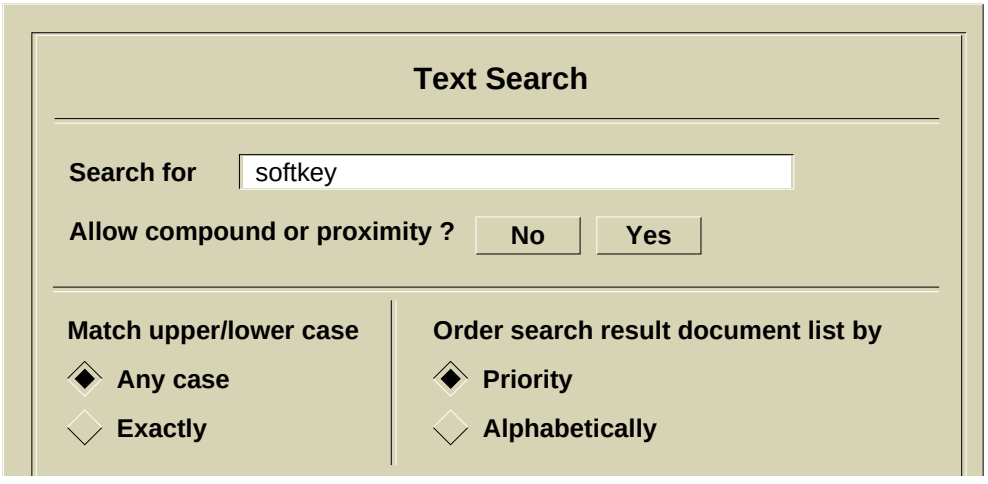
Opening Online Documents

Online documents are grouped into bookcases. When you choose **File > Open > Bookcase...**, the form illustrated on the left appears. When you want to open a bookcase to view the documents, just double click on the bookcase name. To open a document, double click on the document name.

All online training documents are contained in a bookcase named **Training.**

Searching and Traveling in Documents





Searching and Traveling in Documents

You can travel around in INFORM documents to continue with your current subject matter or to find additional information by one of the following methods:

- **Icons in the title area.** Clicking on these icons enables you to travel to the table of contents, index, a previous page, or the next page.
- **Popup menu or function keys.** Enables you to travel to the table of contents, index, a previous page, the next page, a particular page number or section, or to pages and documents that you previously viewed.
- **Hypertext links.** Enables you to travel to hyperlinked pages in the same document or in different documents. Hyperlinks are color highlighted on color displays and outlined on black-and-white displays. You click on the highlighted reference to move to that location.

The BOLD Browser incorporates a full text search index, which is a list of words and their locations in the online library. When you initiate a search for a word or word phrase, the BOLD Browser searches this index, rather than scanning through the text of all the documents at search time. This type of search is significantly faster than textual scans.

You can specify that BOLD search for specific needs, such as the following:

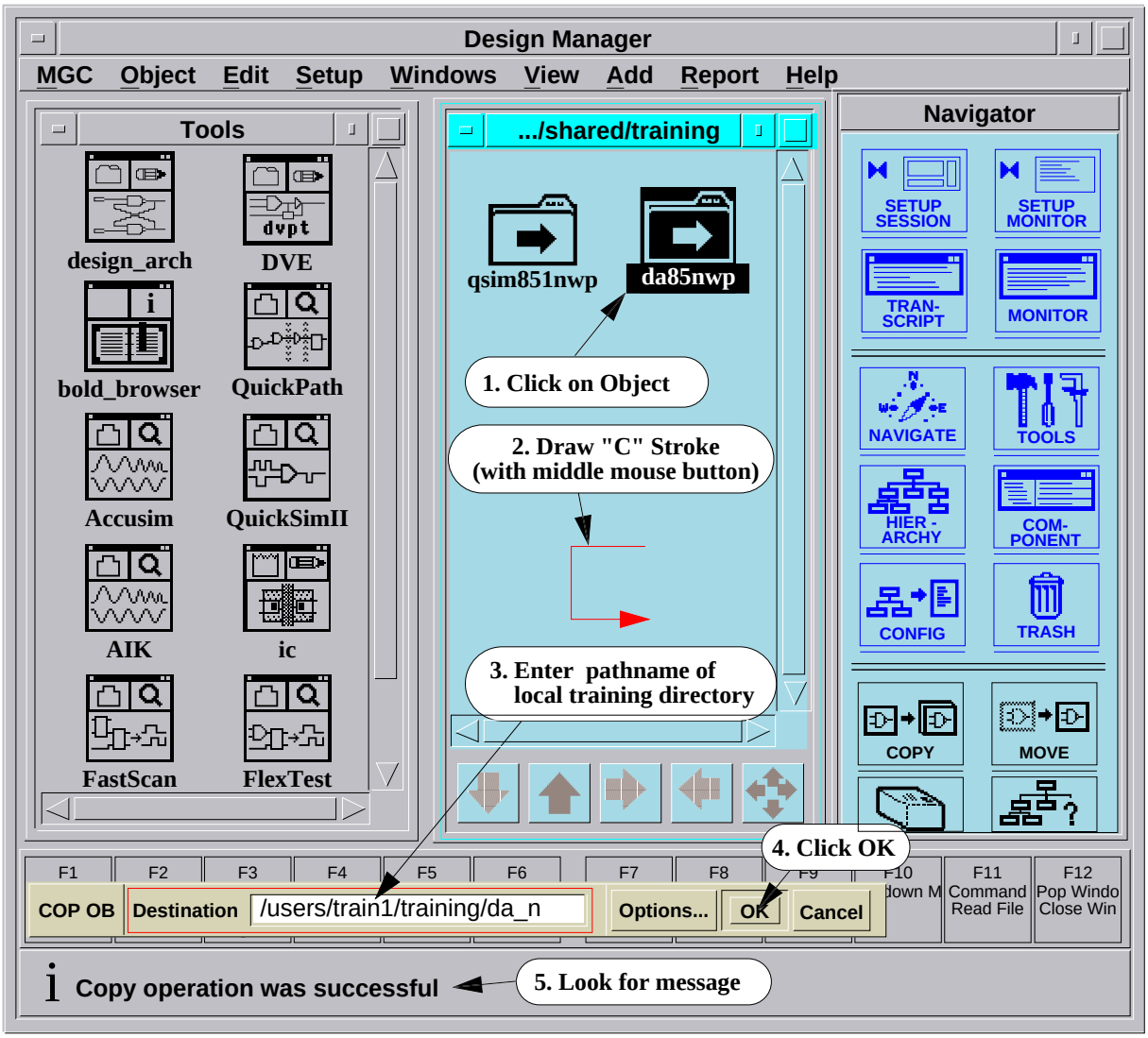
- Whether the word is part of a compound word.
- Determine letter case.
- Find variant forms of hyphenated words and plural forms.
- Restrict the search through certain document or a bookcase.

When the BOLD Browser locates the occurrences of the word(s) you requested, it displays a “Search Results” window where you can see a list of documents containing the term. You can click on the document titles to disclose lists of pages where the term occurs.

Lesson 5
Using Design Manager to Copy Objects

Changing the location of your design data in the file system should always be done with Design Manager. This lesson explains why you need to use Design Manager and how to successfully copy objects.

Copying Objects in the Navigator Window



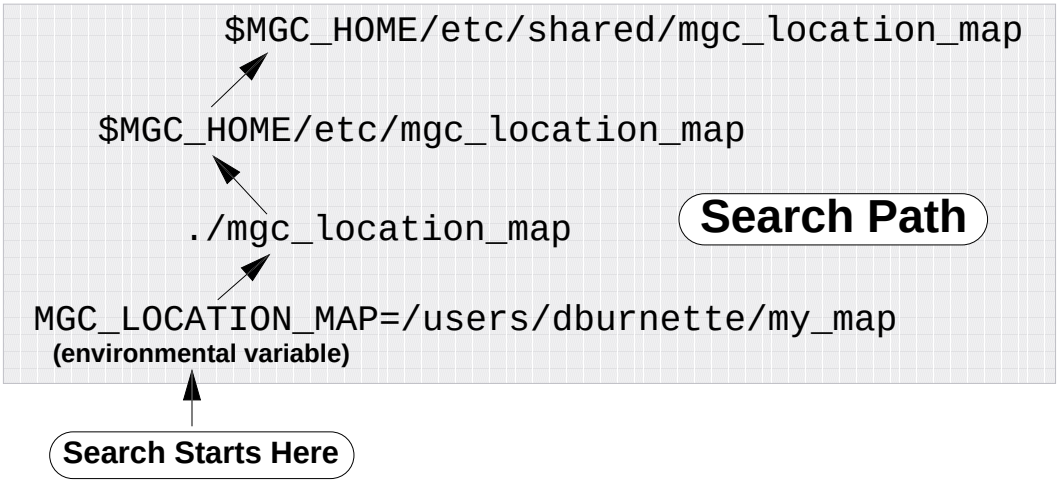
Copy Objects in the Navigator Window

The illustration to the left shows the steps required to copy an object to another location in the directory structure. An alternative to using the “C” stroke is to press the right mouse button and execute **Edit > Copy:** from the popup menu.

Soft Prefixes and Location Maps

```
MGC_LOCATION_MAP_2 force

$CUSTOM_LIB -t LIBRARY
/usr2/dburnette/my_custom_parts

$PROJECT
/usr2/dburnette/project

INCLUDE /usr1/team_project/mgc_location_map
```

```
MGC_LOCATION_MAP_1

$MGC_GENLIB
/usr1/mgc_libs/gen_lib

#$MGC_LSLIB
#/usr1/mgc_libs/ls_lib

$PROJECT
/usr1/team_project
```



Soft Prefixes and Location Maps

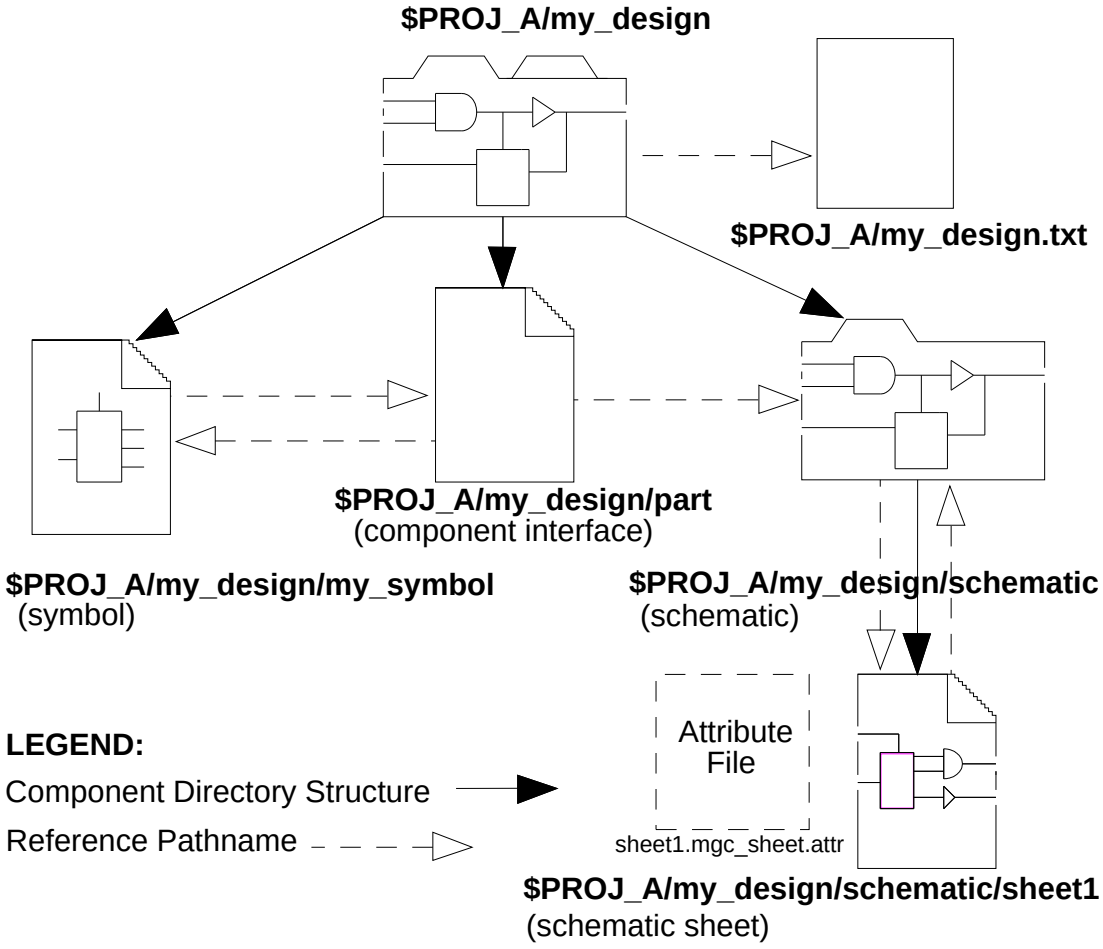
Soft prefixes are a Mentor Graphics mechanism for sharing resources, such as parts libraries and project data, among users on networks that might contain different types of workstations with different operating systems and configurations. Soft prefixes make it possible for users to access these shared resources in the same way from any workstation on the network, even though different workstations may require different hard pathnames to get to the same resource.

Your system administrator will set up and maintain the soft prefixes used at your site in a mapping file called a *location map*. To give you access to this location map, you may need to define the shell environment variable $MGC_LOCATION_MAP. You should contact your system administrator about defining this environment variable and about the set of soft prefixes that your site supports.

Once your system administrator has set up a location map and has defined the $MGC_LOCATION_MAP environment variable, you should be able to use the soft prefixes you will find in this training workbook. When you see an example that uses a soft prefix as part of an application command or as a response to an application prompt, you can type the soft prefix just as it appears in the manual or substitute the corresponding soft prefix in use at your site. If you experience any problems using soft prefixes, contact your system administrator.

The search path for a location map is shown graphically at the bottom of the facing page. The system always looks first for a pathname that is defined by the environmental variable $MGC_LOCATION_MAP. If not found, it looks for a file named **mgc_location_map** in the current working directory, then in the location $MGC_HOME/etc, then in the location $MGC_HOME/shared/etc. As soon as it finds a map in this search, the search stops and that map is used.

Design Object References



- **Reference - a pointer between two design objects**
- **References are keep in associated ".attr" file**
- **You can check and modify references using Design Manager functionality**

Design Object References

A *reference* is a pointer from one design object to another design object. Each reference consists of the pathname to the design object, its type, and a version specifier. References show relationships between design objects.

Design Architect creates references within the component. You can create and modify references using the Design Manager. You can modify DA-created references using the Design Manager or Design Architect. However, if you modify these references within the Design Manager, you run the risk of modifying them incorrectly.

You can display design object references by invoking the **Report > Show References** menu path in the Design Manager pulldown menu or you can click on the **Show References** (right arrow) icon in the Navigator window. The Design Manager also provides other navigation buttons to allow you to explore a design object's references, enabling you to traverse the design hierarchy.

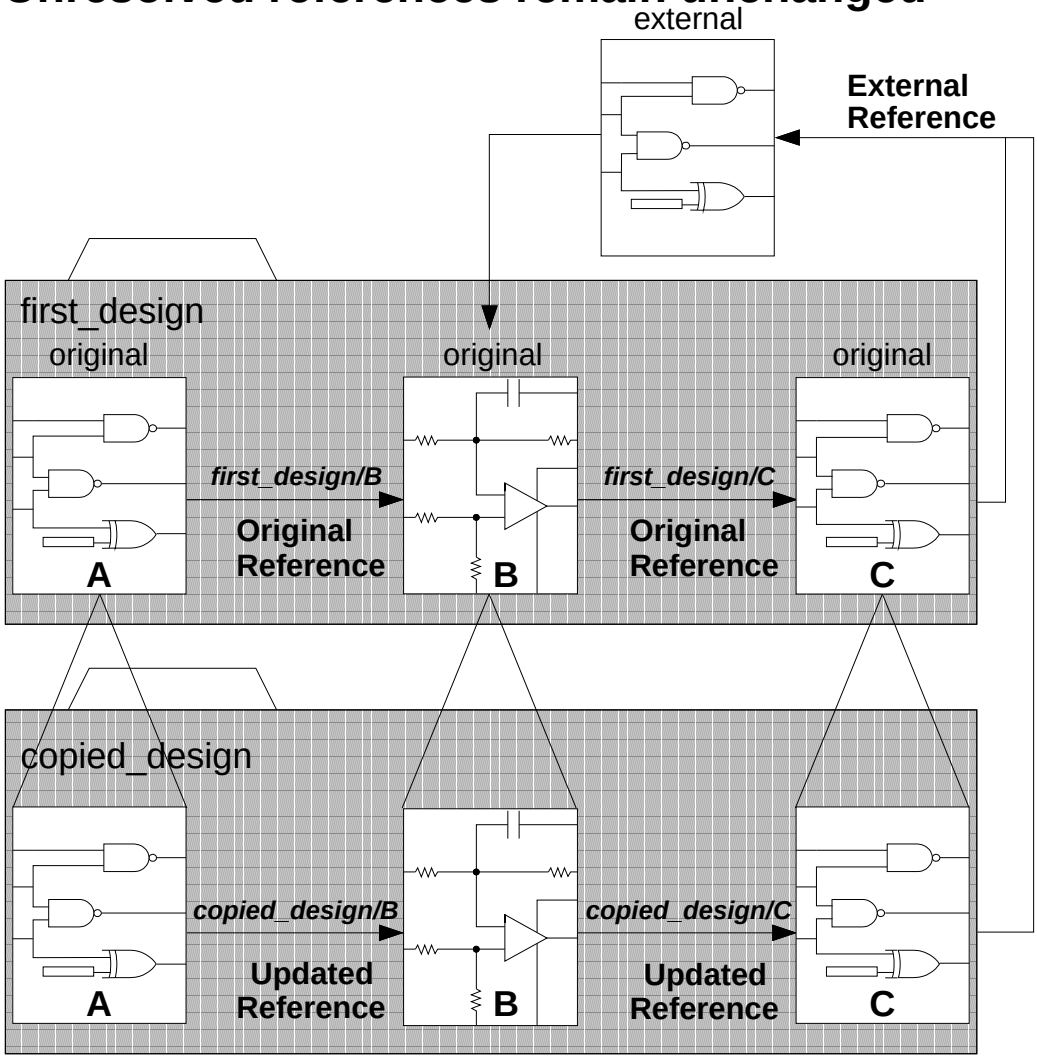
The illustration on the facing page shows two concepts: (1) the component hierarchy and the reference pathnames, and (2) references that are created by the Design Manager, and those that are created by Design Architect. The component hierarchy is defined by the solid arrows; the reference pathnames are defined by the dashed arrows.

When a symbol or schematic sheet is created, they are placed under the specified component. Reference pathnames are automatically defined by Design Architect. Thus, the symbol model *$PROJ_A/my_design/my_design* contains a reference to the component interface *$PROJ_A/my_design/part*. Notice that *$PROJ_A/my_design/part* also contains a reference to the symbol *$PROJ_A/my_design/my_design*.

The schematic model also contains a reference to *$PROJ_A/my_design/part*. In addition, the schematic model contains a reference to the sheet *$PROJ_A/my_design/schematic/sheet1* and *sheet1* contains a reference back it its parent *schematic*. The references for sheet1 are keep in an associated file called a ".attr" file.

Copying Design Objects

- **In Design Manager**
  - **Copy by containment or by reference**
- **Resolved references are updated**
- **Unresolved references remain unchanged**



Copying Design Objects

You can use the Design Manager to copy your design or component. The Design Manager copies objects in two modes: by reference or by containment. The simple copy uses containment to determine which objects are copied. All objects contained in the component container are copied.

All resolved references are automatically updated. Any references that were unresolved before the copy operation remain unchanged. You can modify these unresolved references to point to existing objects using the Design Manager. The Design Manager allows all objects within a design object to be copied.

The figure on the facing page shows schematic reference updating during a simple copy operation. A set of schematics A, B, and C is copied from the *first_design* directory to the *copied_design* directory. In the directory, *copied_design*, the references of A, B, and C now point to local locations. The Design Manager automatically updates references. If you did not use the Design Manager to copy, the original references would have remained unchanged.

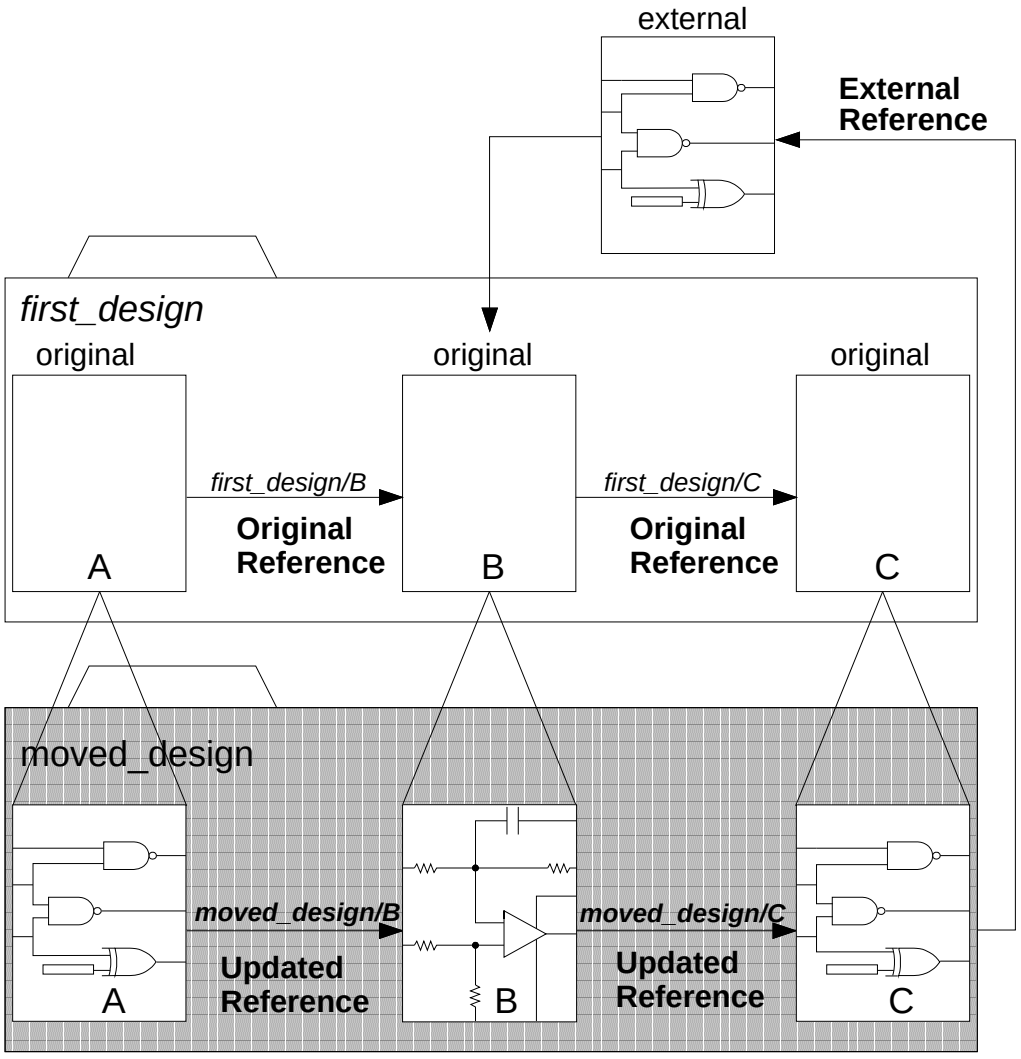
References to external objects are also copied. You can optionally choose that the Design Manager copy the referenced objects into the copied design configuration, instead of just copying the references. Thus, any design object referenced by the original design can optionally become part of the new design configuration. However, any references attached to outside objects that point to the original design remain the same; that is, they reference the original object and not the new copied object. You need to understand the design well enough to decide whether the copied design should reference other objects like the original design, or whether the copy should include the objects in the new configuration.

Note

If you copy a schematic or sheet model within a component, you must register the newly-copied model within Design Architect. You will learn more about model registration later in this training course.

Moving and Deleting Design Objects

- **Resolved references are updated**
- **Unresolved references remain unchanged**
- **References to moved/deleted object outside or at the same level as the component are not updated**



Moving and Deleting Design Objects

You can use either the Design Manager to move or delete a design or component. You can also use Integrated Design Management (iDM) functions, which enable you to manage design data that you create in Mentor Graphics applications by providing easy access to copy, move, delete, and change references.

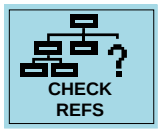
In essence, a moved design object is one that is copied and then deleted. When you move an object within a component or design, all objects in the containment hierarchy of the selected object are also moved. When you move design objects that refer to other design objects in the selected set, the Design Manager automatically updates those references to reflect the new location. Unresolved references or references to external objects remain unchanged.

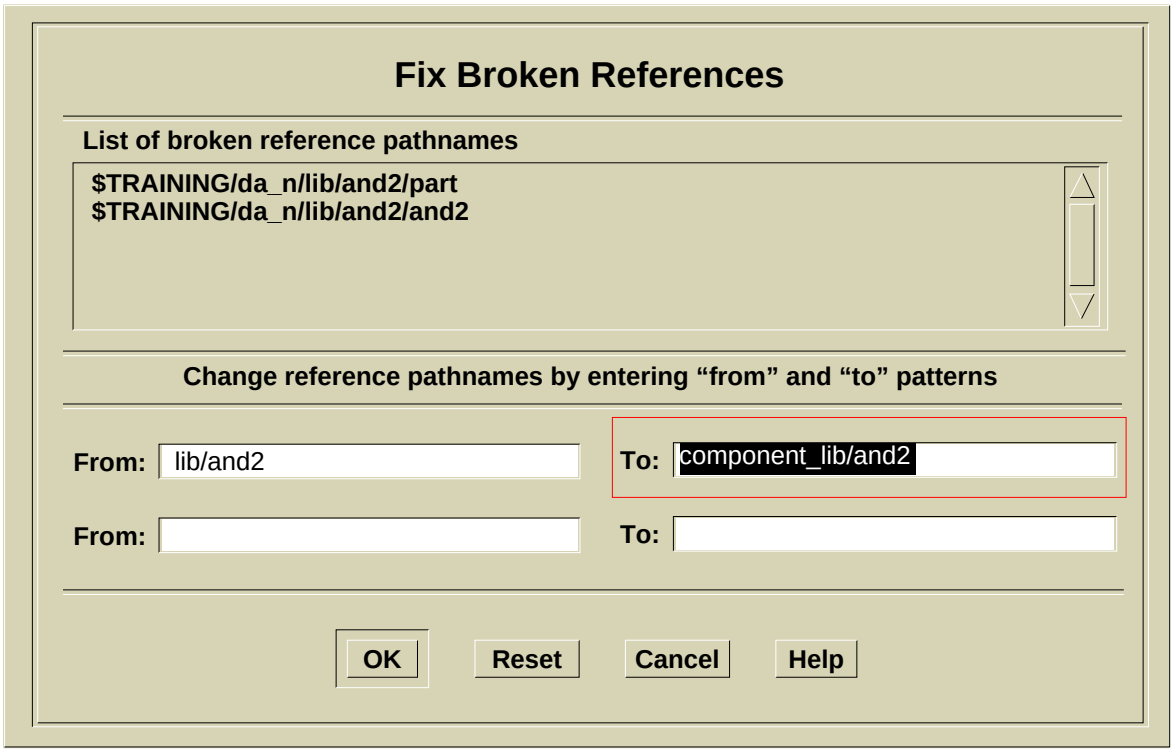
Any design objects that reference the moved object within the containment of a component are also automatically updated to reflect the new location. However, any external references that point to the moved object are not updated; that is, they continue to point to a design object that no longer exists. You need to understand the design well enough to decide whether moving the design will break external references.

The Design Manager allows all objects within the component container to be moved with the exception of symbols. Symbols are not allowed to be moved outside of their owner component container. It you attempt to move a symbol outside of its component container, Design Manager issues an error message and does not move the symbol.

When you delete an object, all objects and references in the containment hierarchy are also deleted. Any external references that point to the deleted object are not updated and are, therefore, invalid; that is, they simply point to an object that no longer exists.

Checking and Changing Design References





Checking and Changing Design References

It is a good practice to always check for broken references before you invoke an application on design data that has been relocated. You can check for broken references by selecting the icon in the Navigator window that represents the top (root) level of the design. When you click on the CHECK REFS icon in the Design Manager palette, a search for broken design references begins at that point and extends down the tree.

Broken references are reported in the Fix Broken References form as shown on the left. You may fix a broken reference by typing the complete “old” pathname in the left entry box, then the complete “new” pathname in the right entry box. To save time typing, you may just specify a pathname segment. For example, in the illustration on the left, the broken reference was created by someone changing the **component_lib** directory name to **lib**. You may fix this broken reference by replacing the pathname segment **lib/and2** with **component_lib/and2**. The important thing to keep in mind is to make sure that the pathname segment is unique, so you won’t be changing similar correct pathnames in other branches from right to wrong.

It is a good practice to always repeat the CHECK REFS operation until the message “**No broken references were found**” is reported.

Lab Exercises

Installing the Training Data

Before attempting to perform the lab exercises in this module, make sure that the design data for this Design Architect training program has been installed on your network. The training data should be at the following path: *$MGC_HOME/shared/training/da85nwp*.

If you can't find the design data, contact you system administrator for assistance or refer to the Mentor Graphics manual titled *Installing Mentor Graphics Software for Falcon Framework Products.*

Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Copying the Training Data

In this training course, you will be creating a hierarchical design from training data supplied from a read-only master location. Since you will be modifying the data, you must first copy the data to a place in your local directory structure.

1. Log in to your workstation.

   Log in by entering your user name, password, and home directory pathname assigned by your Instructor.

   User Name: _____

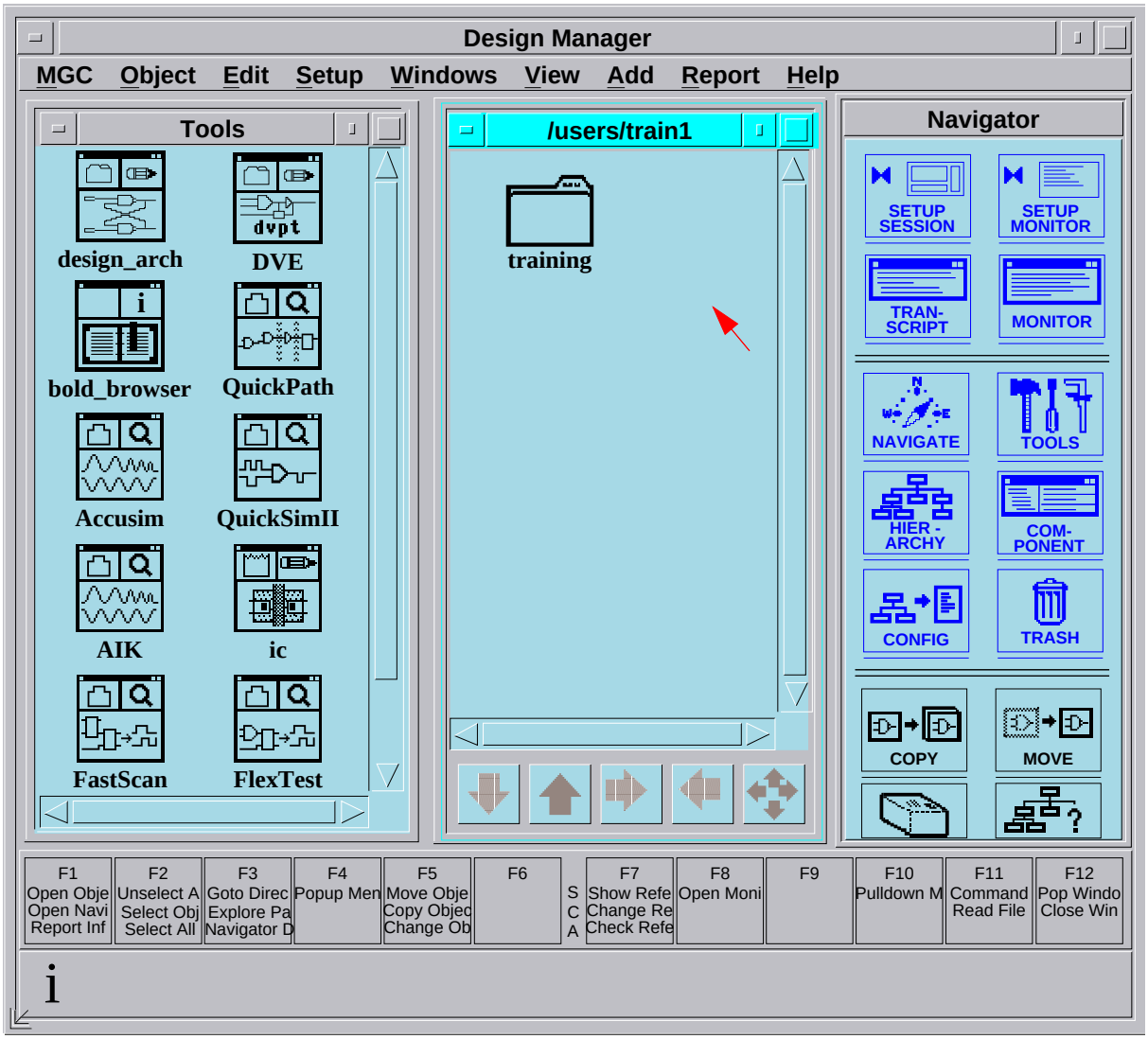
   Password:_____

   Home Directory pathname:_____

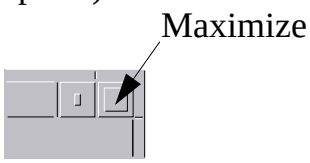
2. Bring up a shell, set the directory to your home directory and enter the following command:

   ```
   $ $MGC_HOME/bin/dmgr
   ```

After a few minutes, a Design Manager window should come up and appear similar to the following illustration:



3. Click the Maximize button to fill the screen with Design Manager (or use the “Full size" window menu option).



(Note: some window environments may have a menu choice that performs this function.)

Within the **Session** window, the **Tools** window is on the left and the **Navigator** window is on the right. The Navigator window displays the contents of the current working directory which is typically the shell directory from which Design Manager was invoked.

The Navigator window is the active window which is identified by the blue border. All the pulldown menus in the top banner are associated with the Navigator window at this time. The icons you see in the Navigator window reflect the contents of you working directory.

The Tools window displays the tool icons representing the applications in your hotbox directory.

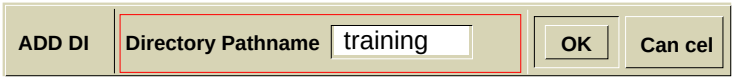
4. If the *training* directory doesn't already exist, create it now as follows:

   a. Select the following menu item from the Design Manager menu bar:

   Add > Directory:

   The Add Directory prompt bar is displayed.

   b. Fill in the ADD DIRECTORY prompt bar as shown below.



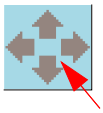
   c. Click **OK**. You will see the *training* directory added to the list of other objects displayed in the Navigator window.

5. View the contents of the *training* directory.

   a. Double Click on the *training* directory icon to expose its contents. There should be nothing in the training directory at this time.

6. Navigate to the *$MGC_HOME/shared/training* directory as follows:

a. Click the **Go To** button in this Navigator window as illustrated below:

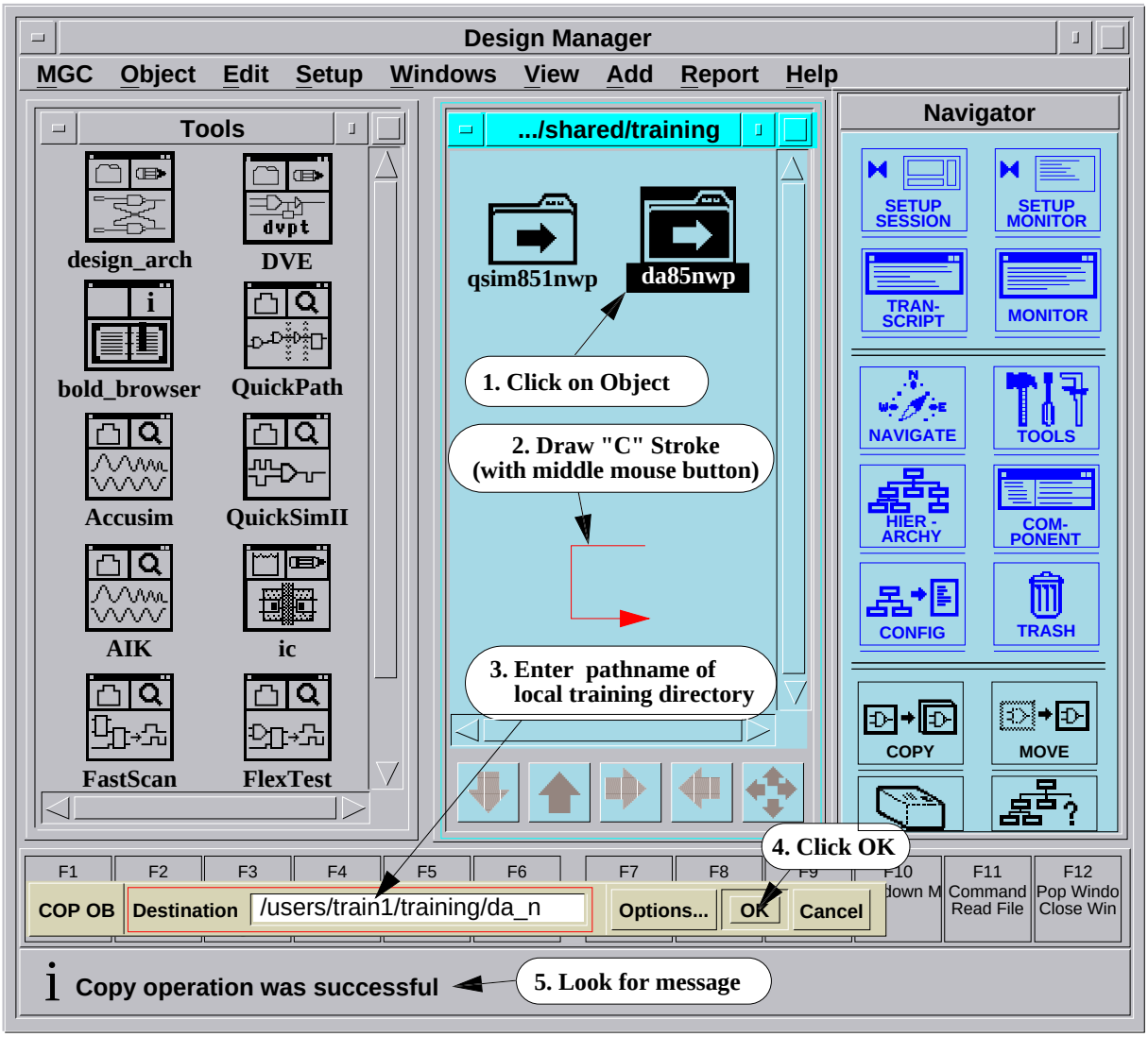


b. Enter the following in the text entry box: **$MGC_HOME/shared/training**

c. Click **OK**.

The Navigator window displays the **$MGC_HOME/shared/training** directory in the master tree.

7. Follow the directions in the illustration on the next page to copy the **da85nwp** training data to your local training directory.



The hourglass prompt should appear while the data is being copied. After the prompt disappears, and the Copy operation was successful message appears, navigate to the *$HOME/training* directory and the **da_n** icon should appear.

8. View the contents of the **da_n** directory, by double clicking on the **da_n** icon.

   The contents of this directory includes the following:

   - **ample_source** -- contains information that you will use in customization exercises later in this course.
   - **card_reader** -- an empty directory that will eventually be turned into a component container.
   - **com** -- contains some files that you will use later in this course.
   - **component_lib** -- contains some library components that you will use later in this course.

Exercise 2: Using Notepad to Create and Modify ASCII Files

During this training course you will have the opportunity perform several user interface customizing exercises. You customize the user interface by creating ASCII files containing AMPLE code. You then save these files in predefined locations. In the following exercise, you will be introduced to the Notepad editor which is a tool used in customizing. Because the use of strokes will increase your productivity, you will begin learning simple strokes that perform tasks like Copy, Move and Delete. These same strokes will be used throughout this course in applications like the Schematic Editor and the Simulator to perform similar tasks.

Creating a New File with Notepad

1. From the Design Manager Session Window, choose:
   MGC > Notepad > New

   A Notepad window appears on the screen, identified by the name **Notepad - (untitled)** in the title area.

2. Choose the **(Menu Bar) View > Wrap** menu item.

3. Click the "**Word**" button under "Mode" and the "**Yes**" button for "Wrap to Window Width."

   This controls the amount of characters on one line in the ASCII file.

4. **Click OK**.

5. Select the pulldown meu item **File > Import...**

6. Click the Navigator button, navigate to the file **...training/da_n/com/notepad_text.ascii**, select the filename, then click **OK**.

7. The following text is imported into the new NotePad session:

   This is a practice Notepad Editor session. Within this practice session, you will search for and replace text, copy text, move text, delete text, and undo the last action.

8. Save the Notepad information to a file as follows:

   a. Choose: **(Menu Bar) File > Save**

   b. Enter: *$HOME/training/da_n/com/**myfile.ascii***

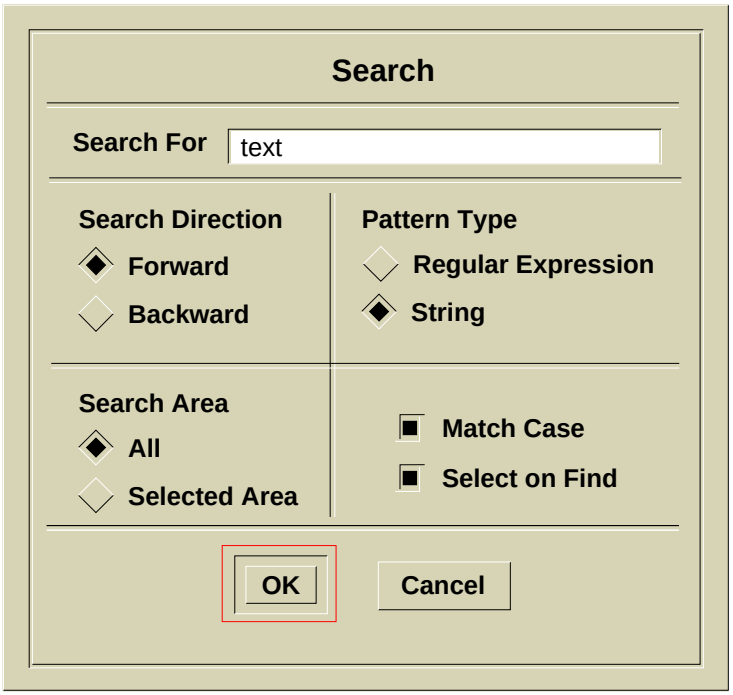
   c. Click **OK**.

Searching for a String

1. Move the cursor to the top of the file by pressing Ctrl-T. (You must position the cursor back at the top of the file each time you wish to search the entire file.)

2. Choose the **(Menu Bar) Search > Search...** menu path.

   Notepad displays the "Search" dialog box. Search for the string "**text**" by filling out the form as shown below:



3. Click **OK**.

4. Notepad highlights the word "**text**" after the word "replace.".

   This is a practice Notepad Editor session. Within this practice session, you will search for and replace text copy text, move text, delete text, and undo the last action.

5. Repeat the search by choosing:

   (Menu Bar) Search > Search Again > Forward

6. Notepad highlights the word "**text**" after to the word "copy.".

   This is a practice Notepad Editor session. Within this practice sessio you will search for and replace text, copy text move text, delete text, and undo the last action.

7. Unselect the string "text" by drawing a "U" stroke  .

Searching for and Replacing a String

1. Go back to the top of the file by pressing Ctrl-T.
2. Display the "Search and Replace" dialog box by choosing:

   (Menu Bar) Search > Replace...

3. Search for the word "**action**" and replace it with "**procedure**", by filling out the form as follows:

   a. Click **OK**.

   The word "**action**" is highlighted in the Notepad window. A "**Replace?**" dialog box asks you to confirm the replace operation.

   b. Click **Yes**.

   Notepad replaces the string "**action**" with the string "**procedure**". The message window informs you that one occurrence of "**action**" was found and replaced.

4. Remove the highlighting by drawing a "U" stroke .

5. Move to the top of the file by pressing Ctrl-T.

Practice Copying, Moving and Deleting Text

1. Activate the Notepad window, if it is not already active.
2. Choose **(Menu Bar)View > Show Line Numbers**
3. Select the first sentence by placing the mouse cursor on the first character, then press the left mouse button and drag across the sentence.

   .

   This is a practice Notepad Editor session. Within this practice session, you will search for and replace text, copy text, move text, delete text, and undo the last action.

4. Click the Select mouse button at the end of line 3 to move the insertion cursor.
5. Move the sentence by drawing a “shark fin” stroke  .

   The block is moved and remains highlighted.
6. Move the insertion point back to the beginning of line 1 (click there).
7. Copy the highlighted text back to the beginning of the file, by draw a “C” stroke . The block is copied, and the copy is highlighted.
8. Undo the copy action by drawing an up-side-down “U” stroke  . The highlighted text is removed. Undo allows you to reverse up to ten (10) edit actions you have made during the session, beginning with the most recent edit action.
9. Select the sentence that you moved to the end of the paragraph.

   Within this practice session, you will search for and replace text, copy text, move text, delete text, and undo the last action. his is a practice Notepad Editor session.

10. Delete the selected text by drawing a “D” stroke .
11. Select the word **practice** in the first sentence of the paragraph.
12. Type **temporary**. The word **practice** is replaced by the word **temporary**.

13. Highlight the string **tempory session**.

14. Send a copy of the string to the System Clipboard with a ↑ stroke.

15. Paste a copy back from the System Clipboard to the cursor position with a ↓ stroke. Do this several times.

16. Abandon the edits you made during this exercises by performing the following steps:

    a. Choose: **(Menu Bar) File > Revert to Saved**

    A dialog box appears asking you to confirm discarding the edits you made.

    b. Click **Yes**.

    The Notepad displays the unedited file.

17. **Close** the Notepad window by drawing a → stroke.

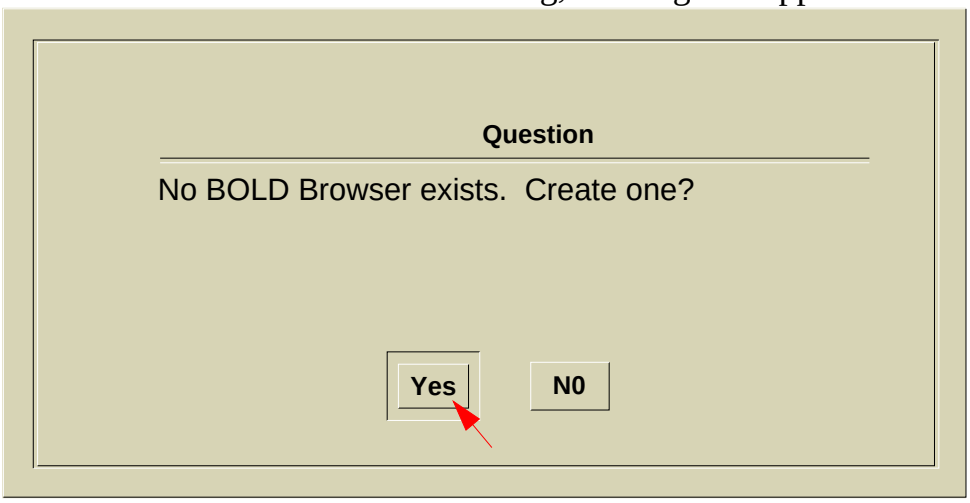
Exercise 3: Viewing and Searching Online Documents

Invoking the BOLD Browser with the Help Pulldown Menu

Start a BOLD Browser session from any application session window by performing these steps:

1. Choose: **(Menu Bar) Help > Open Bookcase**

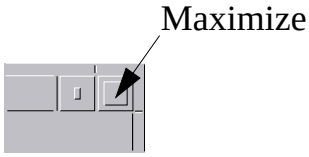
   If a BOLD Browser session is not running, a dialog box appears as follows:



2. Click **Yes**.

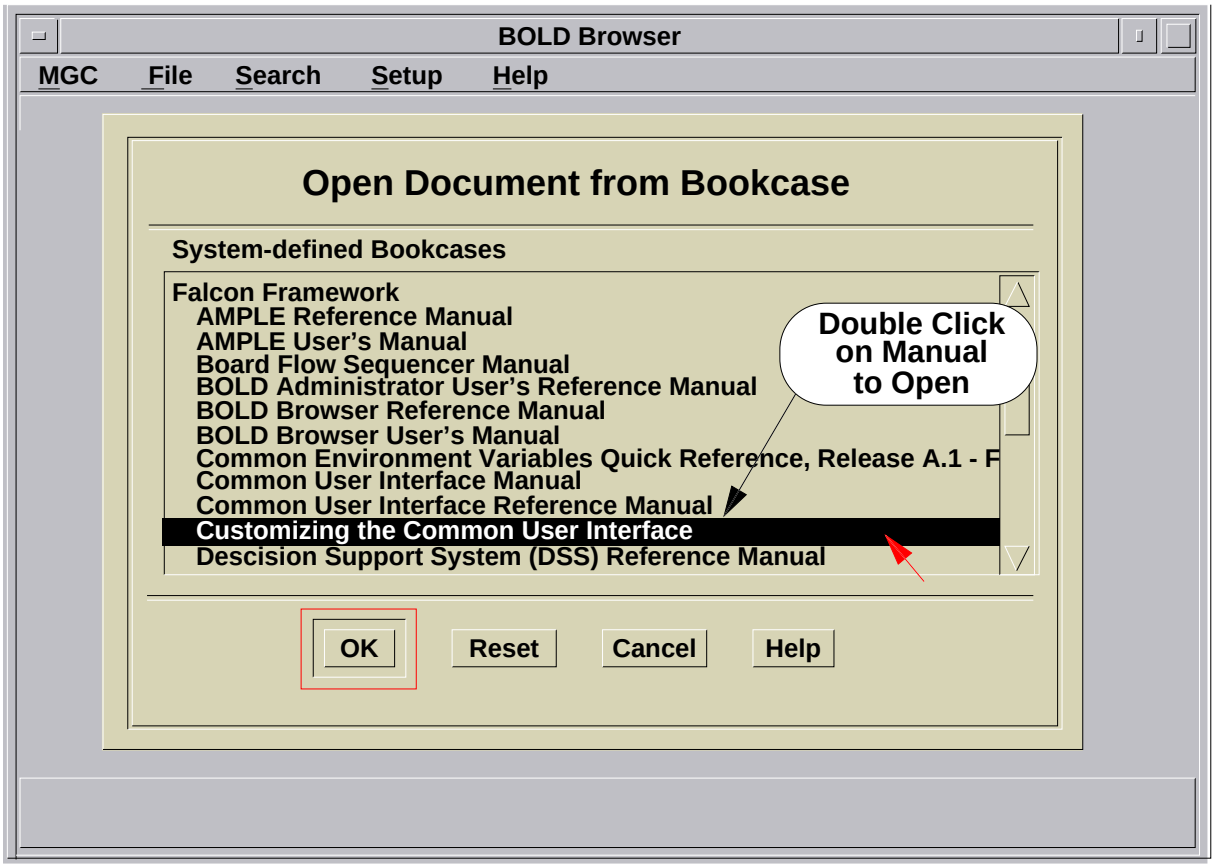
   A BOLD Browser session window appears, with an “Open Bookcase” dialog box displayed.

3. Maximize the window.



   (Note: some window environments may have a menu choice that performs this function.)

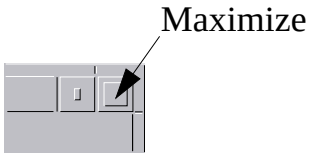
If the BOLD Browser does not display the “Open Bookcase” dialog box, choose the **(Menu Bar) File > Open > Bookcase** menu path and double click on the Falcon Framework bookcase.



4. Double click on **Falcon Framework** bookcase, if it is not already open.

5. Scroll down, then double click on
   Customizing the Common User Interface

6. Maximize the Document Window.

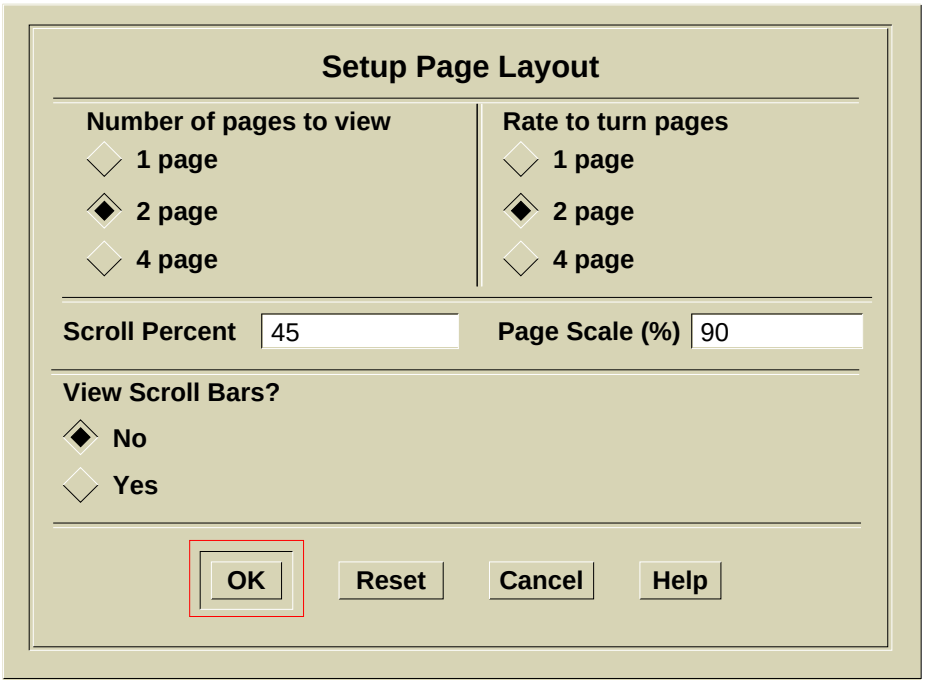


Setting Up the Page Layout.

You can setup the browser to display one, two, or four pages at a time. The default settings allow you to:

- Display one page of the document at a time.
- Turn pages one at a time.
- Scroll 35% of the page when you use the page up or page down keys.
- View the page at 115% of the original page size.

1. Change the Page Layout settings by choosing:
   (Menu Bar) Setup > Page Layout...



2. Change the settings to match the figure above.

3. Click **OK**.

   The document window now displays two smaller (90%) pages. When you use the page up or page down keys, you scroll 45% of the page.

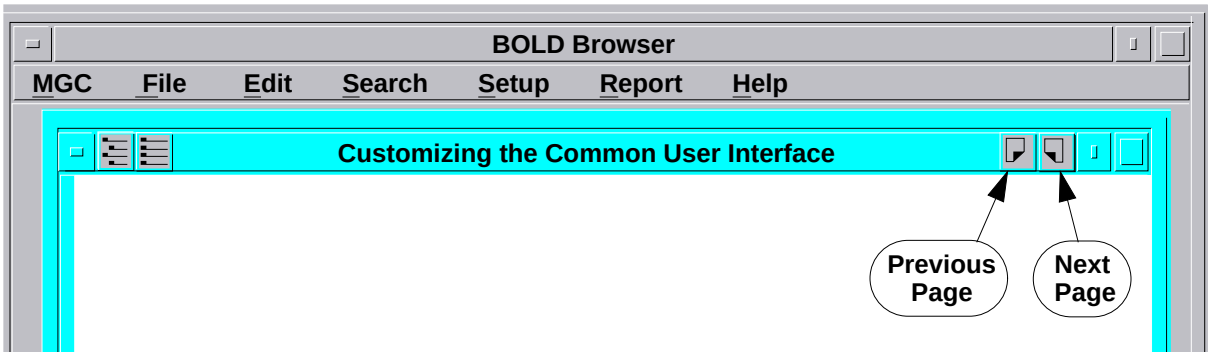
To quickly change the layout, you can press the F9 function key to view one page, SHIFT-F9 to view two pages, and Ctrl-F9 to view four pages. Try this, then return to the two-pages-up layout.

Using the Page Icons

The BOLD Browser provides icons and key definitions to allow you to navigate within an online document.

The figure below shows the location of the page icons. If you are located at the beginning of the document, the previous-page icon is not visible. Similarly, if you are located at the end of the document, the next-page icon is not visible.

Practice browsing the document by clicking the Page icons.



Turning Several Pages at a TIme

1. Type “**turn 20**”.

   A popup command line appears with “turn 20” in it.

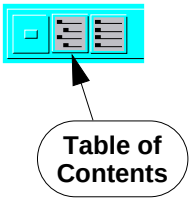
2. Press **Return**. BOLD Browser turns the document forward twenty pages.

3. Type "**turn -10**" and press the **Return**. BOLD Browser turns the document backward ten pages.

Following Hyperlinks within a Document

Hypertext links allow you to travel to a specific location in the document, or to a different document. Practice using hypertext links to travel within a document by performing the following steps:

1. Click on the Table of Contents icon.



2. Move the mouse pointer down the items listed in the table of contents.

   Notice how the mouse pointer changes to a hand with a pointing finger as the mouse pointer moves over the hypertext linked section names or page numbers. The hypertext links are enclosed in a box on black and white workstations. They are indicated by the default color on color workstations, usually blue, when BOLD Browser is invoked with the -Color option.

3. Place the pointer on the Section 2 title block and click.

4. The first two pages in Section 2 are displayed.

Following Hyperlinks to Another Document

Use a hypertext link to travel to another document by following these steps:

1. Click the Left mouse button on $time() in the middle of page 2-1. The BOLD Browser opens the AMPLE Reference Manual to the reference page for this function (page 3-316).

2. Click the Select mouse button on $date() at the bottom of page 3-317. The BOLD Browser moves to the reference page for this function (page 3-83).

Copying a Code Example to a Notepad Window

There are many AMPLE coding examples in the online documentation to help you customize the user interface. These coding examples may be copied directly to a Notepad window, then saved to the appropriate location before being loaded into an application scope.

There are two examples of AMPLE code on pages 3-83 and 3-84 in the *AMPLE Reference Manual*. Practice copying this code from the BOLD Browser to a Notepad window as follows:

1. With the Document window active, choose
(menu bar) Edit > Copy Pages...

2. Click on the Notepad radio button and execute the form. A Notepad window comes up with the pages of text in it.

3. Choose (menu bar) View > Show Line Numbers

4. Select and Delete the following lines 1 to 32, 9 to 16, and 28 to 41. The remaining text is two samples of ample code.

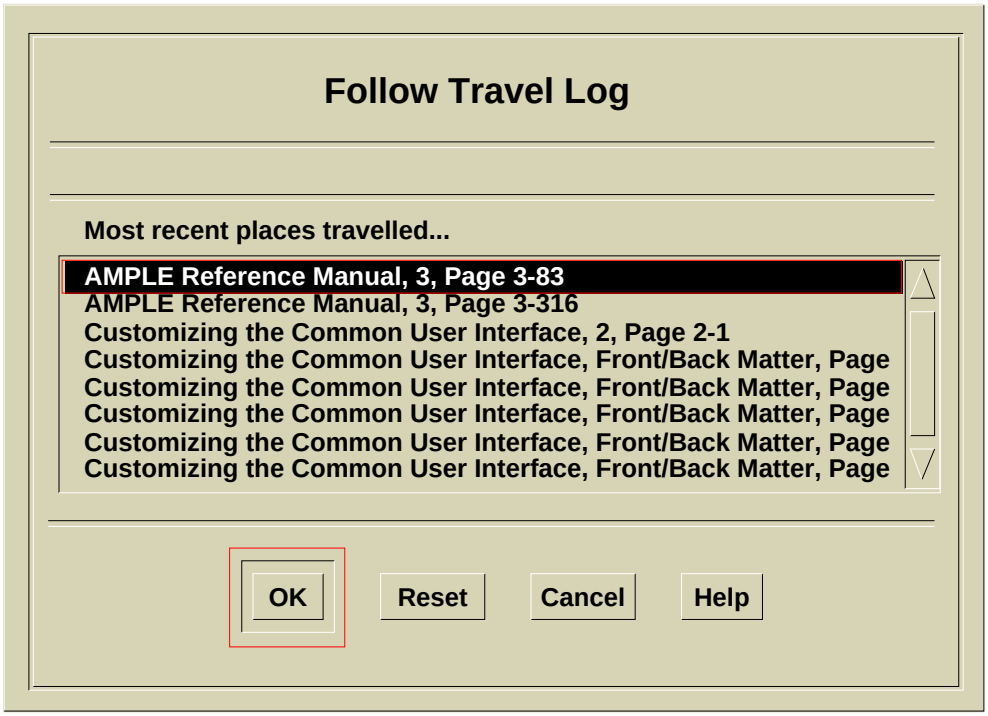
5. Using the **File > Save As...** menu item, save the code to a file named:
*$HOME/training/da_n/com/**date_function_ample***

6. Close the NotePad with a horizontal stroke.

Travelling Back Using the Travel Log

The *travel log* is a list of previously viewed pages and manuals. Practice using the travel log by performing the following steps:

1. Choose: **(popup menu) > Travel Log > Summary**



The “Follow Travel Log” dialog box appears as shown above.

2. Select the “**Customizing the Common User Interface, 2, Page 2-1**”.

3. Click OK or execute a → stroke.

   The BOLD Browser replaces the *AMPLE Reference Manual* with the document *Customizing the Common User Interface.*

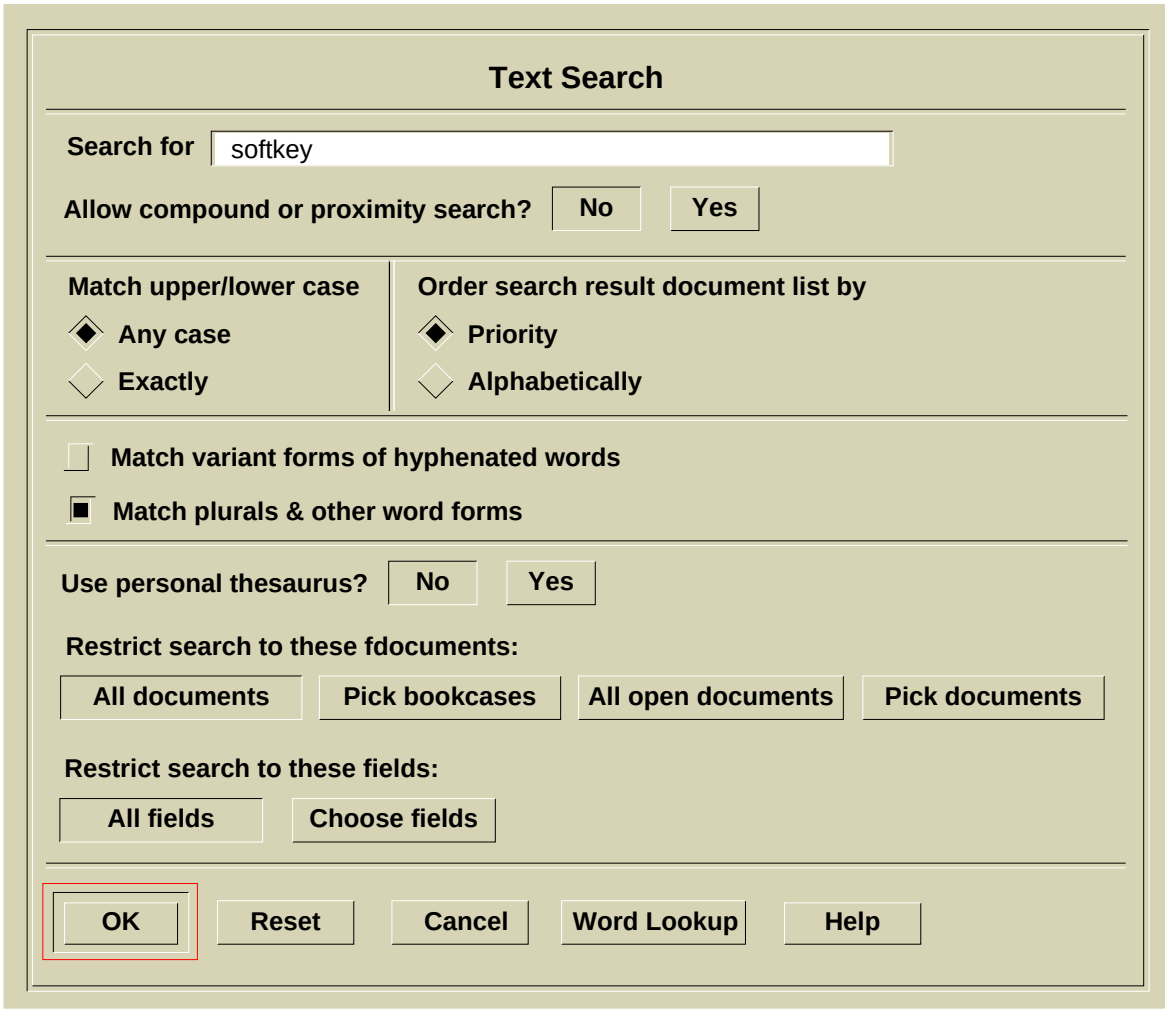
4. **Close** the document window when you are finished experimenting with the travel log.

Executing a Full Text Search

You can search for specific words or groups of words using the Search facility in BOLD Browser. You should have no windows open within the BOLD Browser except for the Session window. If you do, close them before proceeding.

1. Choose: **(Menu Bar) Search > Text Search (choose options)**

The BOLD Browser displays the “Text Search” dialog box as shown below.



2. Enter “**`softkey`**” in the “Search for” text entry box.

3. Click on “**Match plurals & other word forms**”, since there are probably instances for the plural form of “softkeys” also.

4. **Click OK**.

   The BOLD Browser indicates it is searching for the word and then displays a “Search Results” window displaying a list of documents in which the terms “softkey” and “softkeys” were found.

5. Select the “Design Manager Reference Manual” item for which there are seven “hits.” A hit is an occurrence of the search text found in a document.

6. Click on the **Visit** button. You can see a black arrow and line that indicates the exact location of the searched text.

7. **Close** the document window, and select and visit other “hits” in other documents.

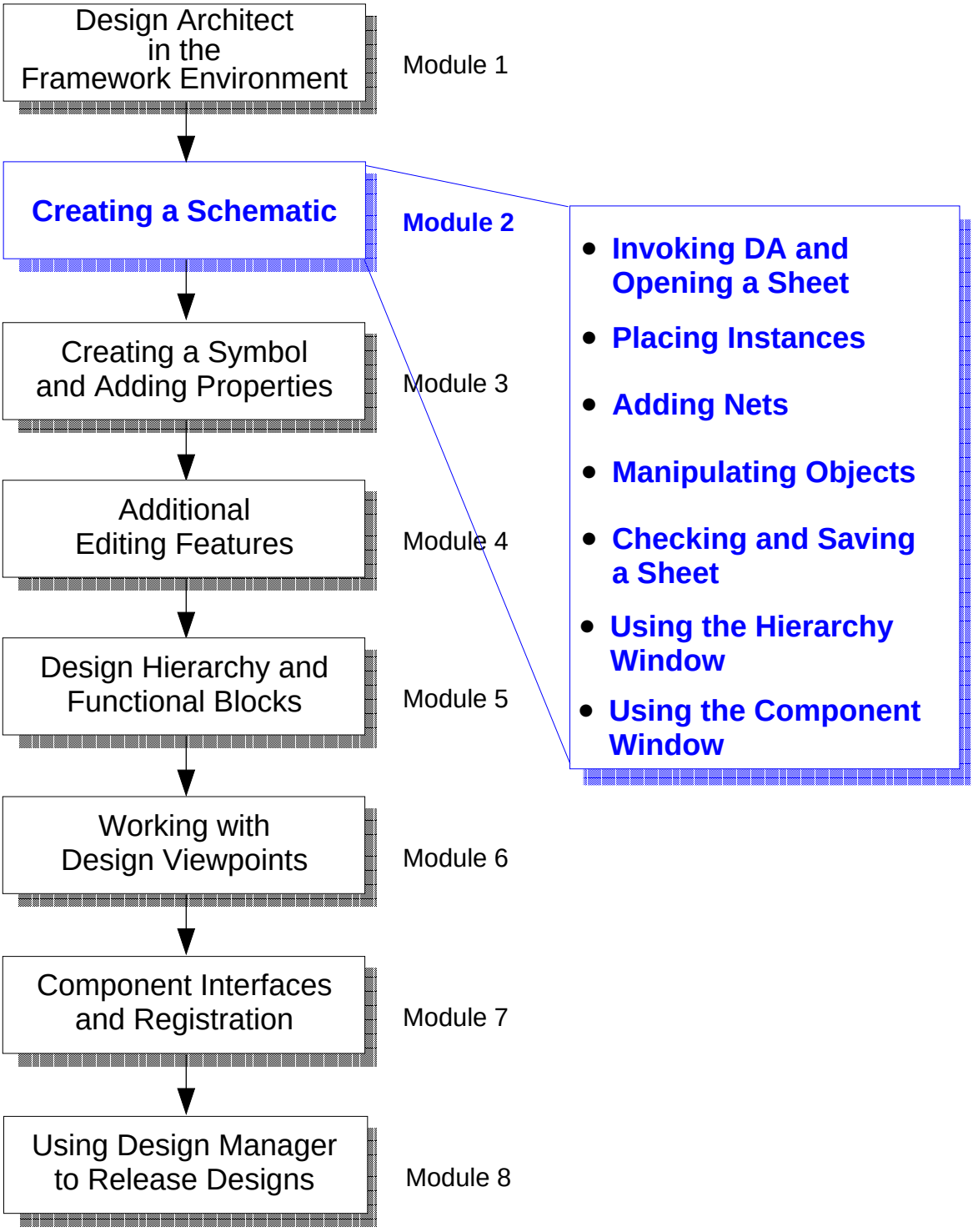
8. You can end the application session at any time by double-clicking on the window menu button.

End of Lab Exercises

This concludes the lab exercises for Module 1. If you have time, turn to **Appendix A - Customizing Exercises** and do Lab Exercise 1.

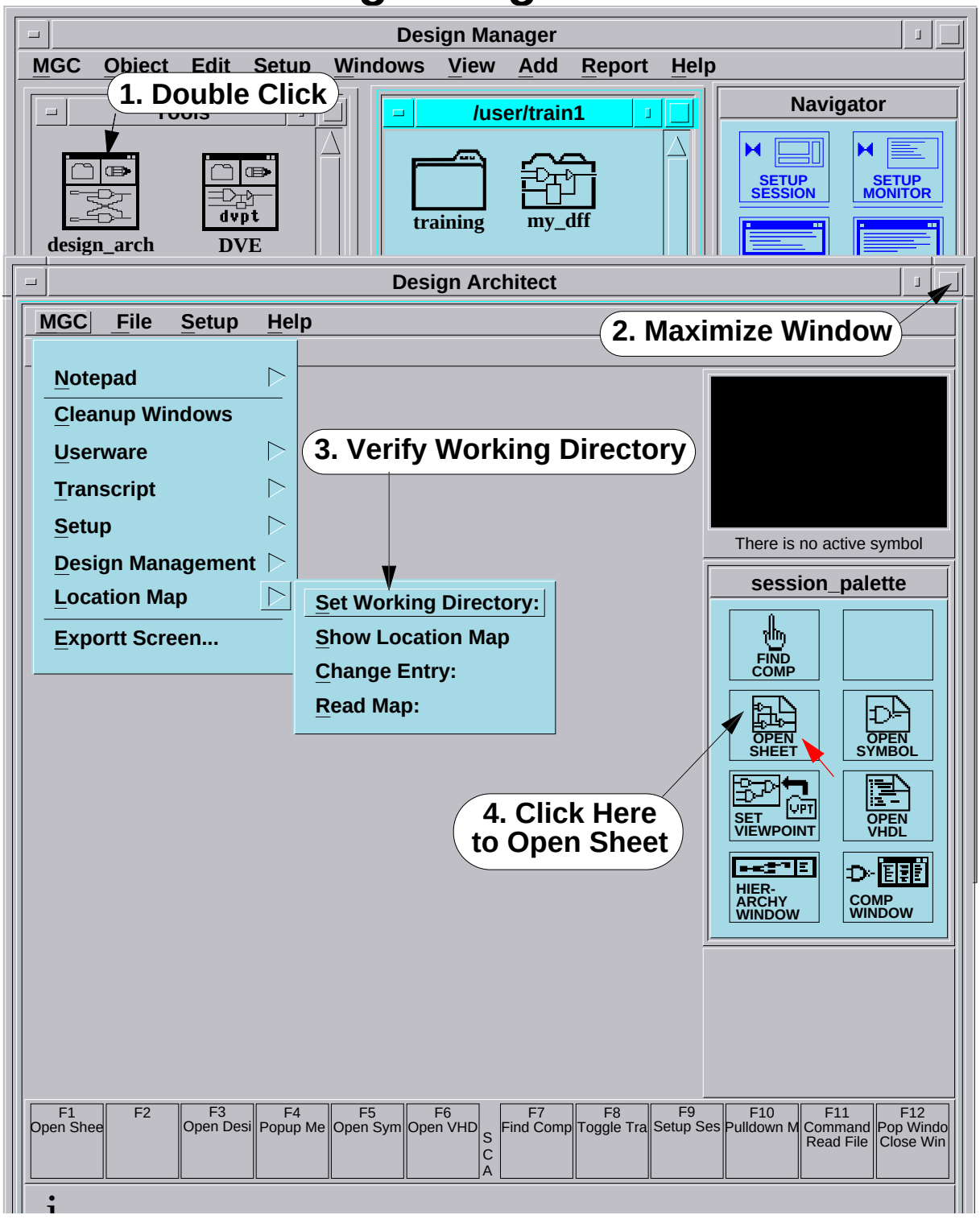
Module 2
Creating a Schematic

Module 2 Overview



Lesson
Creating a Schematic

Invoking Design Architect



Invoking Design Architect

You invoke Design Architect from the Design Manager in one of two ways:

- Double Click on the **design_arch** icon in the Tools Window, or
- Select a component icon in the Navigator window, press the right mouse button, and choose **Open > design_arch**.

Design Architect can also be invoked directly from a shell by typing *$MGC_HOME/bin/da*.

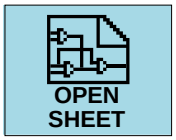
After Design Architect comes up, it is a good practice to Maximize the window, then verify the setting of the working directory. Normally, the working directory will be set to the pathname specified by the shell environmental variable $MGC_WD, if this variable is defined; otherwise the working directory is set to the same location as the shell from which DA is invoked.

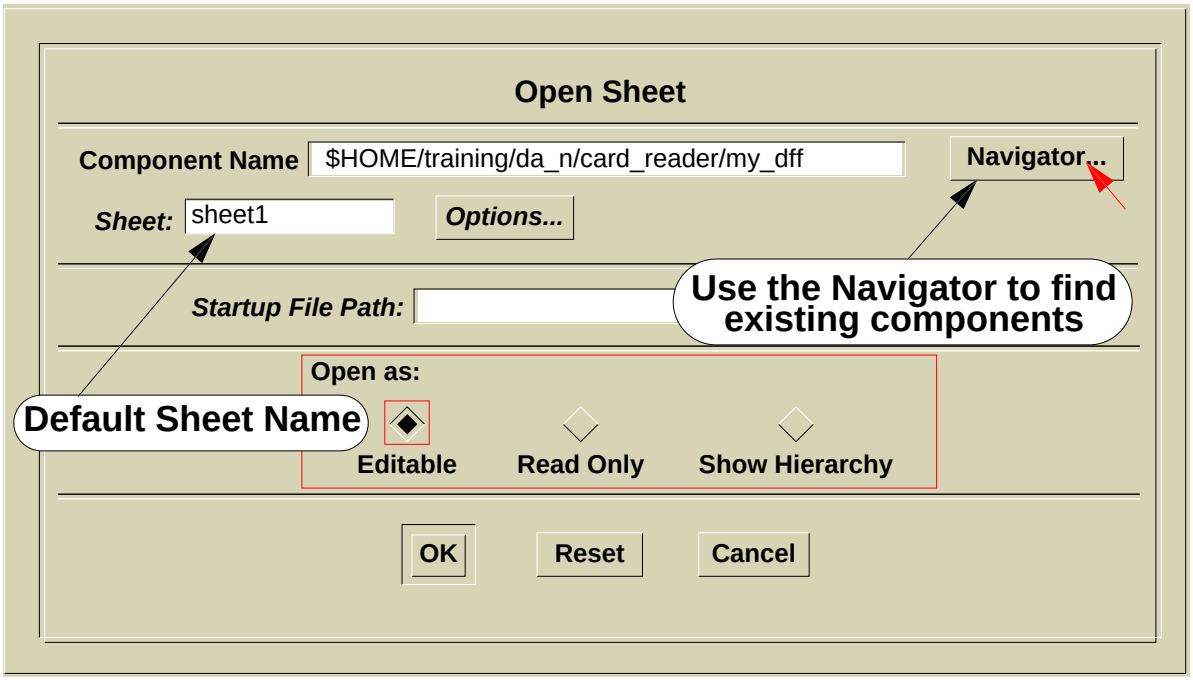
It is always best to verify that the working directory is set to the location where you want it, because all relative pathnames that you enter will be considered relative to the setting of the current working directory.

The tools within the Design Architect environment are represented by icons in the palette on the right. You click on the OPEN SHEET icon to bring up the Schematic Editor window.

Opening a Schematic Sheet

- Click the OPEN SHEET icon
- Enter the new component pathname
- Use the Navigator button for existing component





The Open Sheet Dialog Box

You click on the OPEN SHEET icon to open the Schematic Editor Window. If you specify a pathname for a component that doesn't exist, Design Architect will create a new component structure by that name at that location. Design Architect will then open a new (blank) schematic sheet for that component.

If the component exists, it is often easier to click the Navigator button, navigate to the component location, select the component icon and execute the form.

The sheet name is automatically set to "sheet1" by default. You can create additional sheets later by changing this name before you execute the form.

Clicking **Options** allows you to specify other tasks such as:

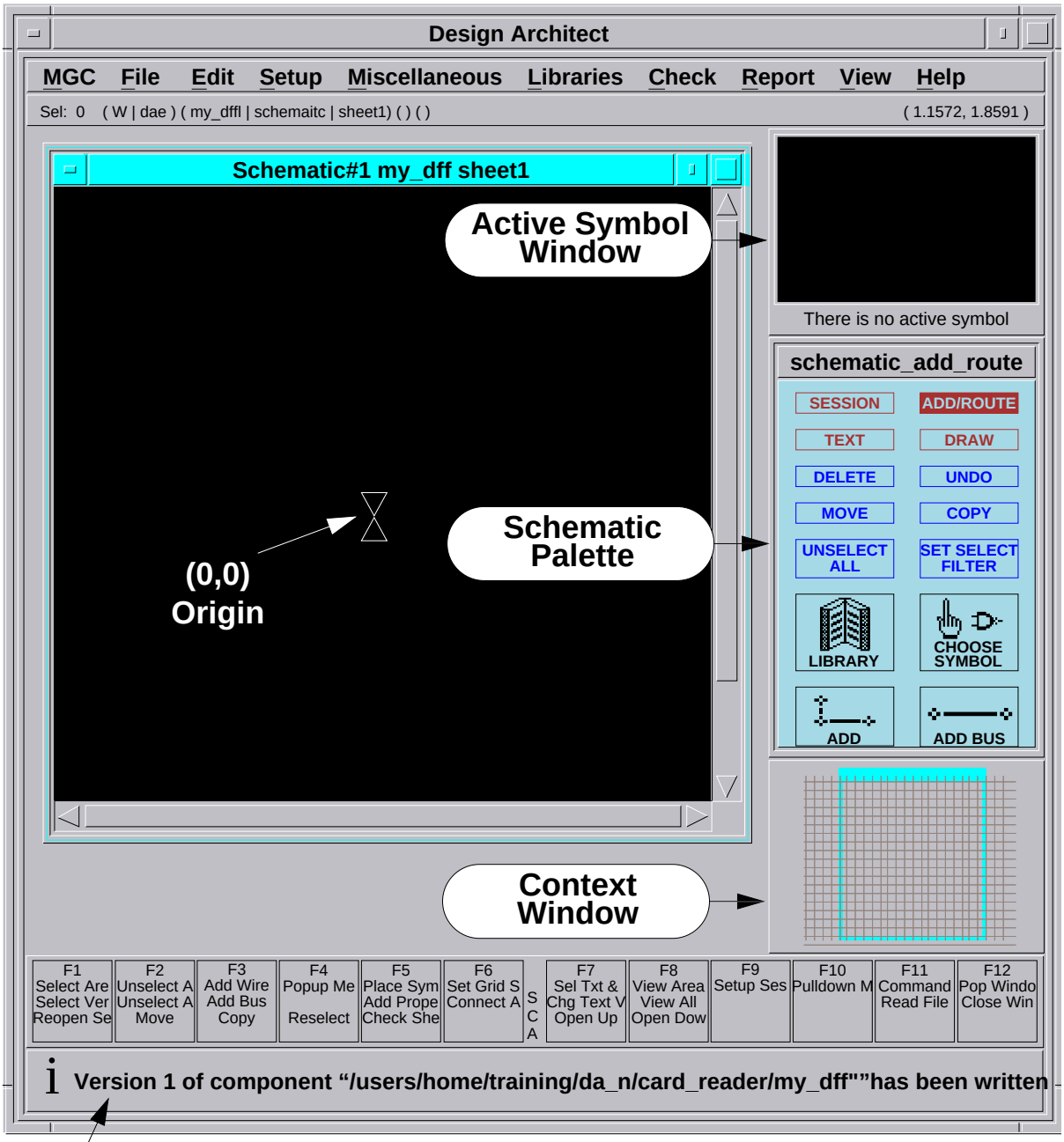
- Edit a sheet in another (non-default) schematic model.
- Create a new schematic model and/or a new sheet that contains a sheet border and title block information.

You can also open the sheet in edit mode, read only mode, or display the component hierarchy.

Note

If you provide a relative component pathname that does not begin with the dollar sign ($) character, that relative pathname will be converted to an absolute pathname based on the value currently set for the working directory. If it is not set properly, the new component structure may be created in a location that you did not intend.

The Schematic Editor Window



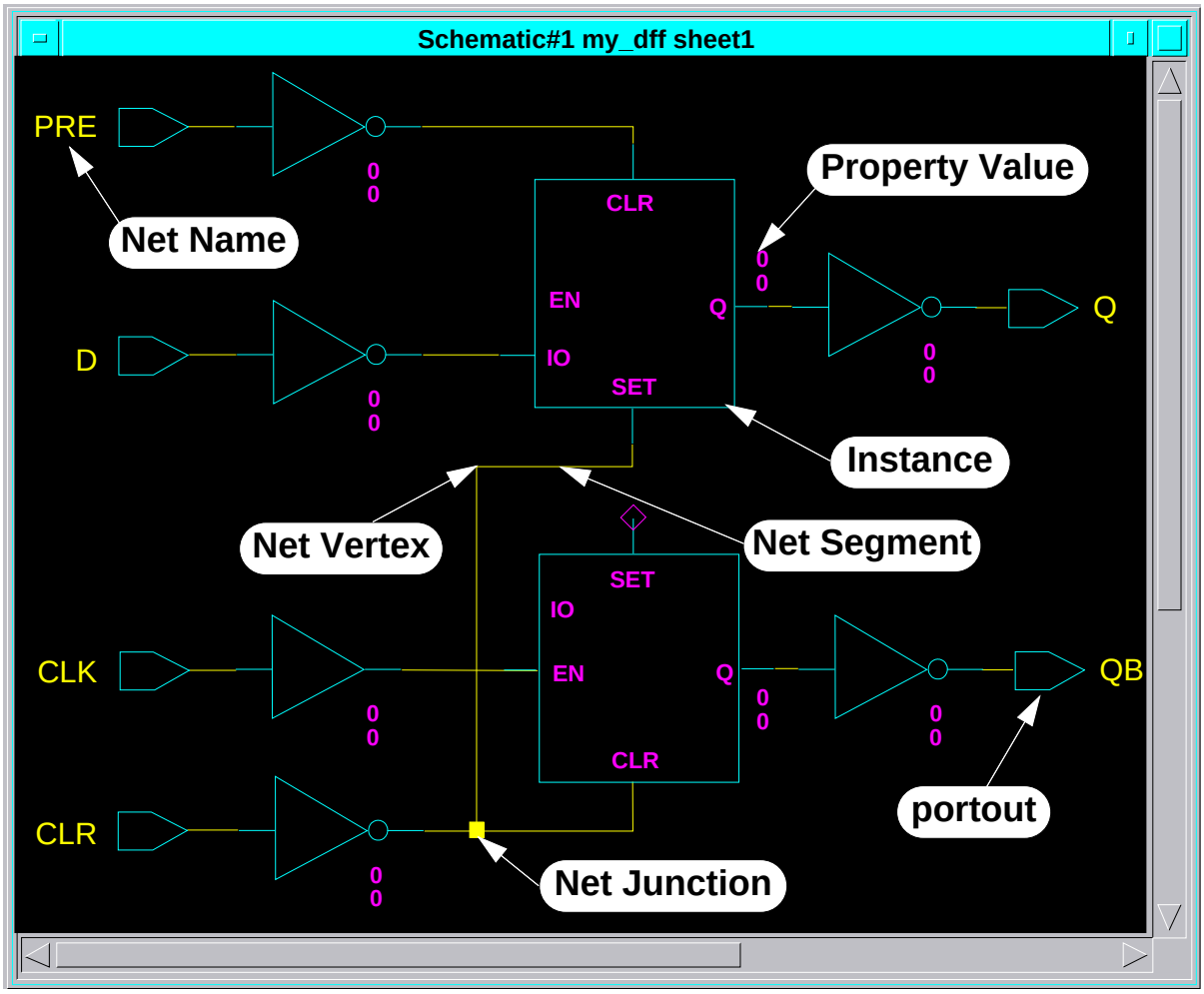
Message indicating the creation of a new component

The Schematic Editor Window

The Schematic window for a new schematic comes up blank with the origin (0,0) set in the center of the screen. A message in the Message window tells you that a new component structure has been created at the specified pathname location. The Design Architect session window changes as follows to accommodate schematic editing tasks:

- **Menu bar(at top)**. Contains the names of the Session pulldown menus; use the Select (left) or Menu (right) mouse button to access a pulldown menu.
- **Active Symbol window**. Located to the upper-right corner of the client area, displays the currently active symbol.
- **Palette menu**. Located to the right center of the client area, contains icons providing common functionality associated with the active schematic window.
- **Context window**. Located in the lower-right corner of the client area, displays where the edit window is located relative to the extent of the sheet being edited.
- **Softkeys**. Located above the message area, contains text describing the function keys for the active window.
- **Message area**. Displays notes, warnings, and errors.

Elements of a Schematic



Elements of a Schematic

A schematic is a functional model of an electronic circuit that is made up of the following elements:

- **Instances of symbols.** An instance is like an active reflection of a symbol in a library. There may be more than one instance of the same symbol on a sheet. Instances have a body(colored blue) and pins(colored magenta). The pins on an instance are different than the pins on the symbol because they have a builtin net vertex, a place for attaching nets.

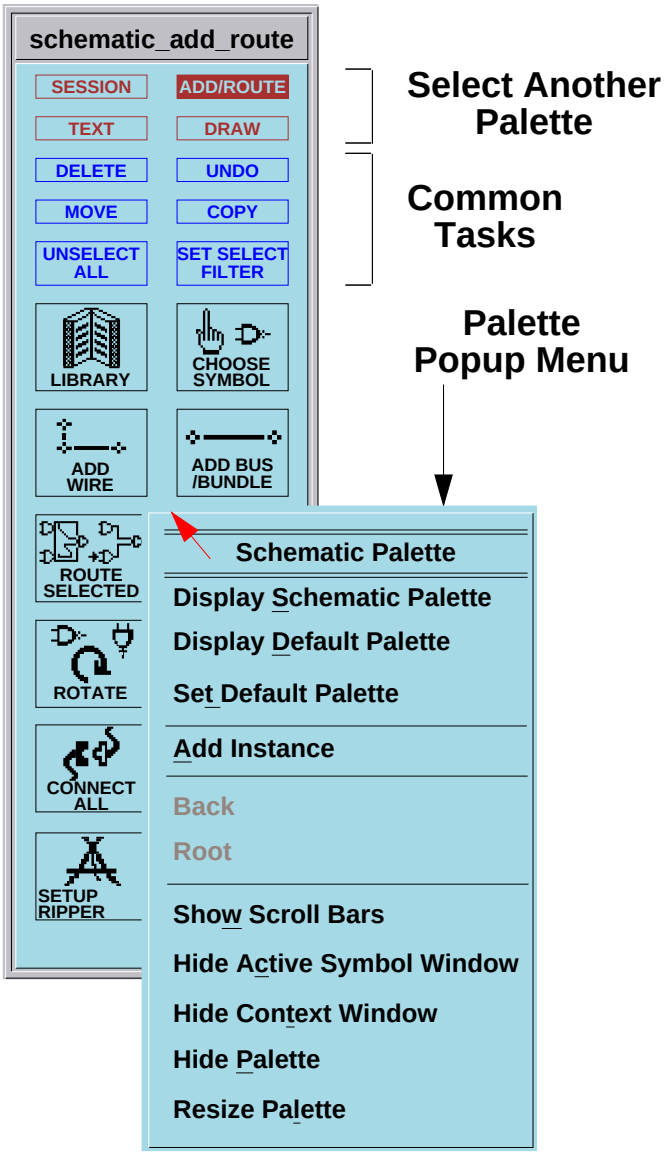
- **Nets.** The term “net” is short for network. A net is a wiring connection between two or more instance pins. The term net refers to either a single wire or a collection of wires called a bus. A bus is sometimes called a bundle or a wide net. A net may contain net vertices (corner points), net segments (the piece between two vertices) and net junctions.

- **Properties.** A property is a name/value pair (text) that represents a characteristic of the schematic that can’t be represented graphically. Properties are typically attached to an “owner” object and take on the color of that object. Only the value of the property is visible on the schematic. For example, in the schematic on the left, the net in the upper-left corner has a NET property with a value of PRE. PRE is yellow, the color of the net (the owner). Attached to the output pin of each inverter are two properties with the value of 0 and 0. Since only the values are shown, you can’t tell what the names of the properties are just by looking at them. By convention, the upper value is usually the RISE(time) property and the lower is FALL(time). Later you will be shown a way to quickly gather information on an unknown property value.

- **Comment text and graphics.** These objects are non-electrical display information (colored green). The sheet border and title block (not shown) are examples of comment text and graphics.

schematic_add_route Palette

- **Default palette: displayed on invocation**

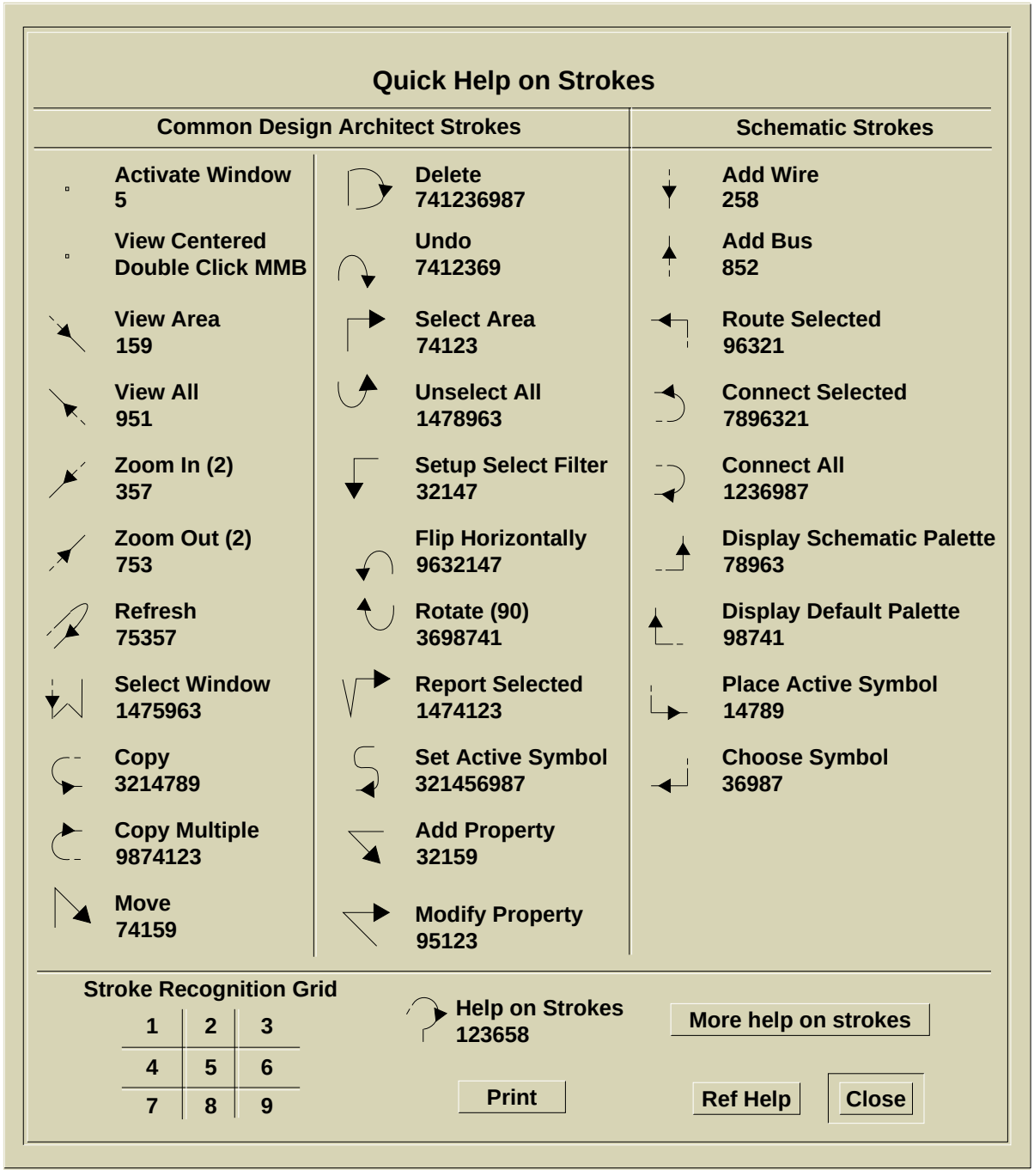


schematic_add_route Palette

The ADD/ROUTE palette is the main palette used for creating the graphic elements of a schematic. The most common tasks for manipulating graphic objects are represented by the blue buttons near the top. The icons in the lower portion also represent common tasks that will be discussed later in this module.

The palette area has a popup menu that allows you to reconfigure what you see. If the palette area is squeezed on the screen so that you can’t see all the icons, you can add scroll bars. Another option is to hide the context window or the active symbol window to make the palette area longer.

Design Architect Strokes



Design Architect Strokes

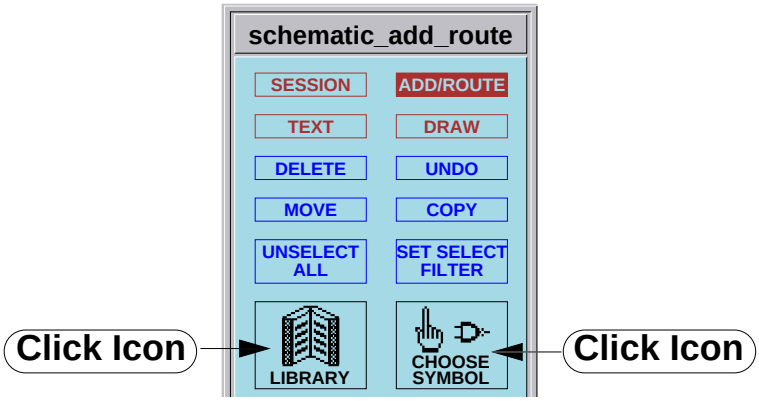
The concept of strokes was discussed in Module 1 and will be emphasized in this course as one of the most productive methods for schematic entry. The default strokes available in Design Architect are shown on the left. This form can be displayed by drawing a question mark “?” stroke.

It is often helpful to make a photocopy of this form, cut it up into strips and tape the strips on the edges of your display. After you use the strokes over time, you will remember them and they will come to you naturally, almost without thinking.

You have already learned some of the common strokes like “C” for copy, “U” for unselect, and “D” for delete. Many other strokes that you will learn in this module will also carry over to other applications.

Placing an Instance on a Sheet

- An instance is like an active reflection of a symbol in a library
- Placing an instance on a sheet is called “instantiating”
- Click LIBRARY or CHOOSE SYMBOL icon



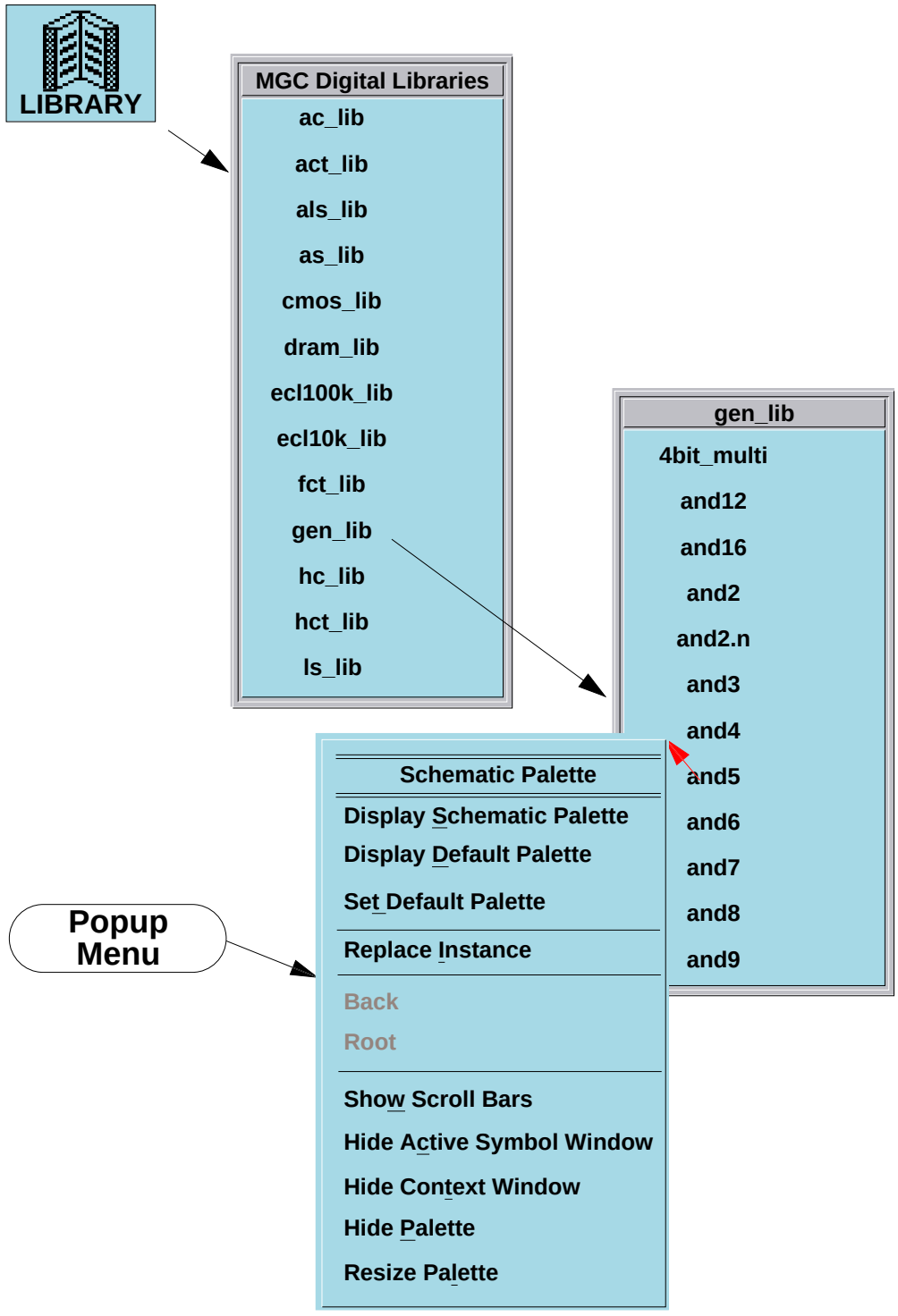
Placing an Instance on a Sheet

Component libraries contain a wide variety of software models that represent off-the-shelf electronic components available from IC vendors. You can use component libraries supplied by Mentor Graphics, third-party vendors, or you can create your own libraries.

When you place a symbol on a schematic sheet, you are really placing an *instance* of the symbol that represents that component. This is called *instantiating* a component symbol. This instance is not a copy of the component symbol; it is more like an active reflection because a direct reference to the symbol is established and maintained. Any changes made to the symbol are generally reflected by the instance on the schematic sheet, after an explicit update of the symbol is made, or the next time the sheet is opened.

There are several methods of placing component symbols on a schematic sheet. You can access component libraries through either the **schematic_add_route** palette, the **ADD** popup menu, or the **Libraries** pulldown menu. You will learn some of the more common methods to choose a component symbol in the next several pages.

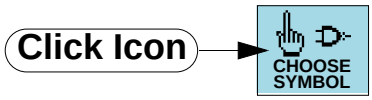
Mentor Graphics Libraries

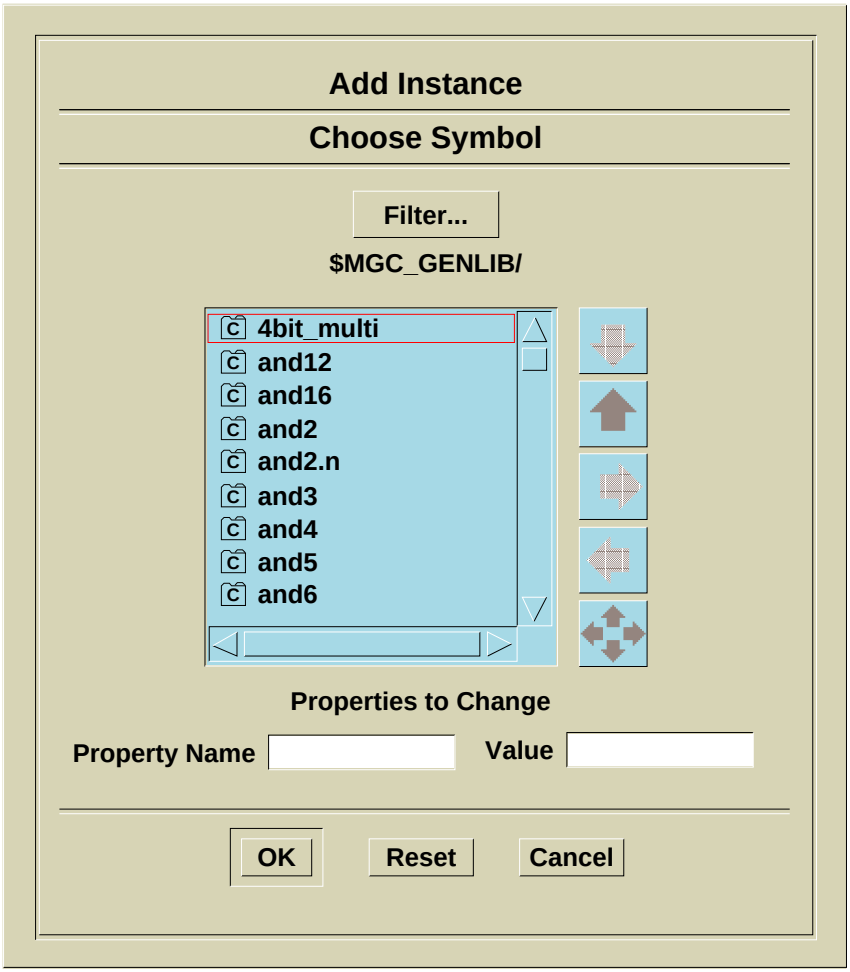


Mentor Graphics Libraries

A variety of Mentor Graphics libraries are available for creating schematics. The most common is **gen_lib** which contains models of common logic elements without technology specific property values. Other libraries are available such as **ls_lib** which models the 7400-series ls family. Mentor Graphics libraries can be accessed through the LIBRARY icon as shown on the left. Once you are in a library, the list of components can be very long. You can use the popup menu to added scroll bars to the palette to help you scroll through the list.

Using the Choose Symbol Option





1. Press Goto button to specify pathname
2. Double click the component icon to see possible symbol choices below.
3. Click on symbol icon, then click OK

Using the Choose Symbol Option

When you click the **CHOOSE SYMBOL** icon from the **schematic_add_route** palette, the Choose Symbol dialog box is displayed as shown on the left.

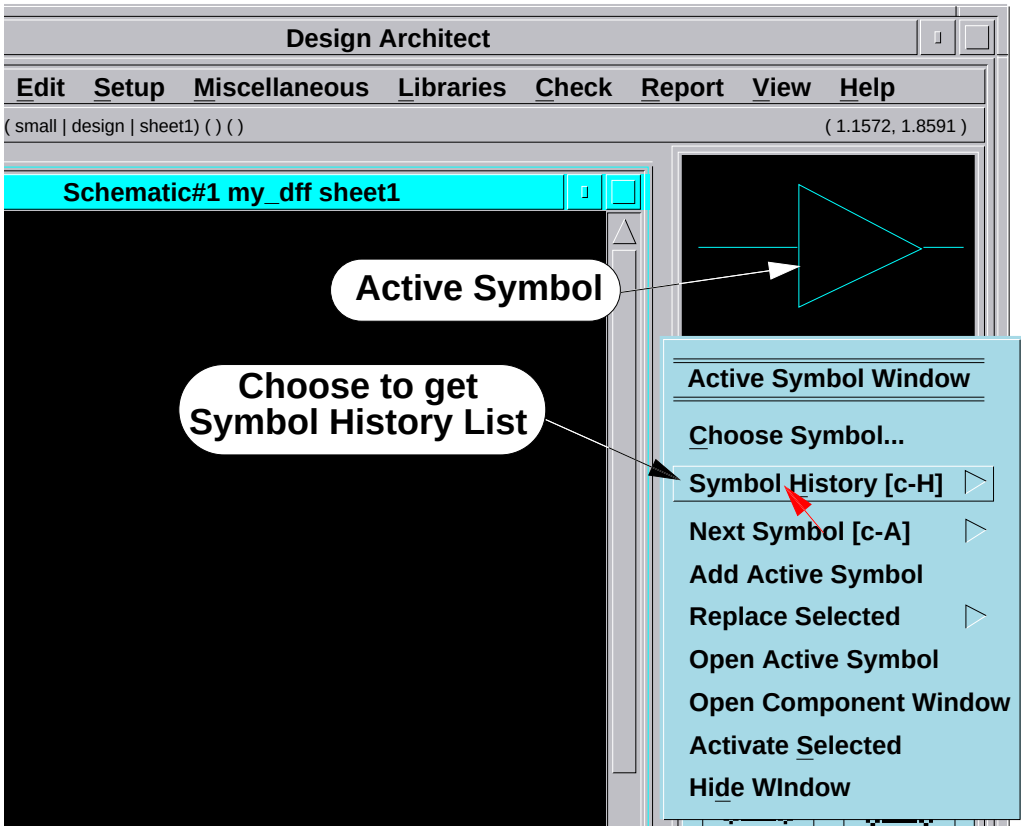
The scrolling list contains the contents of the current working directory. To move to another directory, you can click the **Goto** navigator button. This brings up another dialog box requesting a directory name. You can type in the name and click **OK**. The scrolling list now displays the contents of the specified directory.

You can select the component by clicking the Select mouse button on the component name (the icon that contains the “c”). You can also optionally select the symbol (if you want to select a symbol other than the default) by double clicking the “C” icon, then selecting the correct symbol icon and executing the form.

The **Filter** button lets you filter out certain types of objects from being displayed in the Dialog Navigator.

The Active Symbol

- Symbol of the last instance added to sheet
- Displayed in the Active Symbol Window



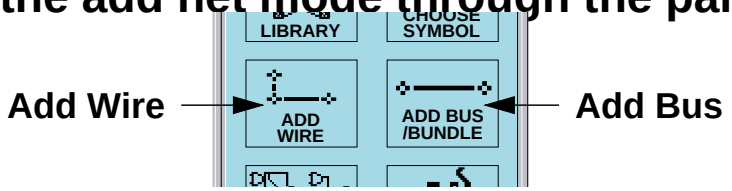
The Active Symbol

The *active symbol* is displayed in the Active Symbol window. It can be set implicitly when you place or replace an instance on a sheet or explicitly when you change the active symbol. For example, if the last instance you placed on the sheet was *$MGC_GENLIB/buf*, then **buf** is the active symbol. The Active Symbol window popup menu(shown on the left) is defined as follows:

- **Choose Symbol**. Changes the active symbol to another symbol.
- **Symbol History**. Shows an ordered history list of previously active symbols. You click on a symbol name in the list to make it active. This list also contains common elements such as portin, portout, vcc and ground to provide a quick way to get to these parts.
- **Next Symbol**. Used for components which have multiple symbol models, such as $MGC_GENLIB/rip. Clicking this item changes the view to the next symbol in the symbol list.
- **Add Active Symbol**. Adds another instance of the active symbol to the sheet. You can also click the Select mouse button in the Active Symbol window or draw an “L” stroke  in the Schematic window.
- **Replace Selected**. Replaces a selected instance with the active symbol.
- **Open Component Window.** Brings up a Component Window on the Active Symbol. This window is discussed later in this module.
- **Open Active Symbol**. Brings up the Symbol Editor containing the symbol in read-only mode.
- **Activate Selected**. Makes the selected instance's symbol the active symbol.
- **Hide Window**. Removes the Active Symbol window from the Design Architect Session window. To show the Active Symbol window, use the popup menu **Palette > Show Active Window** or the pull down menu **MGC > Setup > Session** dialog box.

Adding Nets

- Nets are used to connect instance pins together
- The term net refers to a wire or a bus
- A single net is called a wire
- A grouped set of wires is called a bus
- Enter the add net mode through the palette icons



- Or, use the Add Wire Stroke ↓ and the Add Bus Stroke ↑
- You stay in the Add Net mode until you click "Cancel" on the prompt bar.

Adding Nets

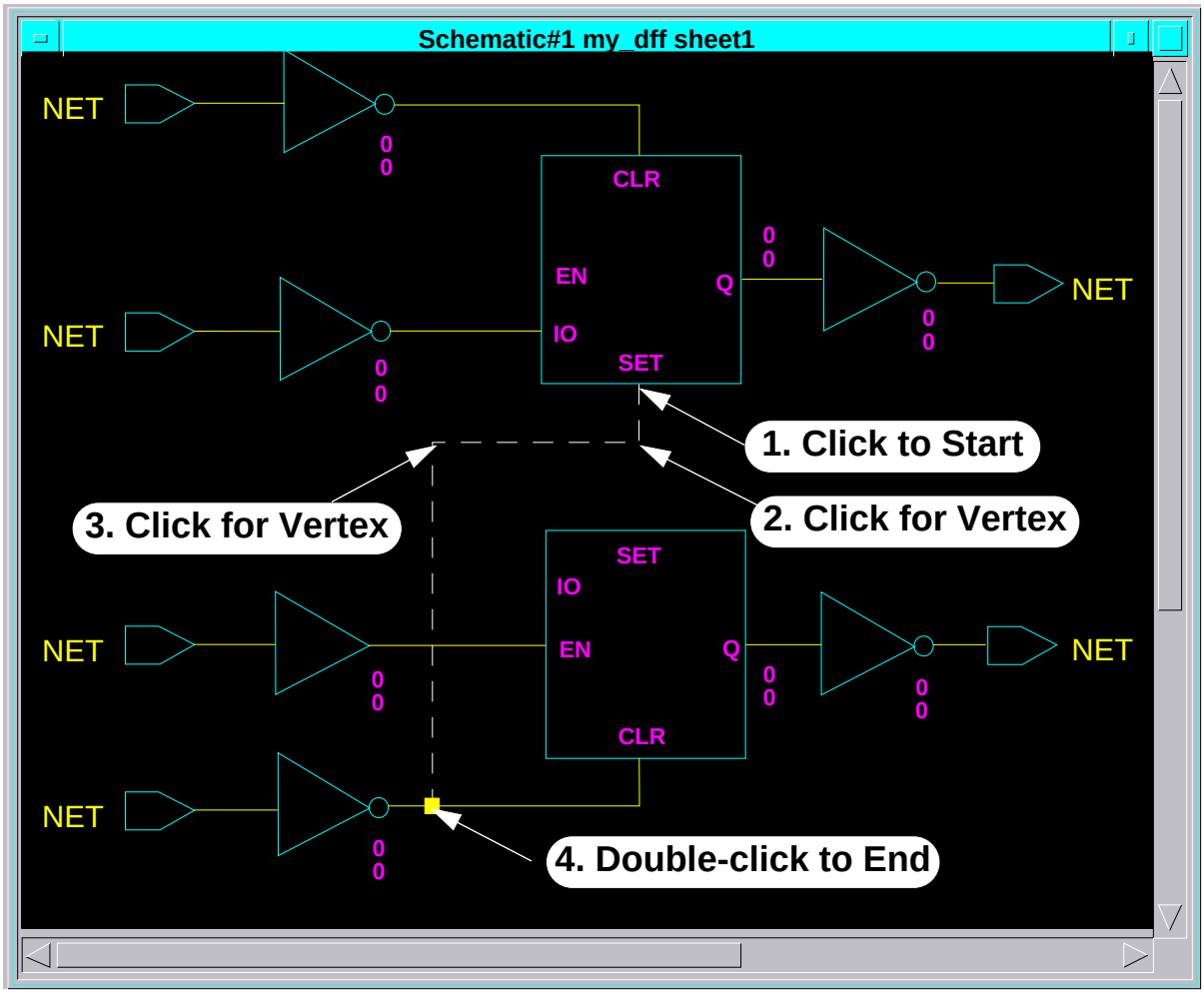
Short for network, the term “net” refers to a wiring connection between two or more instance pins. The term net refers to either a single wire or a collection of wires called a bus. A bus is sometimes called a bundle. A net may contain net vertices (corner points), net segments(the pieces between two vertices) and net junctions.

Although Design Architect assigns an internal system name to each net (a handle name like N$3) you can assign names that have more meaning. External nets, the nets connected to ports, must be named to match the pins on the associated symbol. You can also assign internal nets meaningful names to make it easier for you to identify them in downstream applications.

Two or more nets with identical names are treated as connected, even if they may not be graphically connected on the sheet. Two nets with identical names on different sheets in the same schematic are also treated as connected.

Graphically, wires are designated as single-pixel lines. Buses are designated as three-pixel lines by default, but they can also be designated as five or seven-pixel lines. The thickness of a wire or bus is only for visual appearance. The system knows whether a net is a wire or a bus by how it is named, not how it looks. Bus naming conventions will be discussed in a later module.

Net Creation Process



Click to Exit Add Wire Mode

- Press “Backspace” key to backup

Nets Creation Process

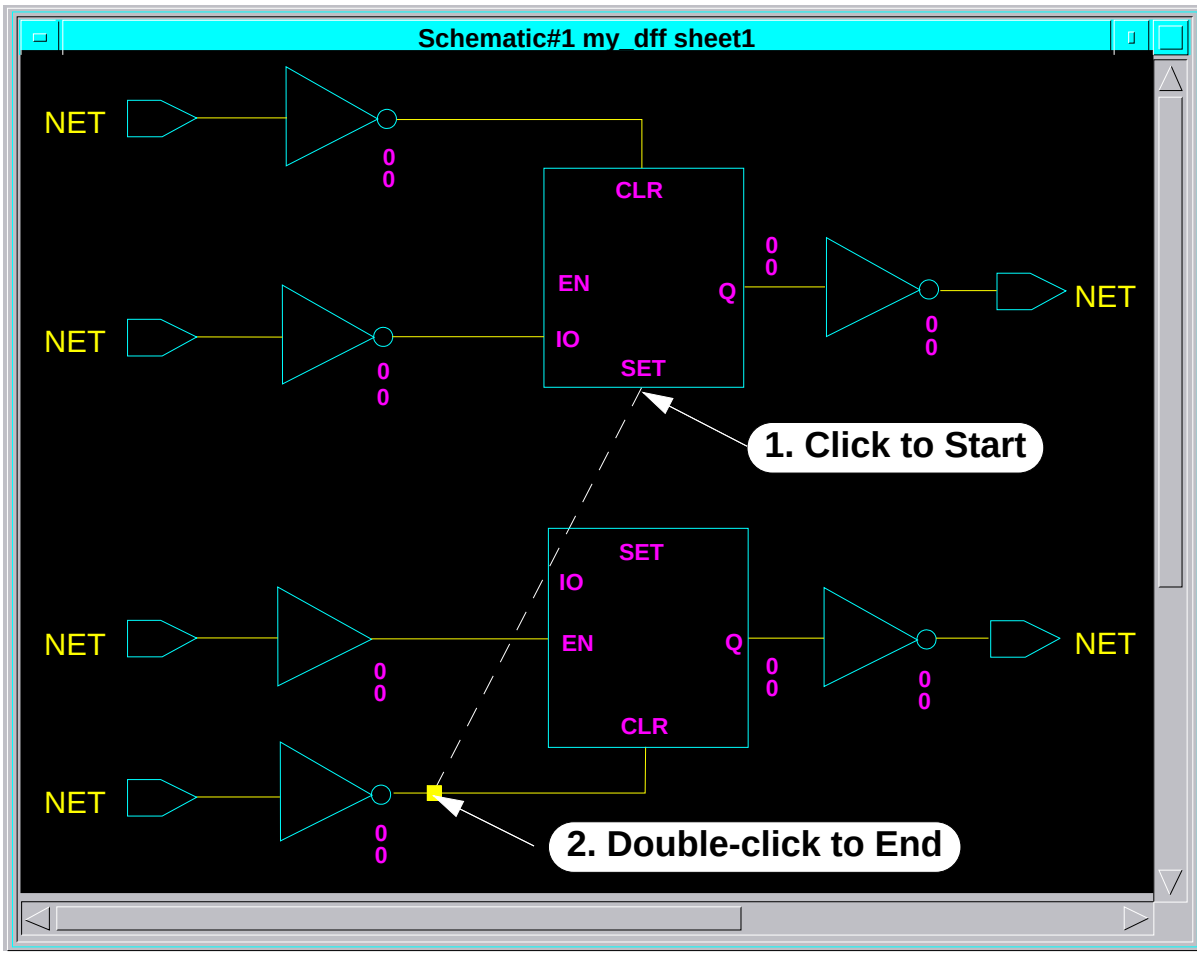
The example on the facing page shows that after the prompt bar is displayed, a net is started by clicking the Select mouse button on the starting point, usually an instance pin. Corner points (net vertices) are made by clicking once on a point and the end of the net is defined by a double click.

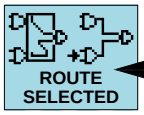
You can continue to add other nets by clicking the Select mouse button. You exit from “add wire” mode by clicking the **Cancel** button on the still-displayed **ADD WI**re prompt bar. The **ADD BUS** functionality works the same way.

If you are in the process of building a net, you can backtrack to a previous net vertex by pressing the BackSpace key.

When you are connecting a net to a pin, you must have the pointer within one-third of the pin spacing unit for the net to snap to the pin. If you don't, the net vertex snaps to another grid. When you check the sheet, the check software flags this as a warning (a dangling net and an unconnected pin). If you think that you missed the connection, you can zoom into the area with a  stroke to take a closer look.

Autorouting Nets





3. Click “Route Selected” Icon

- **Choose “Setup > Set Autoroute On” to autoroute nets as they are drawn**

Autorouting Nets

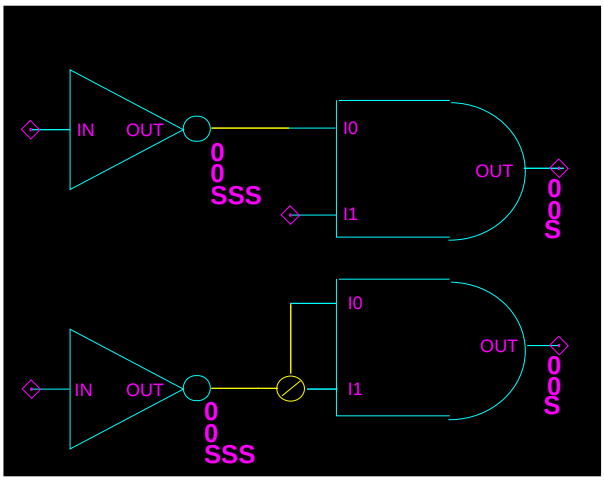
You can automatically route nets as they are drawn, or you can manually select and route the existing nets later. The net router defines a pathway for a connected net that avoids instance extents, comment objects, and other nets, utilizing the pin snap grid as the routing grid. If net vertices are not on the grid, they are not routed.

If you create a straight net between two pins, then click the ROUTE SELECTED icon, the autorouter will attempt to route the selected net. If you execute the **Setup > Set Autoroute On** pulldown menu item, the autorouter will route each net as you draw it.

Routing performance is faster if the pin snap grid is initially set to a value larger than one pin interval during the route operation, and then set back for component instantiation.

Net Connection Rules

- **Automatic connections are made when nets are created and instances are placed**
- **When Manipulating objects (such as move and copy)**
  - **Connectivity is preserved**
  - **No new connections are made at pin / vertex intersections**
- **Not-dots:** 
  - **Are non-electrical, graphical indicators showing that no connection was made**
  - **Are displayed when a net crosses a pin or vertex during an edit operation**
- **Example:**
  - **Before move:**
  - **After move:**



Net Connection Rules

During net creation, connections are created at input points with pins, net vertices, or segments. However, edit commands such as Move, Copy, Flip, Delete, Rotate, and Pivot, do not automatically make new connections. Instead, they preserve the connectivity that was established before the edit operation. If a net passes over any existing pins or vertices, no connections are made at those vertices.

This can result in cases where nets may look connected, but are not. To enable you to see where a net connection has not been made, these locations are marked with a non-electrical graphical object called a "**not-dot**." A not-dot on a vertex indicates that not all segments passing through the vertex are connected. It can be plotted, but cannot be removed without changing the graphics or connecting the overlapping vertices using one of the **Connect** commands (discussed on the next page).

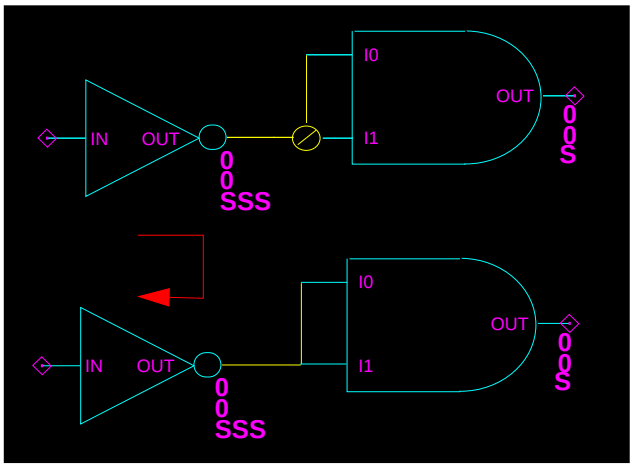
In the example on the facing page, an instance of an **inv** symbol and an instance of an **and2** symbol are connected by a net. The **inv** instance is selected and moved so that the attached net touches the second pin vertex of the **and2** instance. A not-dot appears to indicate that there is no electrical connection made at that point.

Connecting and Disconnecting Net Vertices

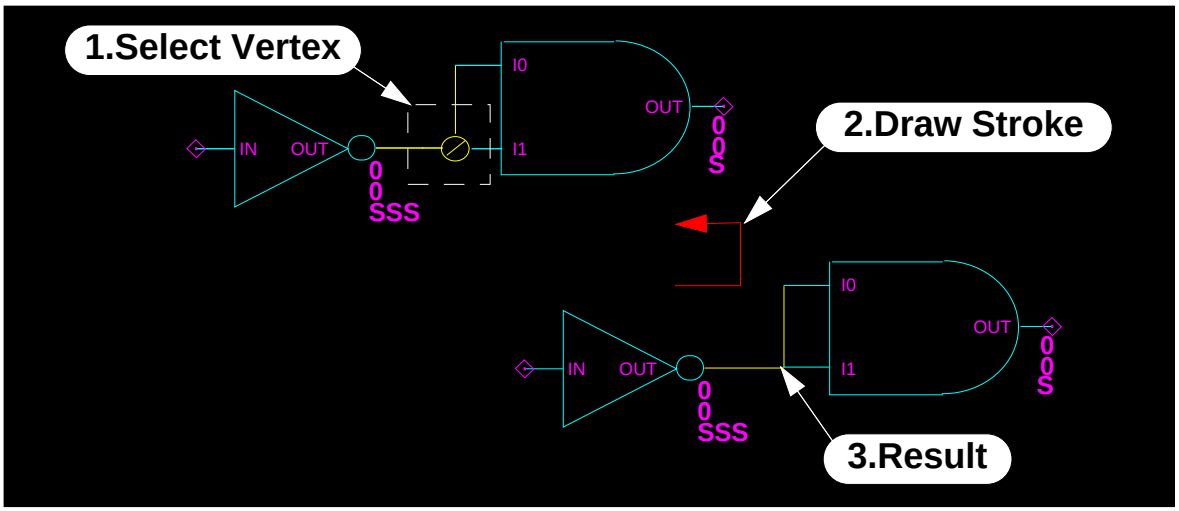
- Forces connect or disconnect of net segments and instance pins
- Occurs at specified junctions and intersections
- Connect All:

Before:

After:



- Connect Selected:



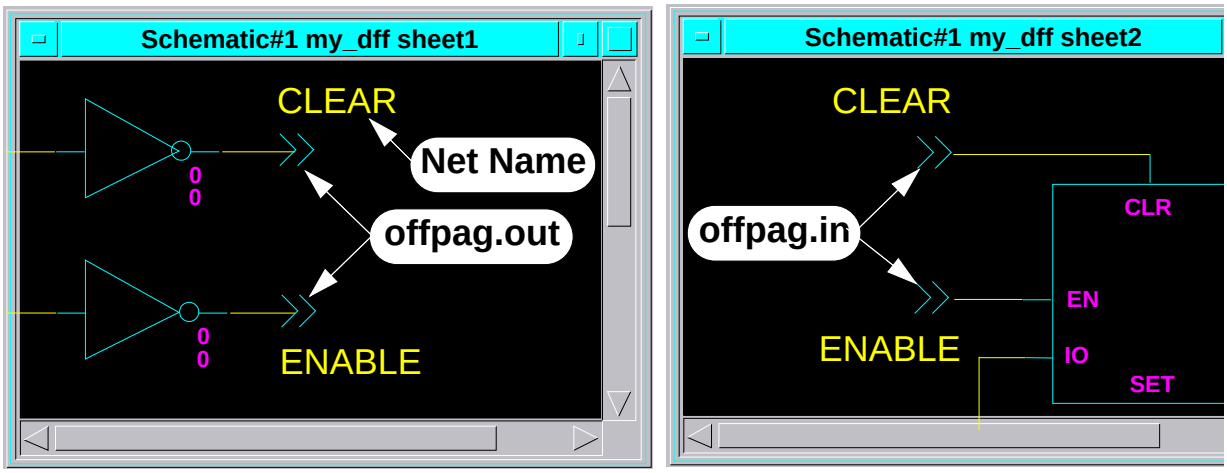
Connecting and Disconnecting Net Vertices

Clicking the CONNECT ALL icon or drawing a backward “C” stroke(top to bottom) forces all net vertices marked by not-dots to be connected. If you select one of several not-dot vertices and draw a backward “C” stroke(bottom to top), only the selected connection is forced.

Sometimes you need to disconnect the end of a net from a pin and move the net to a different location. The procedure is to execute the popup menu item **ADD > Connections** > **Disconnect Area,** draw the bounding box around the pin (with the Select mouse button, select the net vertex at the end of the net and move the vertex with a move command.

Naming Nets

- Net Names give each net a unique identity
- Net Names establish connectivity across sheet boundaries



Adding Net Names

1. Select the nets you wish to name
2. Choose (popup menu) Name Nets:

Changing Net Names

1. Place the mouse cursor over the net name
2. Press Shift-F7 (Change Text Value) function key

Naming Nets

You can easily name a net that currently has no name and you can rename a net that does have a name. Remember all net names must be unique and all buses must have a net name. In the illustration to the left, the offpage connectors are added only to provide a visual indication that the net goes off the page. The net name is the object that actually establishes the connection across the sheet borders.

You can use the **NET > Name Nets:** menu item to add new net names and to change existing net names. This menu item works with selected nets, selected vertices, and selected net names, or a combination of all three.

To quickly change an existing single net name, you can use the Shift-F7 function key. Select the name, press **Shift-F7**, fill out the form and click OK.

Selection Concepts

- **Types of Selection**
  - **Point Selection (click on object)**
  - **Area selection (press and drag bounding box)**
- **Selection Modes**
  (da_session) Setup > Set > Individual Selection Model
  - **Additive - selected object is added to the set**
  - **Individual - selecting an object deselects others (Ctrl-LMB overrides and adds to the set)**
- **Selection Sets**
  - **Objects are added to a selection set until an operation that uses the selection set is performed**
  - **One selection set per sheet is maintained**
- **Selection filter**
  - **Used with mouse pointer**
  - **Function keys do not use selection filter**

Selection Concepts

Types of Selection. You select objects so that you can manipulate them with commands such as Move and Copy. You select a single object by clicking the Select mouse button on an unselected object. This is called *point selection*. When you click the Select mouse button on an already-selected object, it becomes unselected.

You can select many objects by pressing the Select mouse button, moving the cursor to the opposite corner of the rectangular area with the mouse button, and releasing it. This is called *area selection*.

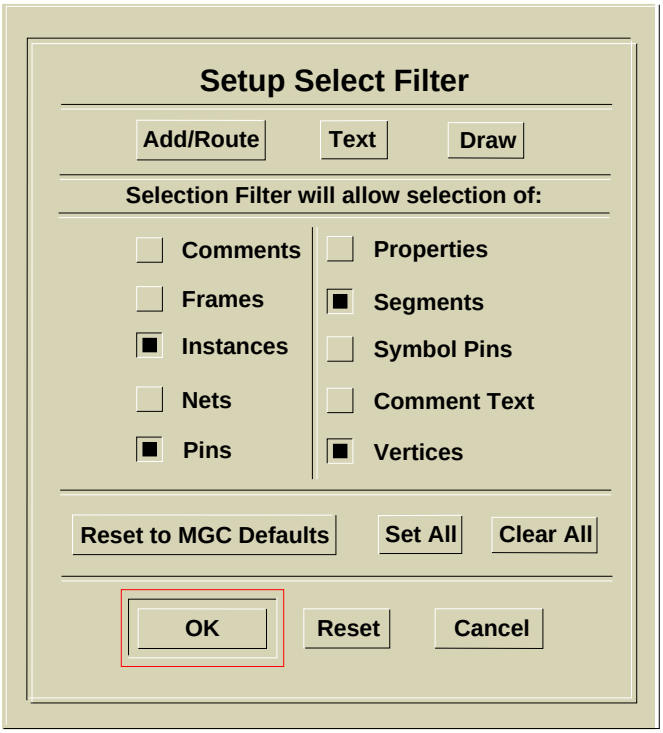
Selection Modes. The default selection mode is *additive*. Each object you select is added to the object already selected. You may switch to the *individual* selection mode by choosing **Setup > Set > Individual Selection Model** from the DA Session window. In this mode, when you click on an object, all others are unselected (unless you hold down the Ctrl Key).

Selection Sets. As you select objects, they are added to the *selection set* (when in the additive selection mode). Operations that use the selection set are any of the following: Move, Copy, Flip, Rotate, Delete, Pivot, Change, and Report. After one of these operations, objects are still selected, but the selection set is closed and still defined. The next selection will discard that selection set to open a new selection set. Each sheet or symbol opened has its own open selection set. If you select objects in one sheet and then activate a different window on another sheet and select new objects, objects in the previous sheet remain selected.

Selection Filter. Whether or not an object is selectable is defined by the *selection filter*, which is used in point and area selection. This filter is ignored when you use the menus or the F1 (Select Area Any) or F2 (Unselect All) function keys. For example, property text is not selectable by default. If you move the cursor on a property text and click the Select mouse button, the property text remains unselected. However, if you press the F1 function key, the property text becomes selected.

Select Filter

- Specifies object types for selection
- Used only with mouse point selection



- Use stroke to bring up form
- Or, click the SET SELECT FILTER button on the palette

Select Filter

The select filter controls what objects are currently selectable from the mouse pointer. It is not use with the F1 (Select Area Any) function key.When you change the type of objects that are selectable through the **Setup Select Filter** dialog box(as shown on the left), the result is in effect for every existing schematic window and any subsequent schematic windows that are opened in that editor.

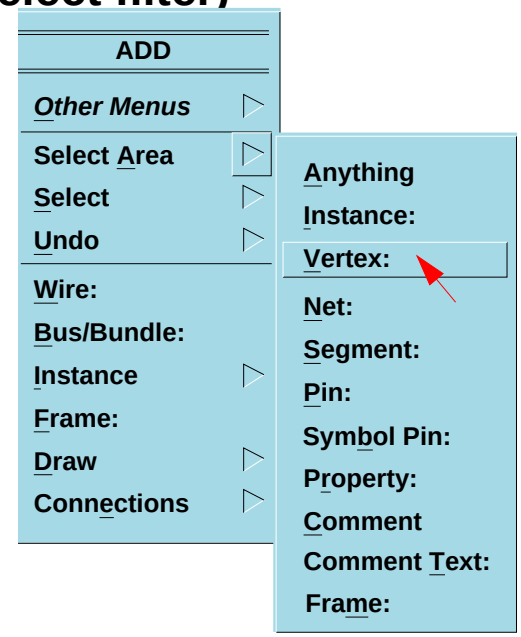
When you choose either the **Set Select Filter** button in the palette, or draw the  stroke, a dialog box is displayed as shown on the left. The three buttons that are displayed at the top, "**Add/Route**", "**Text**", and "**Draw**" correspond with the three Schematic palette buttons. When you are adding instances and creating nets, choose the "Add/Route" button to set the appropriate selection filter. When you are adding and manipulating property or comment text, choose the "Text" button. And when you are creating symbol graphics, choose the "Draw" button. Or, you can click on the individual object types that you want to be selectable. The "Reset to MGC Defaults" button resets the options to the Mentor Graphics-specified defaults.

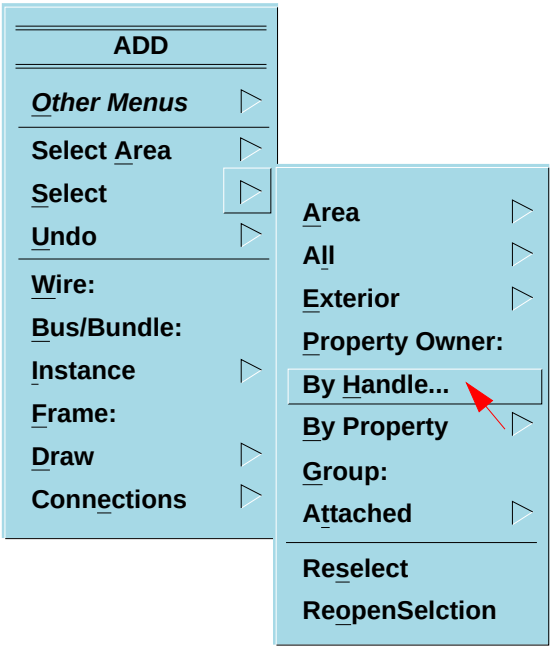
You can override the select filter by choosing menus from the **Select > Area**, **Select > All**, or **Select > Exterior** menus. However, you only override the filter for that one time.

The filter remains in effect for subsequent select actions for the current Design Architect session unless you override them for a single operation or change the defaults in the Setup Filter dialog box. You can add the appropriate select filter function to a startup file that can be executed any time a sheet or symbol window is opened, or you can include this function in a startup file that is executed when Design Architect is invoked.

Using the Select Popup Menus

- **Good for one selection operation (then returns to select filter)**





Using the Select Popup Menus

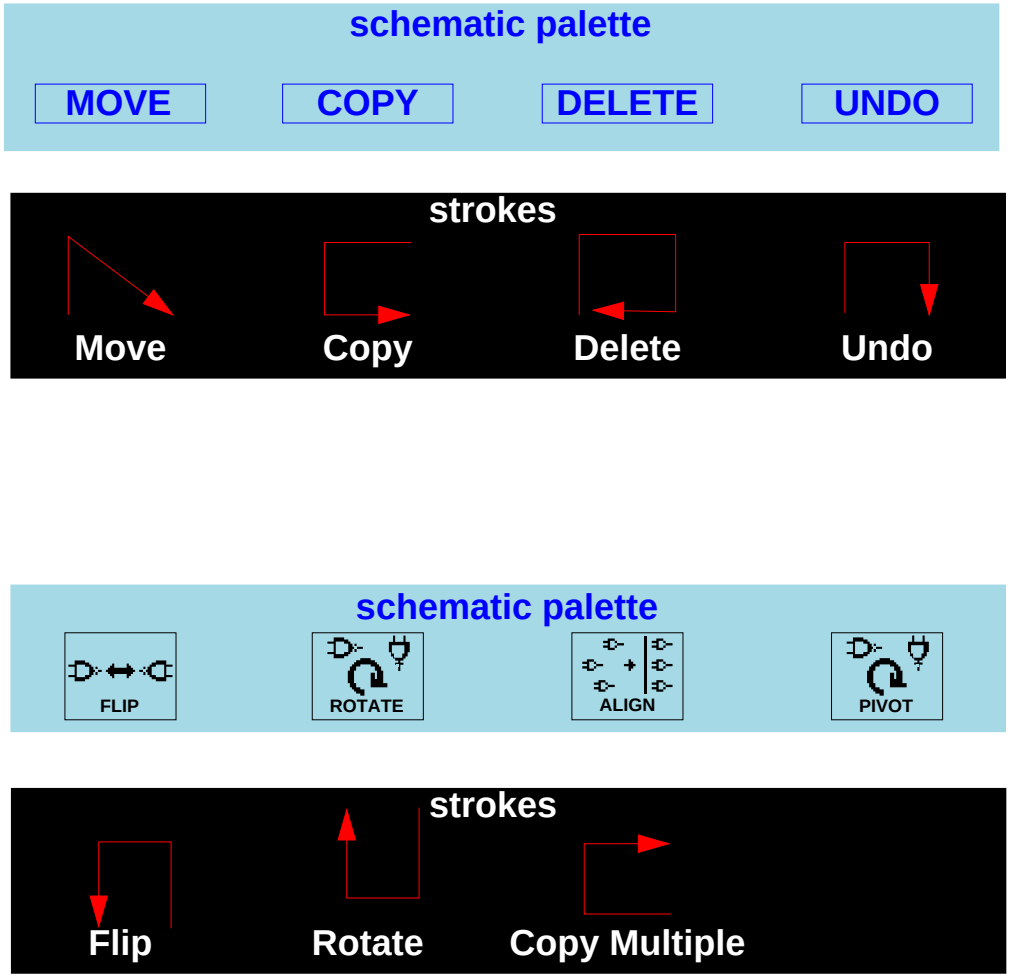
Objects can be selected in a variety of ways using the **popup menus.**

Select > All, **Select > Area**, and **Select > Exterior** cascading menus are found under all popup menus. If you choose anything other than Filtered or Anything, the selection of that object overrides the selection filter for that one time only.

For example, assume that the selection filter prevents property text from being selected, and that nothing is currently selected in the window. If you choose the **ADD > Select > All > Filtered** menu item, none of the property text is selected. If you choose the **ADD > Select > All > Anything** menu item, all of the property text is selected, in addition to everything else that is in the window. This may not be what you want. However, if you choose **ADD > Select > All > Property**, all of the property text is selected in the window, and all other objects remain unselected.

The **Select > Exterior** menu selects objects outside a specified rectangular region.

Manipulating Objects



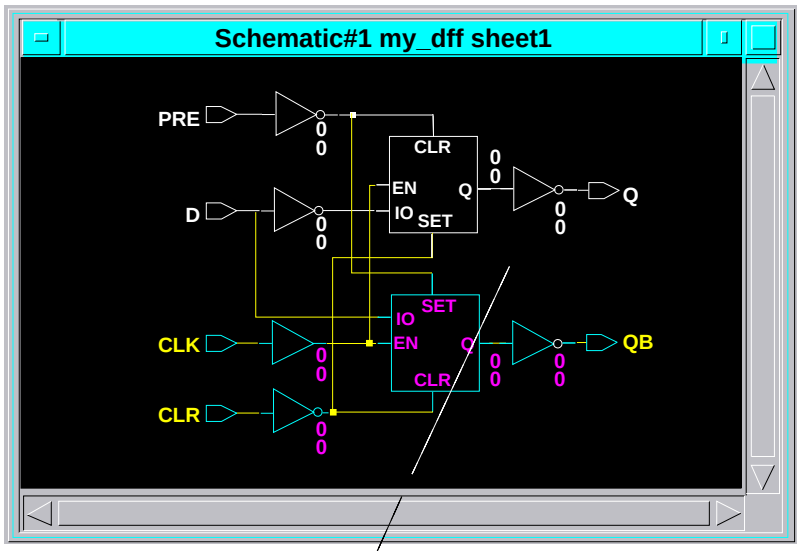
- Select objects, then click icon or draw stroke
- Net connectivity is preserved

Manipulating Objects

After selecting an object(s), you can manipulate it (them) by clicking the COPY, MOVE, DELETE, FLIP, ROTATE, ALIGN and PIVOT palette items as shown on the left. You can manipulate the objects a little faster by using the equivalent stroke as shown on the left.

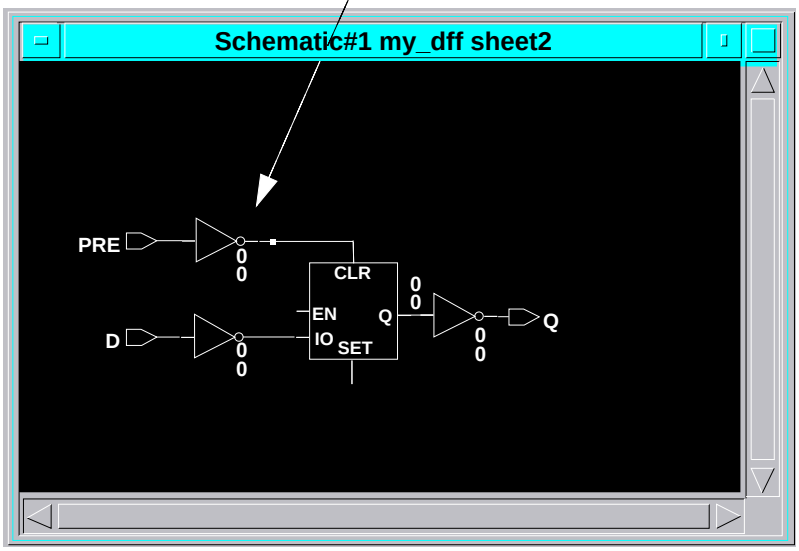
These actions preserve the net connectivity that existed before the edit. For example, if a net vertex is placed over any existing pin or vertex, no connections are made at those vertices. However, not-dots appear at those vertices as a warning that what might appear to be a connection, is not.

Interwindow Copy and Move



1. Select Objects

2. Execute Copy or Move



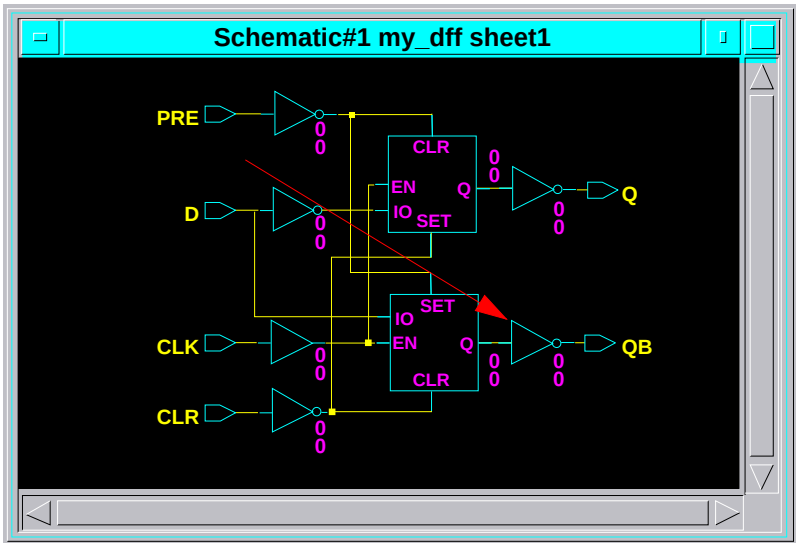
3. Move cursor to second window

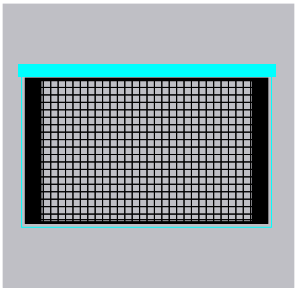
4. Click the Select Button

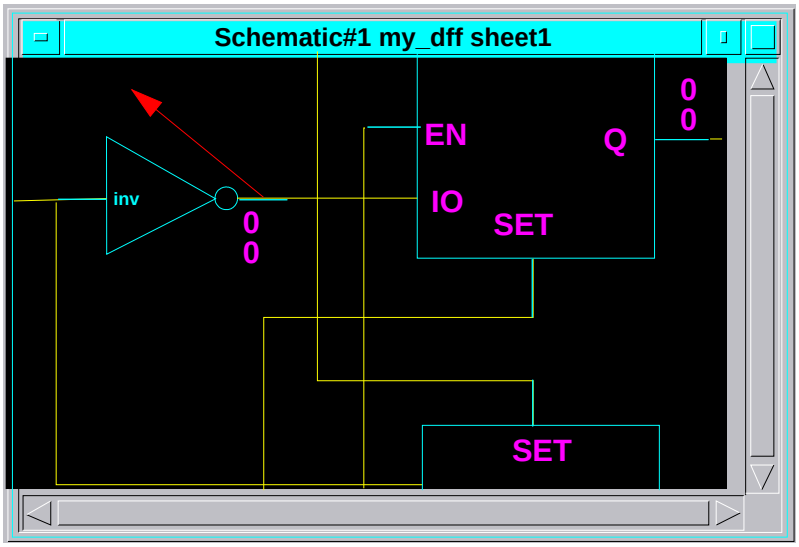
Interwindow Copy and Move

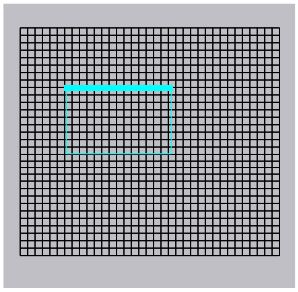
Moving and Copying schematic objects from one sheet to another or from one schematic to another is quick and easy. The procedure is to open a new window on a second sheet or second schematic. You select the objects you want to move or copy, execute the MOVE or COPY command, then move the mouse cursor to the second window and click.

The Context Window

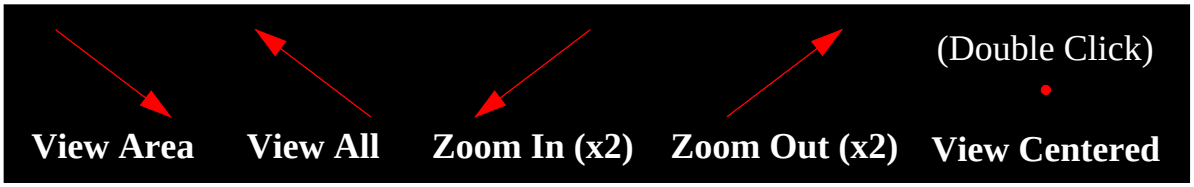








Viewing Strokes



The Context Window

The Context window is displayed in the lower-right corner of the DA Session window. The display of the Context window consists of two rectangles. The solid patterned rectangle represents the contents of the sheet in the active window, and the window-shaped hollow rectangle represents the viewing area in the active window. The two rectangles in the Context window are moved around to remain in proportion with the active window's border and the extent of the schematic in the window.

View functionality is available through the strokes shown on the opposite page. The top illustration shows the results after a View All action is performed. The Schematic Editor windows displays the entire contents of the sheet, and the Context window shows that the viewing area is the entire sheet.

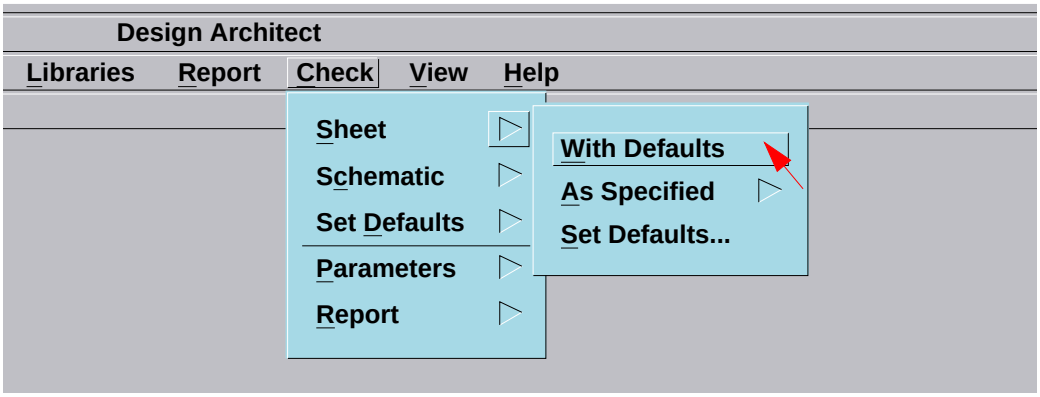
The second illustration shows the results after either a View Area or Zoom In action. The Schematic Editor window displays the partial view of the sheet and the Context window shows the relationship of the viewing area with respect to the entire sheet.

The viewing strokes can be done in either the Schematic Window or the Context Window itself.

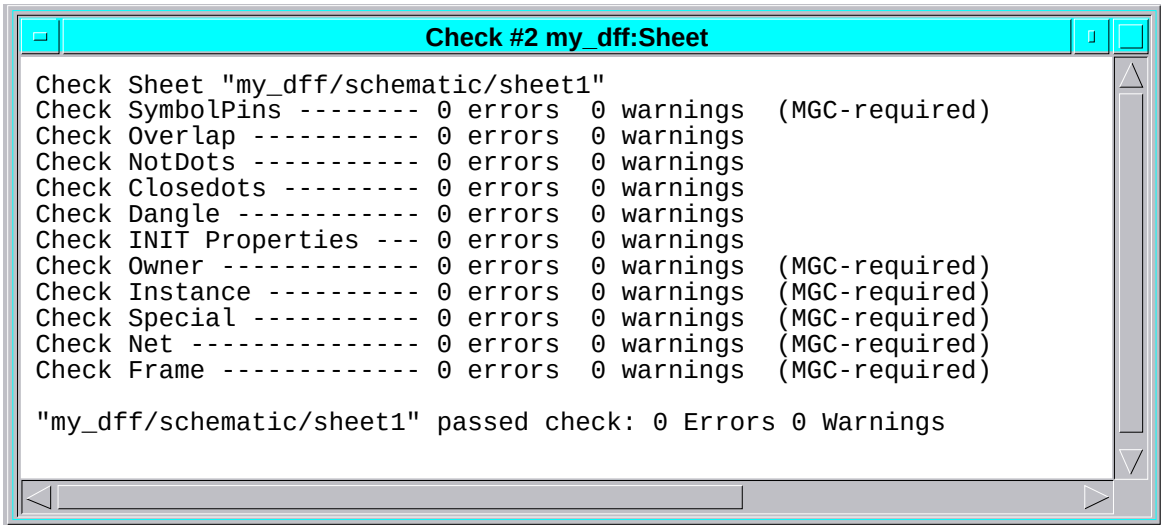
If you use the Context window to identify the viewing area and are concerned about “screen real estate”, you can hide the scroll bars associated with the active window by typing the **$hide_scrolls()** function in the popup command line.

Checking the Sheet

- **Sheets must pass required set of checks:**



- **Displays check status window:**



Checking the Sheet

To ensure that you produce a valid, workable circuit, a full set of checks must be passed. Many downstream Mentor Graphics applications require schematic sheets to pass a set of checks. In addition to the required checks, Design Architect includes a set of optional checks that can be incorporated into your design check and validation process.

Designs are not complete until they have passed the minimum required checks. If a sheet does not pass the required checks before a downstream application is invoked, the downstream application typically issues a warning message.

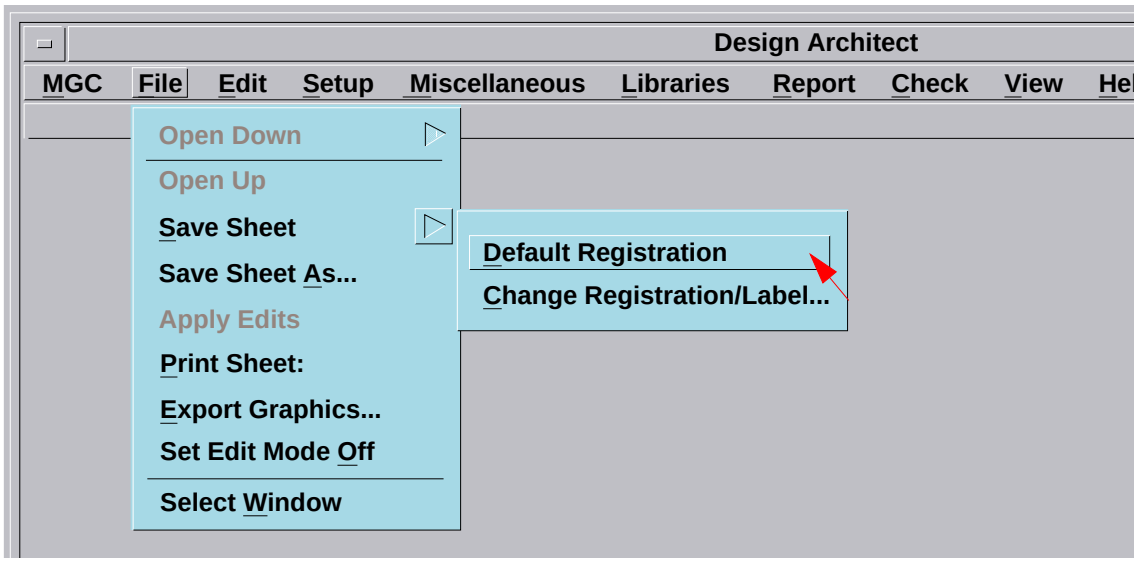
There are three levels of checking: (1) report all errors and warnings, (2) report only errors, and (3) do not check. By default, all required checks are set to the errors and warnings check level. Optional checks are set to a nocheck level.

You can specify sheet checks and schematic checks. Sheet checks validate only the contents of the sheet in the active window. Schematic checks actually validate all of the sheets of the schematic. You can check your sheet using the default check levels by selecting **Check > Sheet > With Defaults** from the pulldown menu bar. Generally, the report generated from this check provides information on instances, frames, nets, any symbol pins left on the sheet, or special instances (such as: bus rippers, net connectors, globals, and offpage connectors). An example is displayed on the facing page.

By default, check messages are displayed in a check status window that is displayed at the end of the check, and in the Transcript window where they are written during the check process.

Saving the Sheet

- **Sheets must be saved to disk:**

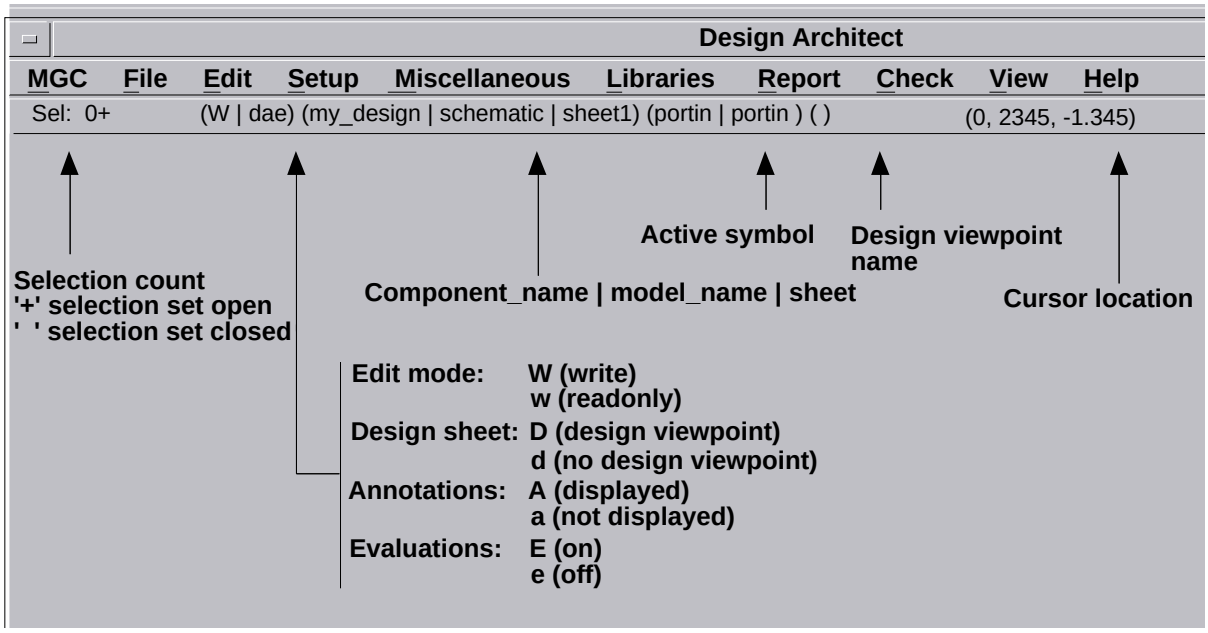


Saving a Sheet

The results of your schematic work are only maintained in dynamic memory until you save to disk with a **File > Save Sheet** command. The data is saved to disk and the schematic is registered to the component interface. The registration process includes running a validation check to see if all the ports on the schematic match the pins on the symbol. If the ports match the pins, the schematic is marked “Valid”. If there is not a one-to-one match, the schematic is marked “Not-Valid”. Some downstream tools care if a schematic is marked Not Valid, and some tools don’t. The action the tool takes when it finds a “Not Valid” schematic depends on the tool.

Regardless of the results of the validation check, the schematic is entered into the Model List in the Component Interface Table. This is called “registration”.

Schematic Editor Window Status Line

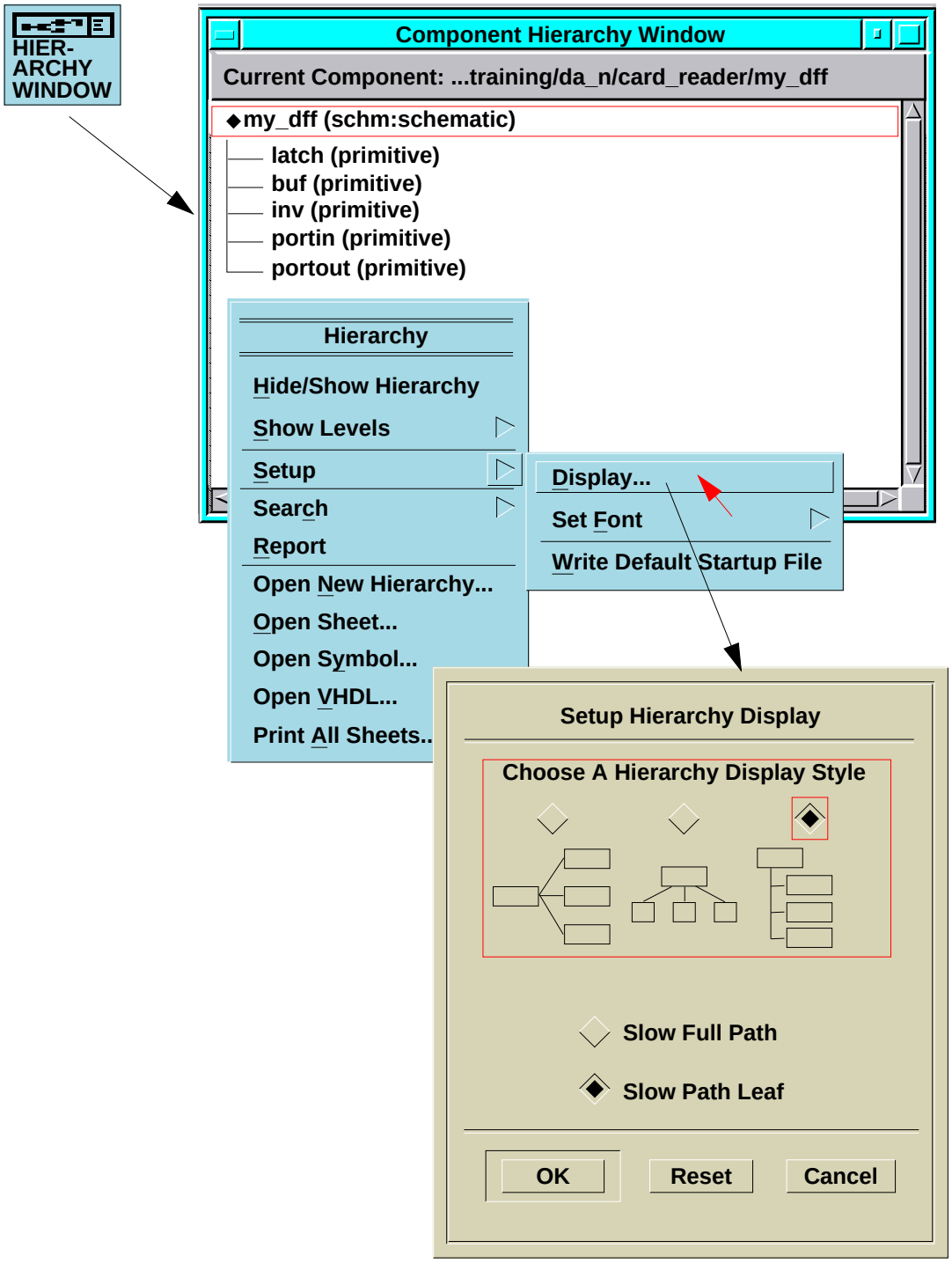


Schematic Editor Window Status Line

Now that you understand many of the basic terms and concepts of schematic capture, it is appropriate to look at the Schematic Editor status line. The status line appears below the menu bar and contains the following information:

- **Sel: (selection count)** tells you how many objects are currently selected; **+** means that the selection set is still open; closed " " means that an edit operation has been performed on the set and the set is closed.
- The sheet is either in edit mode **W** or read-only mode **w**.
- The sheet was opened in the context of a design viewpoint **D** or not **d**. (Opening on a viewpoint will be covered in a later module.)
- If the sheet has been opened in the context of a design viewpoint, either back-annotated property values are visible **A** or hidden **a**.
- If the sheet has been opened in the context of a design viewpoint, expressions are either evaluated **E** or not **e**.
- The component leaf name, the schematic name, and sheet name are displayed next.
- Active symbol information includes the leaf name of the component associated with the active symbol and the symbol name.
- The design viewpoint name is displayed after the active symbol name.
- All the way to the right is the current cursor location in user units. The point of origin is in the center of the sheet when the new blank sheet is opened for the first time.

Using the Component Hierarchy Window



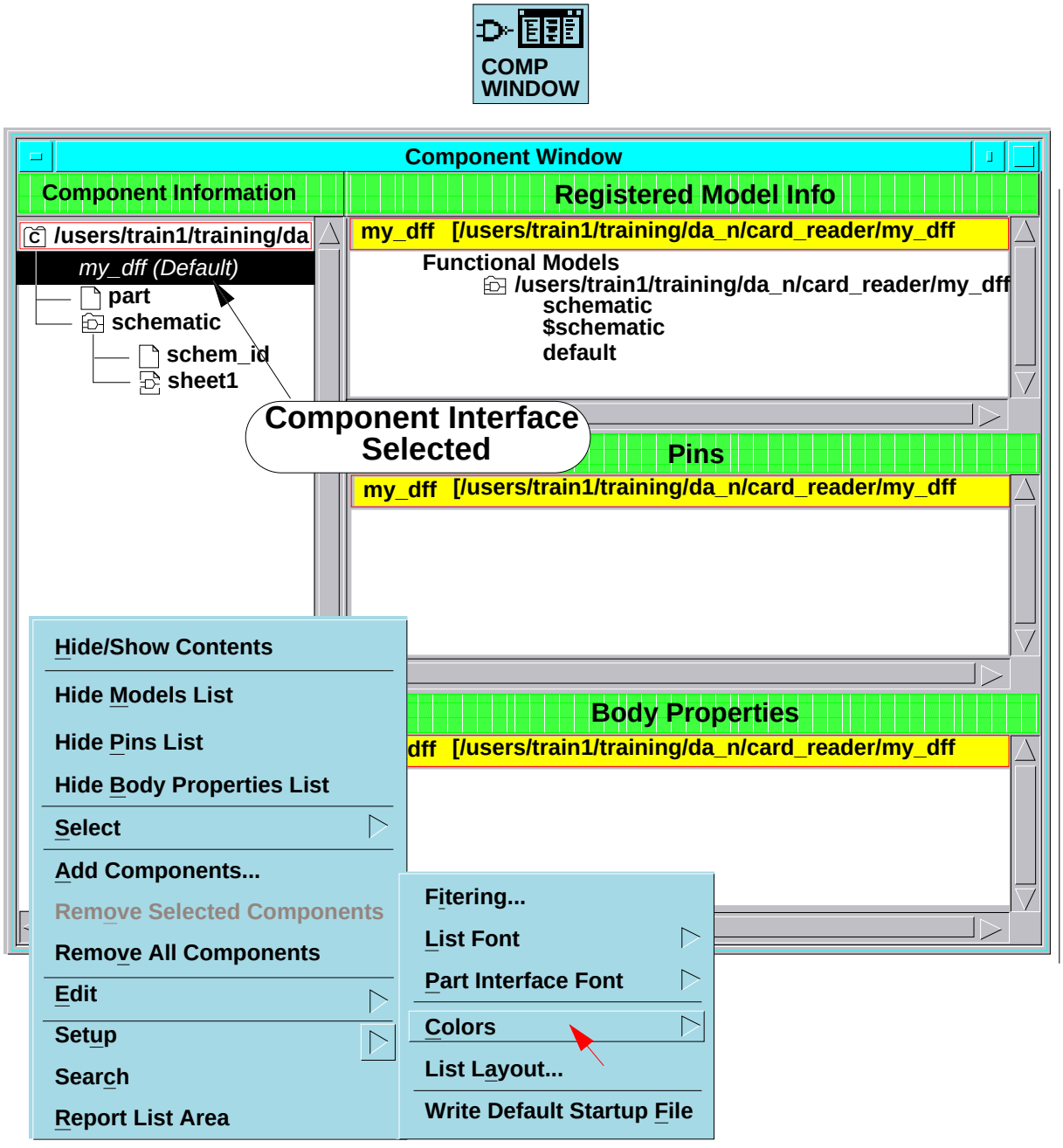
Using the Hierarchy Window

Clicking the HIERARCHY WINDOW icon in the DA Session palette brings up a Hierarchy Window on the component you specify. The illustration to the left shows a typical window. The hierarchy structure displayed can be set to three different modes through the use of the popup menu **Setup > Display...**

Double clicking on any component labeled "**schematic**" reveals the hierarchy structure underneath. Any component labeled "**primitive**" means that the component has no schematic.

The popup menu allows you to also select a component, then generate a report on its characteristics or open the Schematic Editor or Symbol Editor on it.

Using the Component Window



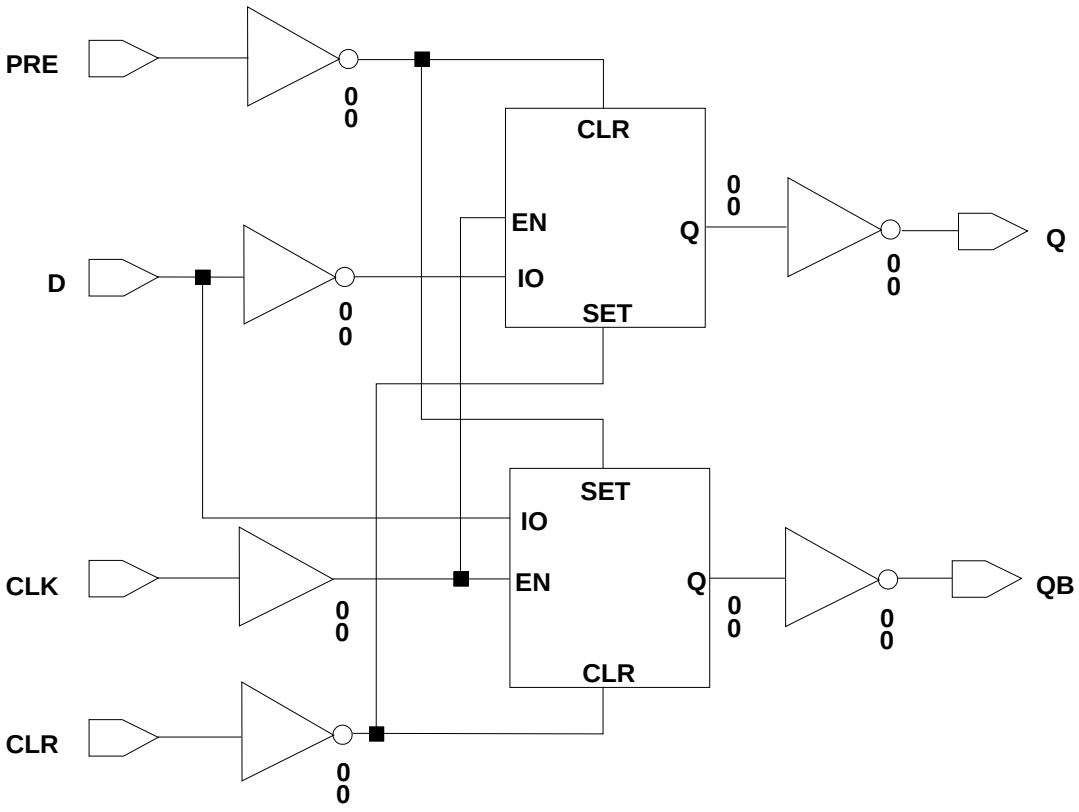
Using the Component Window

Clicking the COMP WINDOW icon in the DA Session palette brings up a Component Window on a component you specify. The Component window is a graphical view into the internal structure of the component and the Component Interface table. This window does many of the tasks that were previously accomplished by using a shell-level utility called the Component Interface Browser(CIB).

The Component Window can have up to four subwindows. The Component Information subwindow shows the component structure. Double clicking on the component icon reveals the component structure underneath and the name of the Component Interface table (italic font). In the illustration to the left, *my_dff* is the name of the Component Interface and it is marked as the default interface table. (Later you will learn that a component can have more than one table.)

When you select the Component Interface name(as shown on the left) and press the right mouse button, you can choose menu items that display information about the Model List, the Pin List, and the Body Properties List. In the illustration, the component my_dff only has a schematic model. Because there is no symbol, the Pin List is empty and the Body Property List is empty. When you double click on the schematic icon in the Model List, the labels for the schematic are listed underneath. Later you will learn that you can reference the schematic by specifying one of these labels as the value of the MODEL property on the symbol. You will also be shown how to add your own custom labels.

Lab Overview



Lab Exercises

Objectives

In the following exercises, you will:

- Invoke Design Architect, open a new schematic sheet and create the schematic shown on the left.
- Perform an exercise that will help you to understand and use net connection rules.
- Learn how to change the selection filter through the use of strokes.
- Browse a design hierarchy using the Component Hierarchy WIndow
- Browse a component structure and component interface table using the Component Window.

If you finish early, you may do Exercise 2 in Appendix A for extra credit. In this exercise, you will learn how to create a Design Architect startup file.

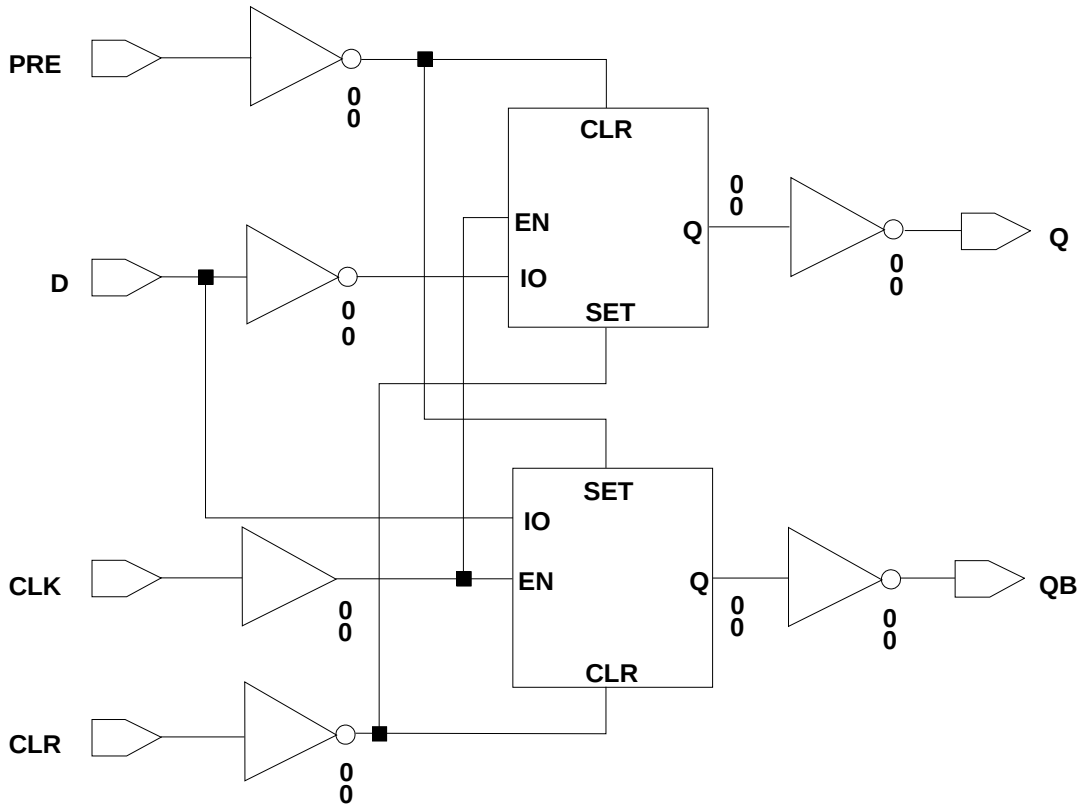
Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Creating a Schematic

Introduction

In this exercise, you will create a new component structure and schematic for a D-type flip-flop. The schematic is shown below.



my_dff Schematic Diagram

Invoke Design Manager and Set the Working Directory

1. Log into your workstation if you haven't already done so.
2. Invoke Design Manager from a shell.
   ```
   $ $MGC_HOME/bin/dmgr
   ```
3. Click the Maximize button to fill the screen with Design Manager.

(Note: some window environments may have a menu choice that performs this function.)

4. Set the working directory to the the following path:
<home_directory>/**training/da_n/card_reader**.

   MGC > Location Map > Set Working Directory:

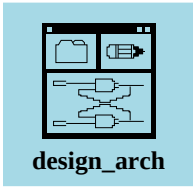
   Enter the above pathname and click **OK**.

Invoke Design Architect

1. Activate the Design Manager Tools window and invoke Design Architect.

   a. Click on the “Tools” window. The border color turns blue.

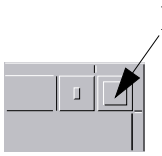
   b. Double-click on the **design_arch** icon
   .



   (If you don't see this icon, press the Right mouse button and execute **Update Window**. Use the left scroll bar, if necessary, to view the icon.)

   After you double click the icon, the message “**Invoking Design Architect...**” appears in the message window below.

   c. Click the Maximize button to fill the screen with Design Architect.



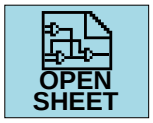
   d. Verify the setting of the current working directory.

      MGC > Location Map > Set Working Directory:

It should read <*home_directory*>**/training/da_n/card_reader**. If for some reason it doesn't, set it to this value and click **OK**; otherwise click **Cancel**.

Create a New my_dff Component Structure and Open a Sheet

1. Click the **OPEN SHEET** icon.



The Open Sheet dialog box is displayed in the DA session area.

2. After **Component Name:** enter <home_directory>**/training/da_n/card_reader/my_dff**

(Notice that the first sheet will be named **sheet1** by default.)

3. Press the **Return** key (or click **OK**).

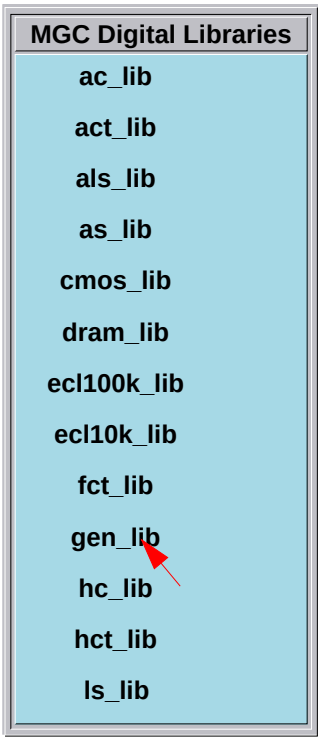
Design Architect creates a new component structure called “my_dff” and opens a Schematic Editor Window on a new (blank) schematic sheet.

4. Click the Schematic Editor Window Maximize button.

Add an Instance of the Latch Symbol to the Sheet

1. Click the LIBRARY icon.

A list of Mentor Graphics libraries is displayed.



2. Click **gen_lib**

   A list of **gen_lib** components is displayed

3. If the scroll bars on the right side of the palettes are not displayed, press the Right mouse button and execute **Show Scroll Bars.**

4. Place the cursor on the lower arrowhead (beneath the right scroll bar). Press and hold the Left mouse button until the **latch** component scrolls into view.

5. Click on **latch**

   You will see the **latch** symbol appear in the Active Component Window.

6. Move the cursor into the Schematic Window and you will see a white image of the **latch** symbol following the cursor. Position the instance in the middle of the window and click the Left mouse button.

7. Unselect the instance by pressing the Middle mouse button and drawing a “U” stroke  . Release the button.

   A red “U” is displayed, then the instance border color turns from white to blue. The instance is now unselected.

8. Draw a  stroke to zoom out a level.

Add Another latch Instance to the Sheet and Flip It

1. Draw an “L” stroke  .

   Again, you will see a white image of the **latch** symbol (the active symbol) follow the cursor.

2. Before placing the instance, move the cursor to the top of the window and double click the Middle mouse button.

   This point on the sheet moves to the center of the window.

3. Move the cursor so that the bottom pin of the second instance is five grid locations above the top pin of the first instance. Click the Left mouse button.

4. Flip the instance vertically by pressing the Right mouse button and from the popup menu choose:

   Rotate/Flip > Flip > Vertical

   The top instance of the **latch** is now flipped vertically.

5. Draw a “U” stroke  to unselect the instance.

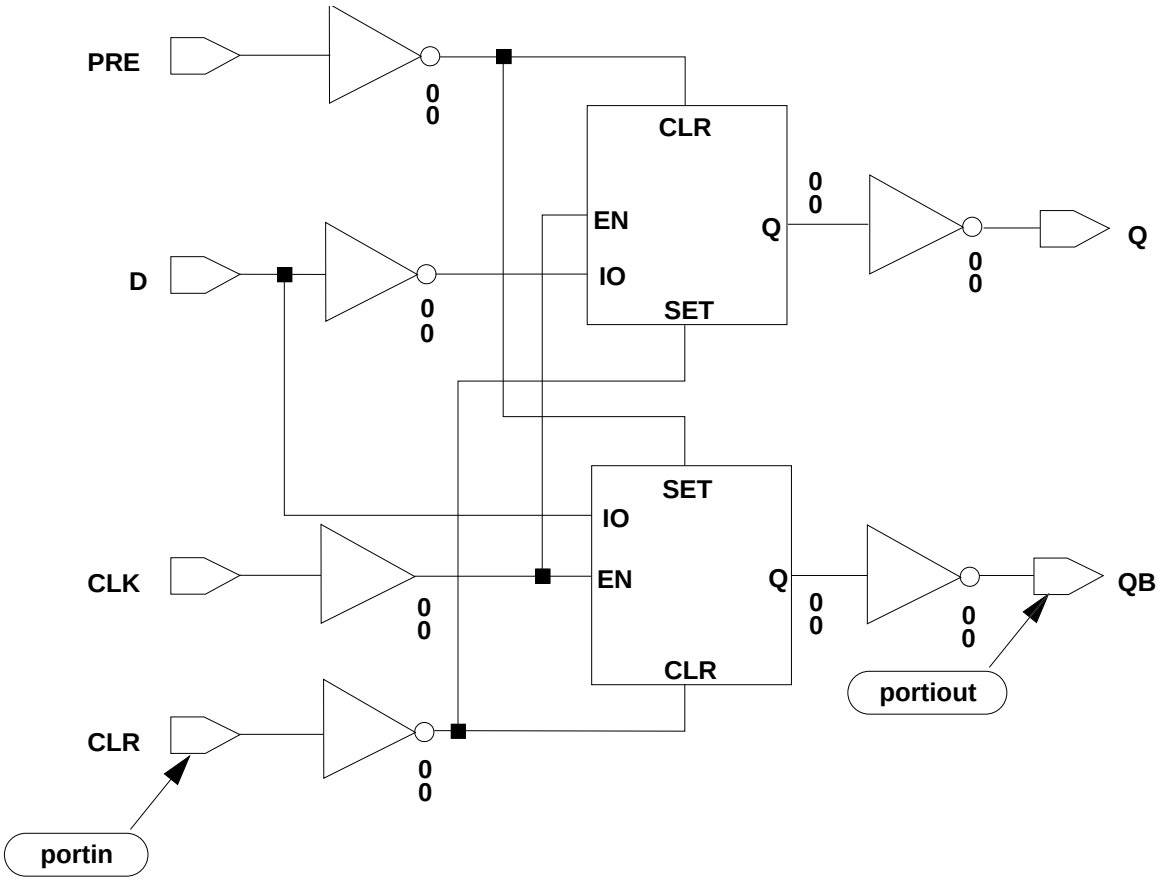
6. Draw a the  stroke to include all placed objects in the viewing area.

Add the buf Instance to the Sheet

1. Move the scroll bar to the top of the **gen_lib** palette, then click **buf.**

2. Place the **buf** instance on the sheet as shown in the diagram.

3. Unselect the instance with a “U” stroke.



my_dff Schematic Diagram

Add the Remaining inv Instances to the Sheet

Add the remaining **inv, portin** and **portout** instances to the sheet as shown in the schematic diagram. Zoom out with a ↗ stroke if you need to expand the view. Double click the Middle mouse button at various points to pan around the schematic. (The point double-clicked on always moves to center screen.)

If you misplace an instance, select it, draw a “shark fin” stroke ↘, then place the instance in the correct position and click the Left mouse button.

Unselect all instances with a ↱ stroke when you are finished.

Add the portin and portout Instances to the Sheet

1. Place the mouse cursor on the Active Symbol window, press the right mouse button and choose: **Symbol History.**
2. Click on **portin** and execute the form with a stroke. The **portin** symbol now becomes the active symbol.
3. Place the **portin** instances on the sheet as shown on the schematic.
4. Repeat the above procedure by selecting the **portout** symbol from the **Symbol History** list and placing the instances on the sheet.
5. Unselect all instances with a  stroke when you are finished.

Connect the Instance Pins with Wires

1. Draw a  stroke to include all schematic elements in the viewing area.
2. Draw a stroke to enter the “Add Wire” mode.

   The ADD WI prompt bar appears at the bottom of the window. The editor will remain in this mode until you click **Cancel**.
3. Connect all instance pins with wires as shown in the schematic diagram. Click once at the start of each wire, once for each corner point (vertex) and twice at the ending point. Unselect the wire with a  stroke before drawing the next wire.

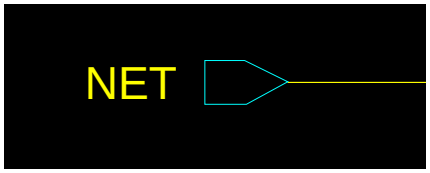
   If you place a net vertex in the wrong place and haven't finished defining the wire with a double-click, use the BackSpace key to move backward and delete the vertices.

   If you finish a wire and want to remove it, make sure it is the only object selected, then draw a “D” stroke  .
4. Click **Cancel** when you are finished adding all the wires.

Assign Each Port a Unique Net Name

Notice that every instance of **portin** and **portout** has a default NET property value of NET. You must change each of these to a unique name or they will be considered shorted together by the EDDM database.

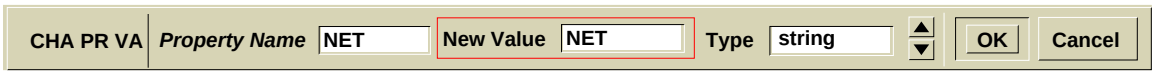
.



Select all the wires that are directly connected to the **portin** and **portout** instances. Make sure that you only have these nets selected.

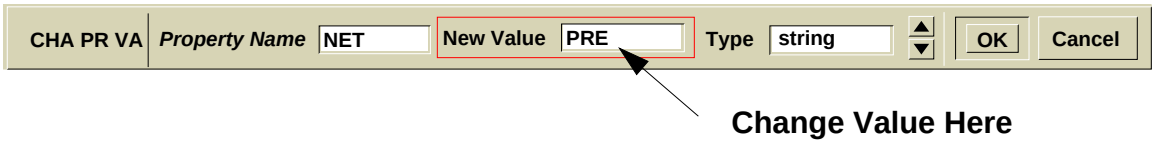
1. Press the Right mouse button and choose **Name Nets:** from the popup menu.

   This menu item lets you change the net name of each selected net in sequence. The Change Property Value prompt bar is displayed (as shown below) one-at-a-time for each net name from the top-most to the bottom-most selected net (without regard to horizontal placement.



   In this case, the first net name that is highlighted is the name associated with the top-most **portin** instance.

2. Use the BackSpace key to remove “NET” from the entry box, enter “**PRE**”, and press RETURN.



   Another prompt bar is displayed with the name of the net that is second-from-the-top.

3. Backspace over “NET”, enter “**Q**”, and press RETURN.

4. Change the net names of the remaining selected nets in a similar manner. Unselect the last object when you are finished.

Generate a Report to Discover Handle Names

The Schematic Editor assigns system-generated names to objects placed on a sheet. These system-generated names are called “handles”. Examples of handle names are I$2 for an instance, N$24 for a net, and P$26 for an instance pin. System-generated reports often refer to objects by their handle names. The following exercise will show you how to quickly discover the handle name of an object.

1. Click on one of the **inv** instances.

2. Draw a “square root sign” stroke  .

   A report is generated that details the information about the object, and related objects, including the handle names. The handle name for the selected **inv** instance is _____.

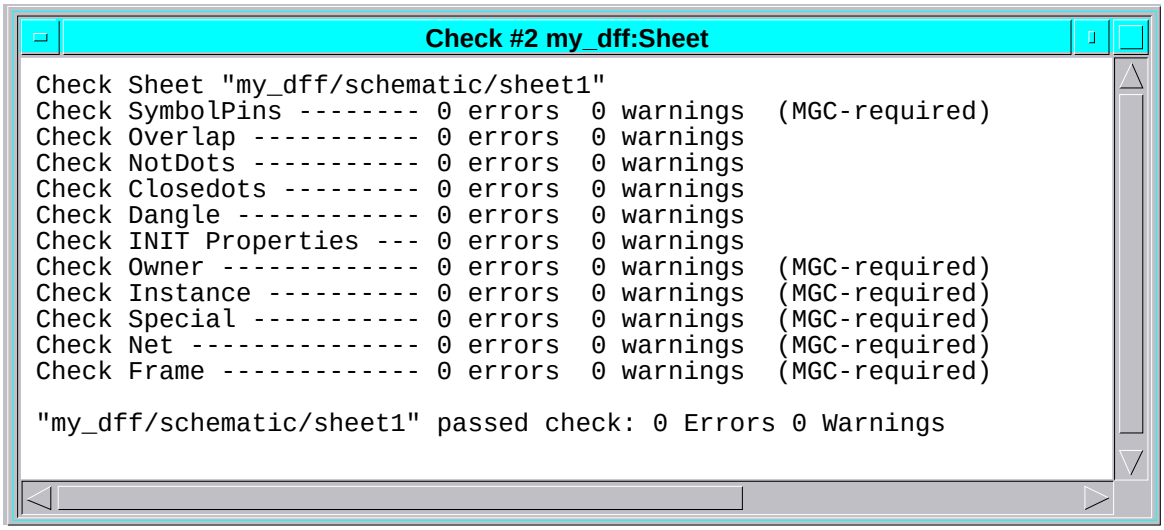
3. Close the report window with a stroke and unselect the **inv** instance with a stroke.

Check the Sheet

1. Choose the following pulldown menu item:

   Check > Sheet > With Defaults

   The Check Status window should appear in a few moments and look like the following:

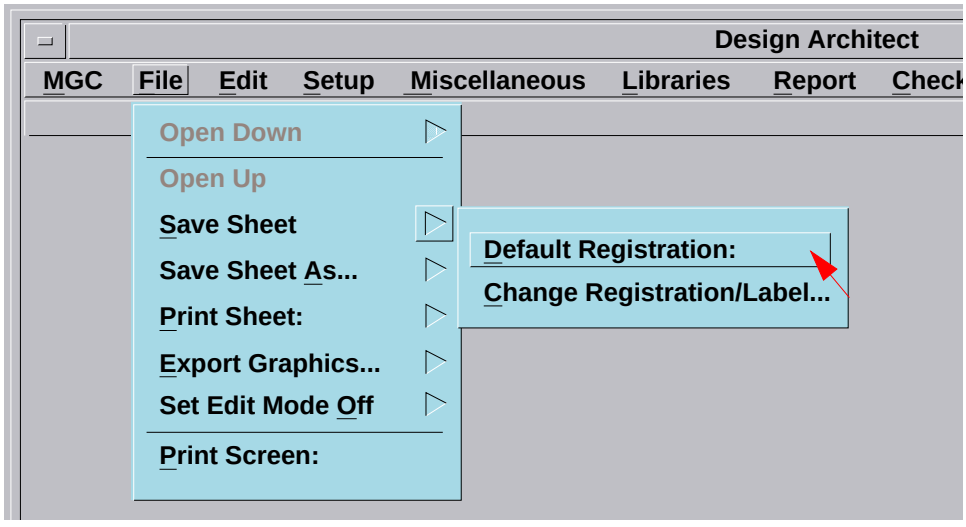


1. If your check operation reports errors, you can identify handle names by slowly clicking on the handle name in the Check Status window. The object associated with that handle name is selected on the sheet.

2. Close the Check Status window with a → stroke.

3. Save the schematic to disk by executing **File > Save Sheet > Default Registration** from the pulldown menu.

.



Exercise 2: Net Connection Rules

The following exercise will help you become familiar with the net connection rules. The basic rule is that edit operations preserve the connectivity prior to the edit and do not make new connections. You must explicitly make the connection after the edit operation.

1. Draw the  stroke to view the entire sheet, then the  stroke to unselect all.
2. Click on a single **inv** instance and draw a “C” stroke  .
3. Place the copy of the **inv** instance so that one pin touches a net. Click the Left mouse button.

   Notice what happens. A not-dot  is displayed at that junction point to indicate that a connection is possible, but won't be made without an explicit command from you.
4. Make the connection by drawing a “connect all” stroke  .

   Notice that the not-dot disappears and a junction dot ■ takes its place.
5. With the **inv** instance still selected, draw a “D” stroke  to delete it.

   The instance and the not-dot disappear from the sheet.

Exercise 3: Changing the Mouse Selection Filter

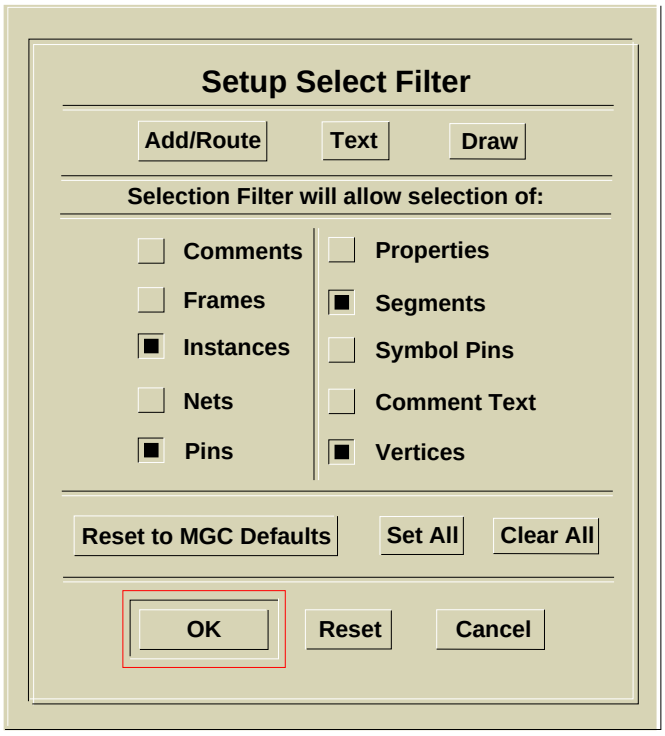
There is a selection filter attached to the mouse that controls what can be selected by pointing and clicking. Property text is not selectable with this filter set to default values. Verify this by clicking on some property text.

The Selection Filter is only associate with the mouse. When you move the mouse cursor over property text and press the F1 (Select) function key, the text is selected. This key allows you to quickly bypass the filter at times when you need to.

The following procedure will show you how to set and use the selection filter to select hard-to-reach objects. In this procedure you will set the filter to select only net vertices. You will select two vertices and move the net segment between, then reset the filter.

1. Activate the Schematic Window and draw a ↓⌐ stroke.

   The Select Filter dialog box is displayed as shown below:



2. Click the **Clear All** button, then click **Vertices.**
3. Draw a → stroke to execute the form.
4. Now draw a selection box around two net vertices on a wire attached to the SET input of one of the latches.
5. Draw a “shark fin” stroke ↘ and move the cursor vertically to move the segment. Click the Left mouse button to place the segment.
6. Draw a ↘ stroke again and place the segment in its original position.
7. Draw a “U” stroke ↑ to unselect all.
8. Draw a ↓ stroke to bring up the Selection Filter form again.
9. Click **Set All** and draw → stroke to execute the form.

   This effectively disables the filter and allows you select any object simply by clicking on it.
10. Practice selecting various objects to verify that the filter is disabled.
11. Close the Schematic window when you are finished.

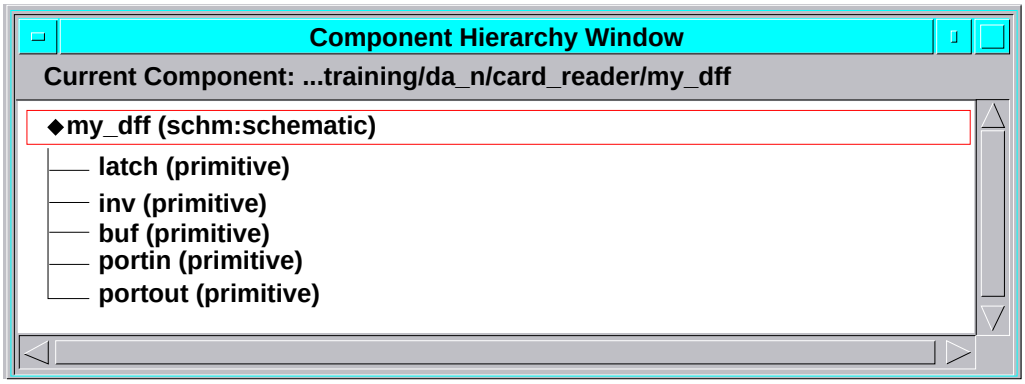
Exercise 4: Browsing a Component in the Component Hierarchy Window

It is helpful to keep track of the hierarchical structure of your design. The following exercise will introduce you to the use of the Component Hierarchy Window.

1. Activate the DA Session window by clicking on it.

2. Click on the HIERARCHY WINDOW palette icon.

3. Select the **my_dff** component in the Navigator Window and click **OK**:



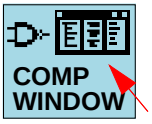
The Component Hierarchy window appears and shows you the structure of the **my_dff** schematic you just created. What does the word **primitive** mean?

_____

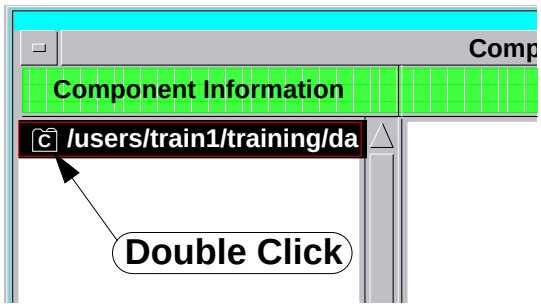
Exercise 5: Browsing a Component in the Component Window

It is helpful to understand the internal structure and content your design. You will be observing and changing this structure throughout this training course. The following exercise will introduce you to the use of the Component Window.

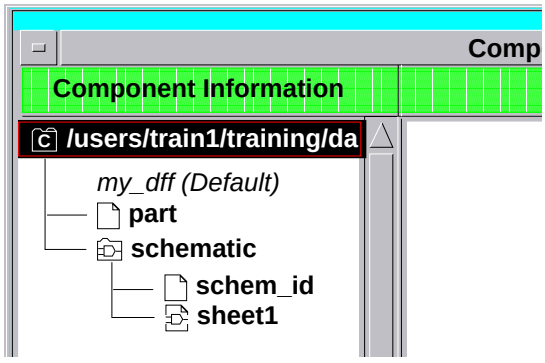
1. Activate the DA Session window by clicking on it.
2. Click on the COMP WINDOW icon:



3. Select the **my_dff** component in the Navigator Window and click **OK:**



4. Double click on the component icon:

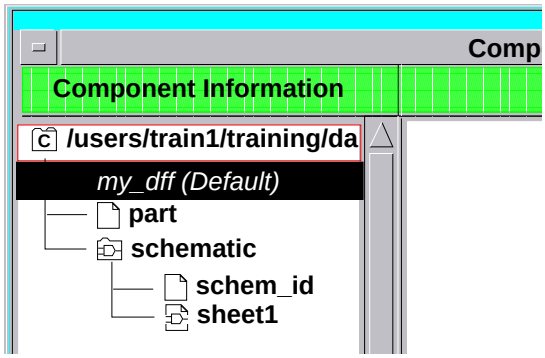


Notice that the component contains two objects, the **part** object and the **schematic**. The symbol does not show up because you haven't created it yet.

Also notice the name of the Component Interface table is *my_dff* and that it is marked as the *(Default)* interface.

5. Double click on the word “schematic” to list the content underneath.

6. Select the name *my_dff (Default)* as shown below:



The content of the Model Info window is displayed.

7. Place the cursor in the Component Information window, press the Right mouse button and select **Show Pins List.**

Why are there no pins displayed in the **Pins** window?

_____

Why are there no body properties displayed in the **Body Properties** window?

_____

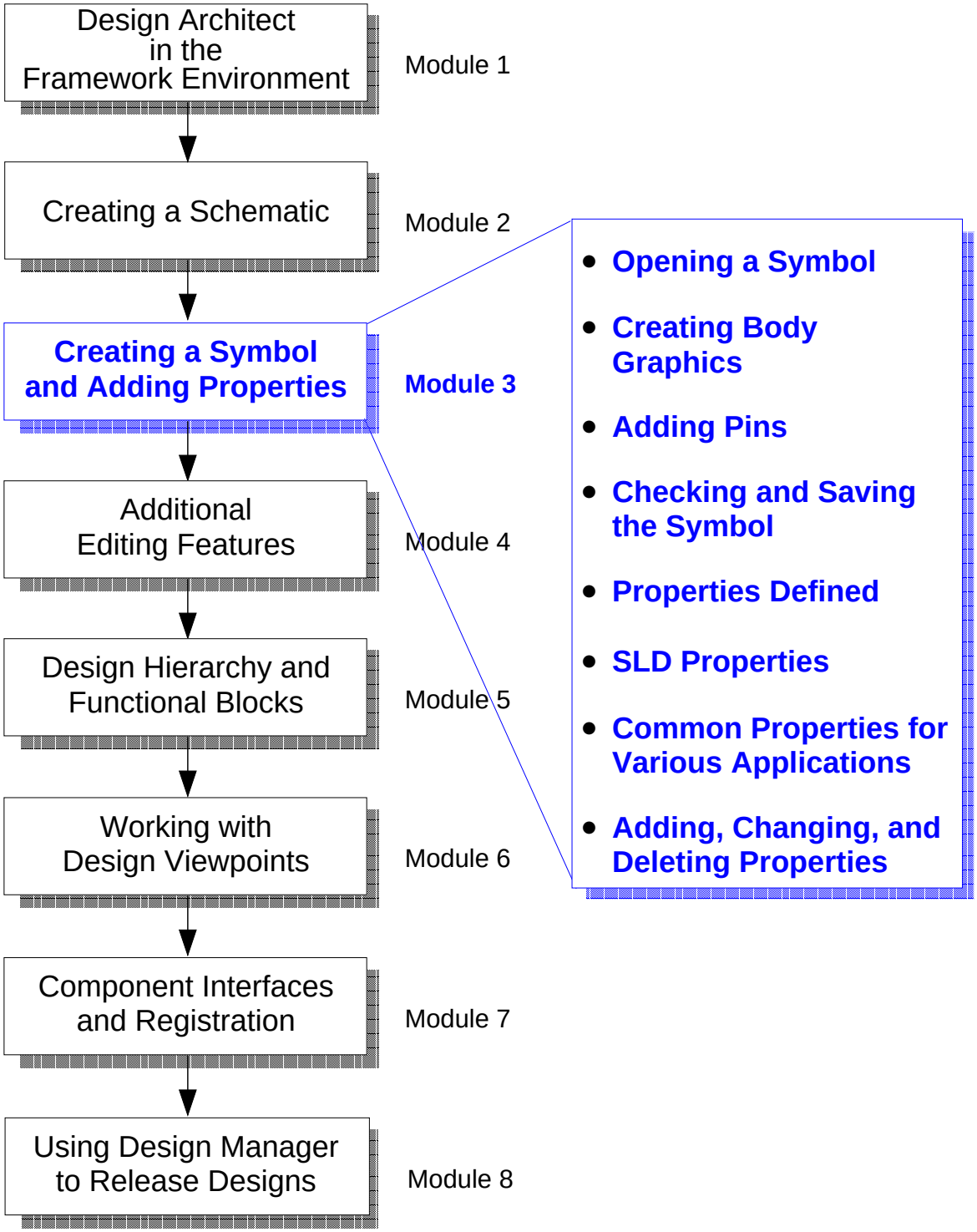
8. Close the Component Window.

End of Lab Exercises

This concludes the lab exercises for this module. If you have time, turn to Exercise 2 in **Appendix A - Customizing Exercises** and learn how to create a startup file for the Design Architect Session Window.

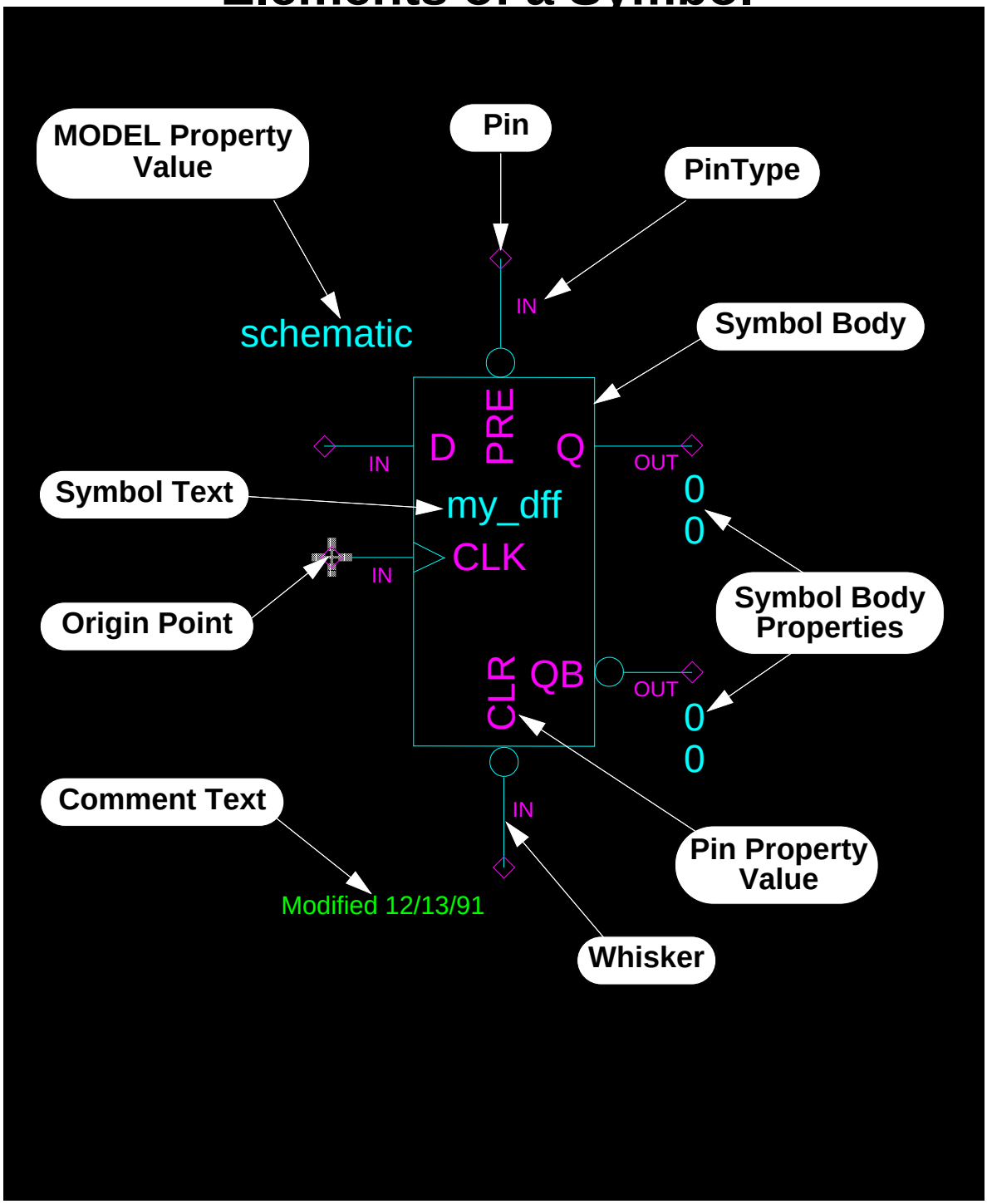
Module 3
Creating a Symbol and Adding Properties

Module 3 Overview



Lesson 1
Creating a Symbol

Elements of a Symbol



Elements of a Symbol

A component symbol is composed of four basic parts:

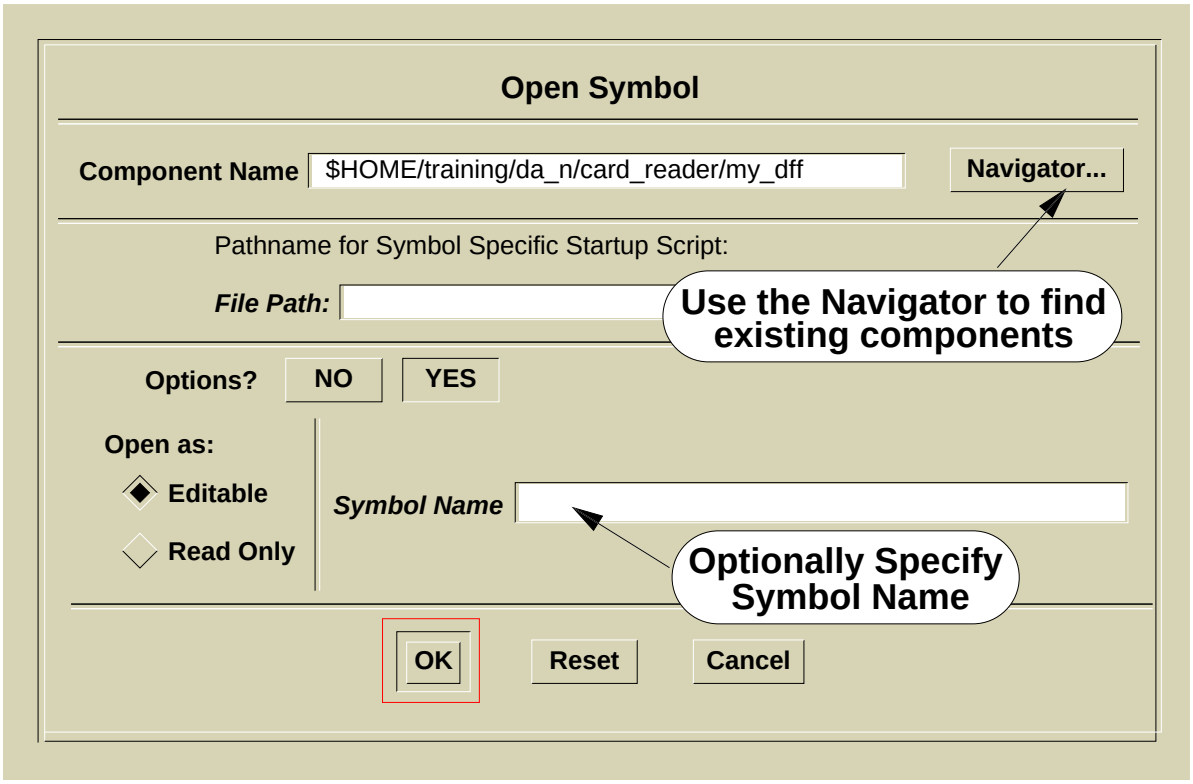
- **Shape (or symbol body)**. The graphical image of the symbol. The graphics that display the shape are called *symbol graphics*. The symbol shape usually conforms to an industry standard.
- **Pins**. Points where the symbol electronically connects when an instance is placed on a schematic sheet. Pin names must match the external nets on the schematic. These external nets are identified by the **portin** and **portout** instances.
- **Origin Point**. The reference point used to place the symbol on the schematic sheet.
- **Properties**. Provide information that can't be represented graphically.

Optionally the symbol may contain the following:

- **Whiskers**. A symbol body can also have short lines called "whiskers" that project from the border of the symbol body to indicate where input and output pins are connected. These whiskers are a convention used in the Mentor Graphics component libraries, but they are not required. When you select the symbol instance on a sheet, the whiskers are also selected, as they are considered part of the symbol body.
- **Symbol Text**. Provides information about the symbol. When the symbol is instantiated on the sheet, the symbol text is visible.

Opening a Symbol

- Click the OPEN SYMBOL icon
- Enter the component pathname
- Use the Navigator button for existing component



Opening a Symbol

The Symbol Editor lets you create and edit component symbols that can then be placed in schematic sheets as instances. The internal functionality of the circuit being represented by the symbol may or may not be defined at the time the symbol is created.

After you click the **OPEN SYMBOL** icon, you must specify the pathname for the component. If a component structure doesn't exist at that location, Design Architect creates one before the Symbol wIndow is opened. Generally, if the component exists, it is more convenient to click the Navigator button and navigate to the component location.

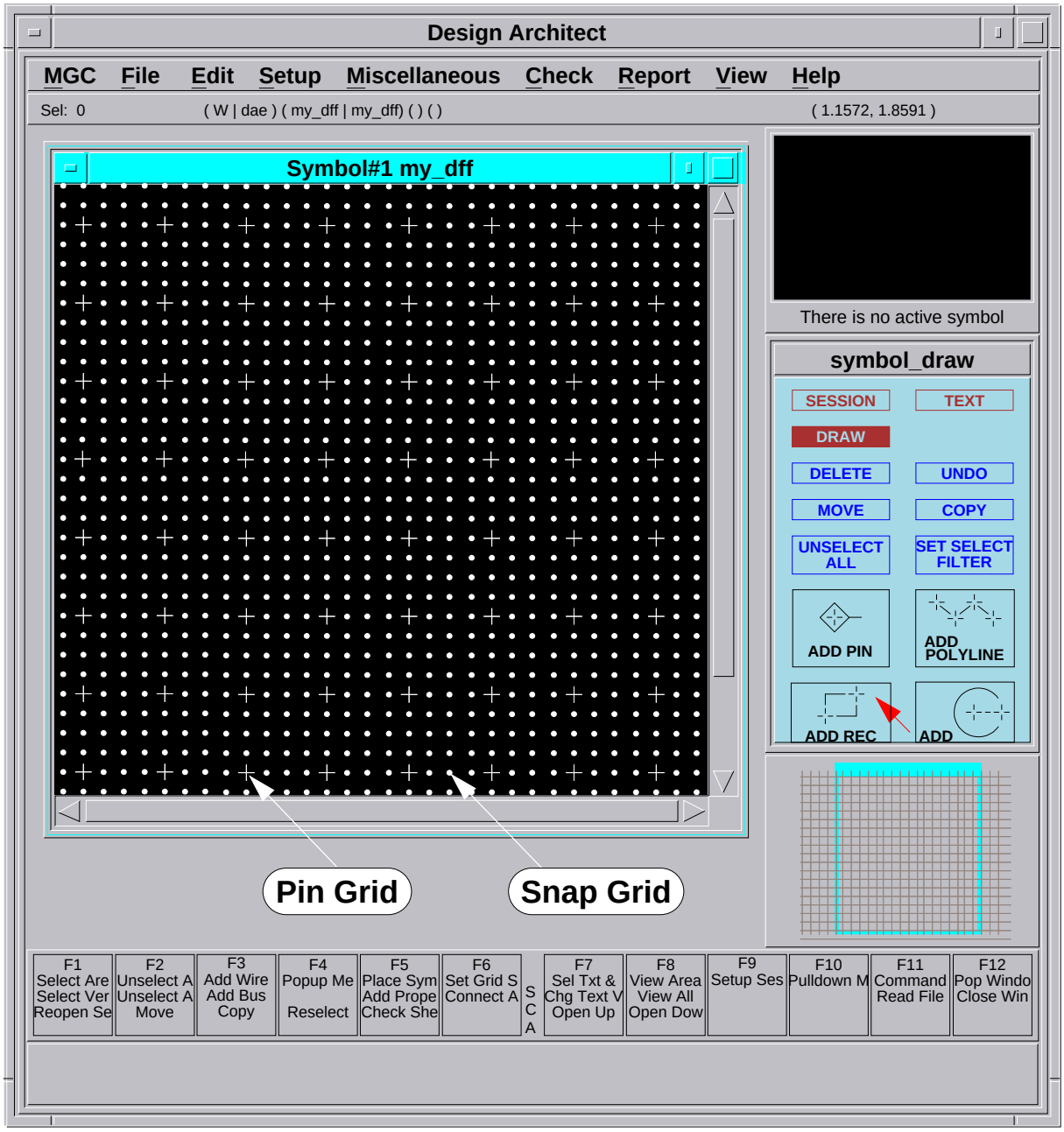
If you click **OK** without specifying a **Symbol Name**, the Symbol window will be opened on the symbol labeled "default". If a symbol doesn't exist, a blank window will come up and the new symbol will be named the same as the leaf name of the component interface. For example, **my_dff** is the default symbol of the component *.../training/da_n/card_reader/my_dff*.

You may specify a pathname in the ***File Path***: entry box. This is a pathname to an AMPLE file that contains commands that customize the Symbol Editor environment for this particular symbol.

When you click **Options? YES**, you will see the "long form" which allows you to change the default values for specific Symbol Editor attributes. It contains the additional following information:

- **Symbol Name**. The name of the symbol model. This entry box is either blank (the default symbol) or the name of the symbol that you selected through the Dialog Navigator. You can override the contents of this entry by typing a new symbol name.
- **Open as**. These are radio buttons; the default is generally **Editable**. Click **Read Only** to change the mode to read-only.

Symbol Editor Window



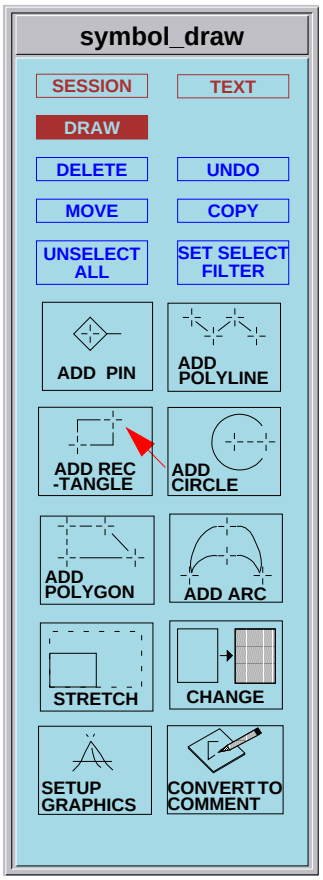
Symbol Editor Window

When the Symbol Editor window opens, it becomes the active window. The menu bar changes to symbol pulldown menus and the **symbol_draw** palette replaces the Session palette.The Context window contains the same functionality and the Active Symbol window contains a subset of the functionality available in the Schematic Editor.

The Symbol Editor window contains two grids. The coarse grid with the + marks is the Pin Grid. Symbol pins must fall in this grid. The fine grid is the Snap Grid. Symbol body graphics can be snapped to this grid.

The symbol_draw Palette

- Used to draw symbol body graphics
- Used to add pins to the symbol



The symbol_draw Palette

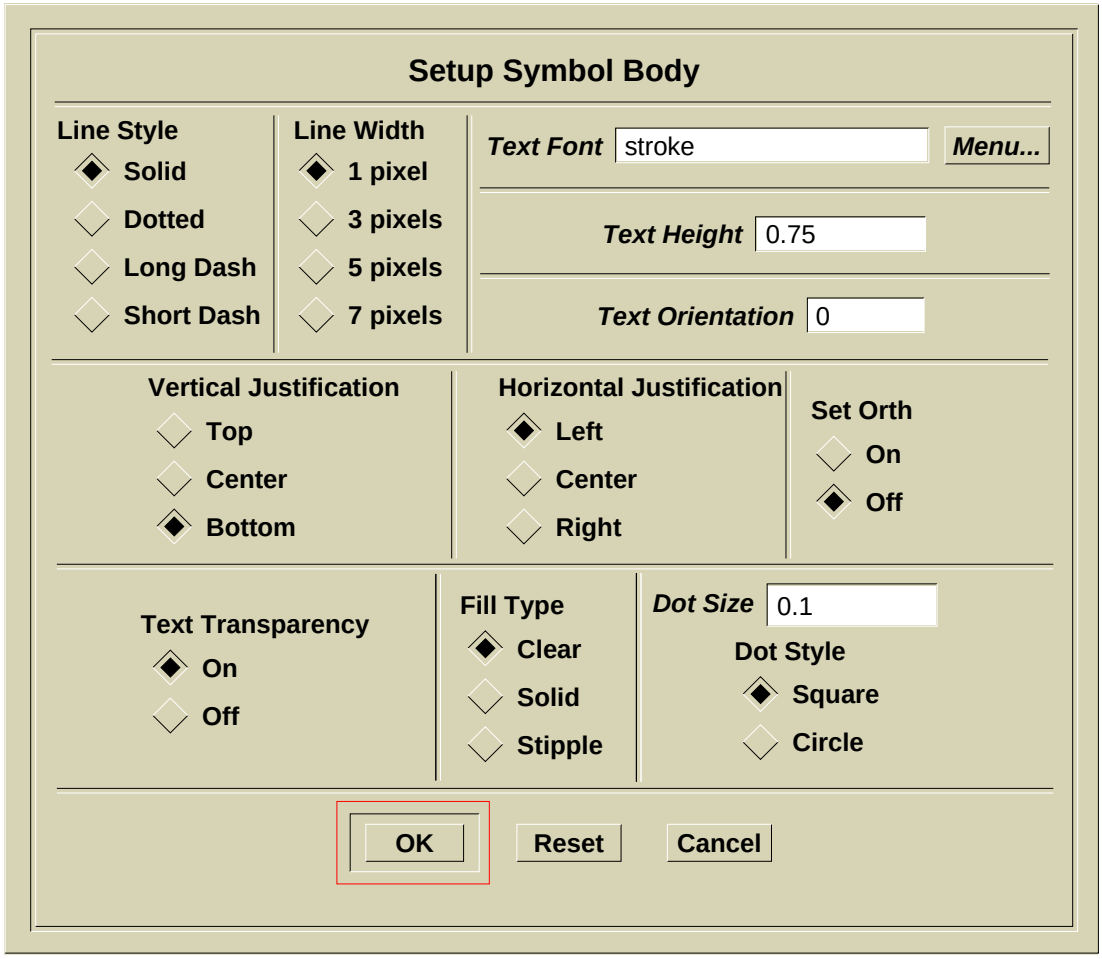
The **symbol_draw** palette is the primary palette used to draw symbol body graphics and add pins to the symbol. You can draw a rectangular body, or any shape consisting of line segments, arcs, and circles. The following table shows the number of location points and the mouse actions required.

Graphics	Prompts	Action
Polyline	initial, end segments (2 minimum)	Click at initial point; click at end of each segment. Double-click to terminate.
Rectangle	diagonal corners (2)	Press at one corner, drag, release to define opposite corner of rectangle.
Arc	initial, end, arc (3)	Click at each end, then at arc point.
Polygon	polygon points (3 minimum)	Click at each point of polygon, double-click to end; segment from last to first point is automatically drawn.
Circle	center, radius (2)	Press button at center, drag, release at radius point.
Two Point Line	initial, end (2)	Press button at one end, drag to other end, release.
Dot	point (1)	Click at dot location.
Text	text, location point (1)	Enter text in prompt bar, drag image of text, and click at desired text location.

Objects placed in the symbol edit area are automatically selected by default. You can turn auto-selection mode off by choosing **Setup > Other Options > Autoselect Off**. To turn auto-selection back on again, choose **Setup > Other Options > Autoselect On** (this menu item is a toggle). You can also resize an object by using the STRETCH feature.

Setting the Symbol Body Defaults

- **To set defaults, use Setup > Symbol Body**

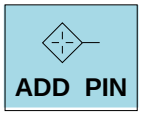


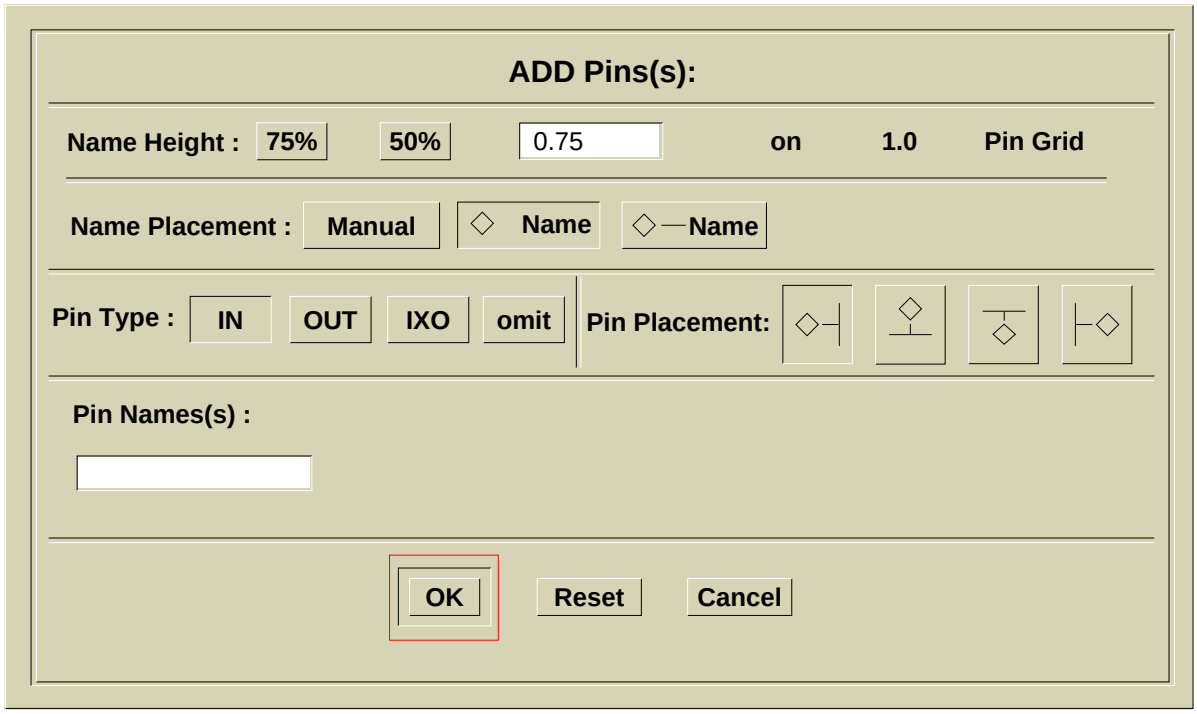
Setting the Symbol Body Defaults

When you create symbol graphics and text, default values are used for line style, line width, polygon fill, and text attributes such as font style, text height, justification, and orientation. You can change these defaults by choosing **Setup > Symbol Body** or the **Setup Graphics** icon (changes only the symbol graphics). The next time you create a symbol graphic or add symbol text, the default values that you specified are displayed.

Adding Pins

- **Electrical connection between symbol body and net**
- **Use the popup menu or the palette icon**





Adding Pins

A symbol is an abstract representation of an associated functional model like a schematic. A symbol pin on a symbol is an electrical connection that represents an external port on the functional model underneath. There must be a one-to-one match between symbol pins and the ports on the functional model. That is, the pin name must match the port name on the schematic.

When a symbol is instantiated on a schematic, the instance pins (which are an active reflection of the symbol pins) become the locations at which net connections are made. Instance pins are different than symbol pins because instance pins have a builtin net vertex.

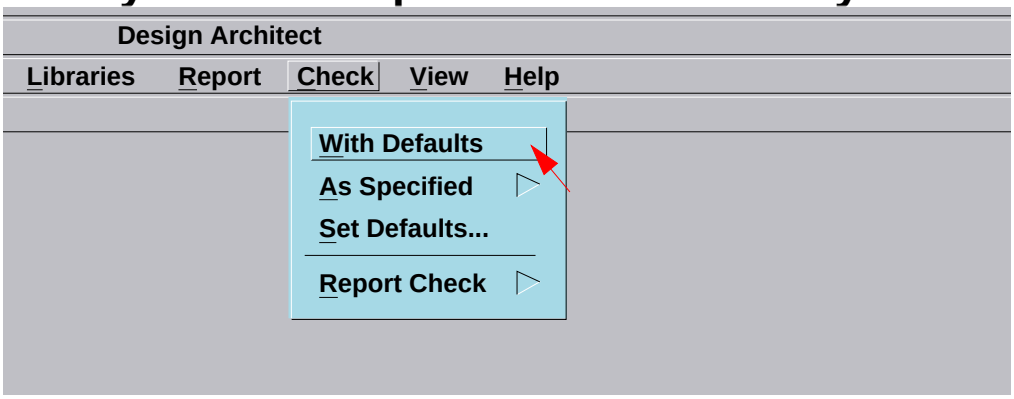
Name Height indicates the height of the pin name with respect to the pin grid. **Name Placement** has three types of pin name placement:

- **Manual**. The pin name and text location are positioned manually.
- **Name (with diamond)**. The graphical pin indicator is created and the pin name is positioned next to it.
- **Name (with diamond and whisker)**. The graphical pin indicator and whisker are created and the pin name is positioned next to it.

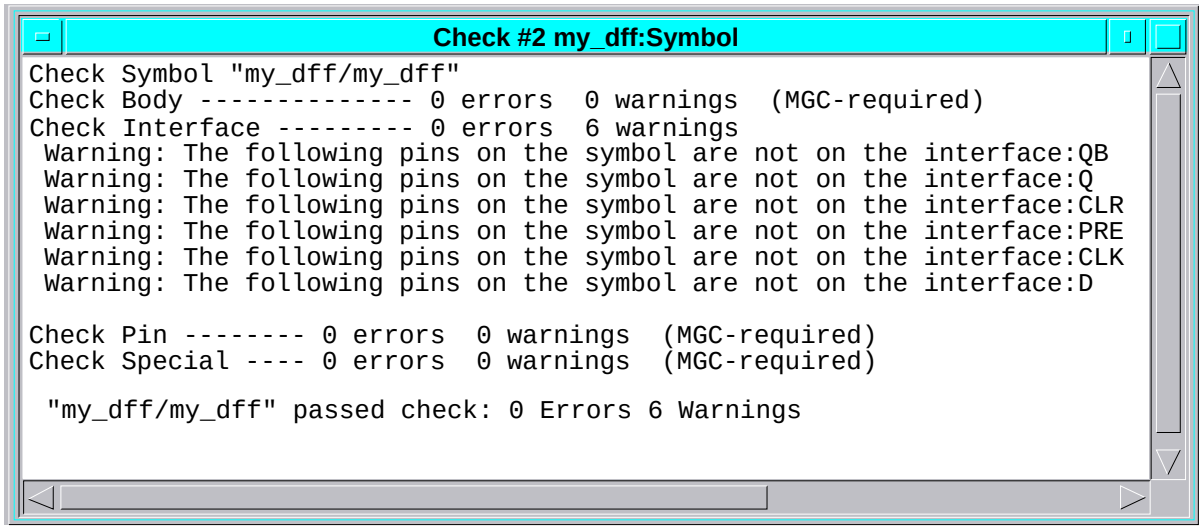
The PinType property associated with each pin can be either IN, OUT, IXO, or omitted. **Pin Placement** designates if the pin is placed to the left, top, bottom, or to the right of the symbol body.

Checking the Symbol

- **The Symbol must pass checks before you use it**



- **Typical warnings when changes are made**



Checking the Symbol

After creating a symbol body, adding pins, and adding properties, you must check the symbol. A symbol must pass certain checks before you can instantiate it on a schematic sheet. The following check categories are required by Mentor Graphics applications:

- **Symbol pin**. Verifies that at least one pin is present on the symbol, all symbol pins have unique names, and symbol property values have valid expression syntax.
- **Symbol body**. Verifies the existence of symbol graphics, checks expression syntax in property values, and looks for duplicate property names on the symbol body objects.
- **Special symbol**. Verifies proper construction of a symbol that represents a special instance, such as a bus ripper or offpage connector.

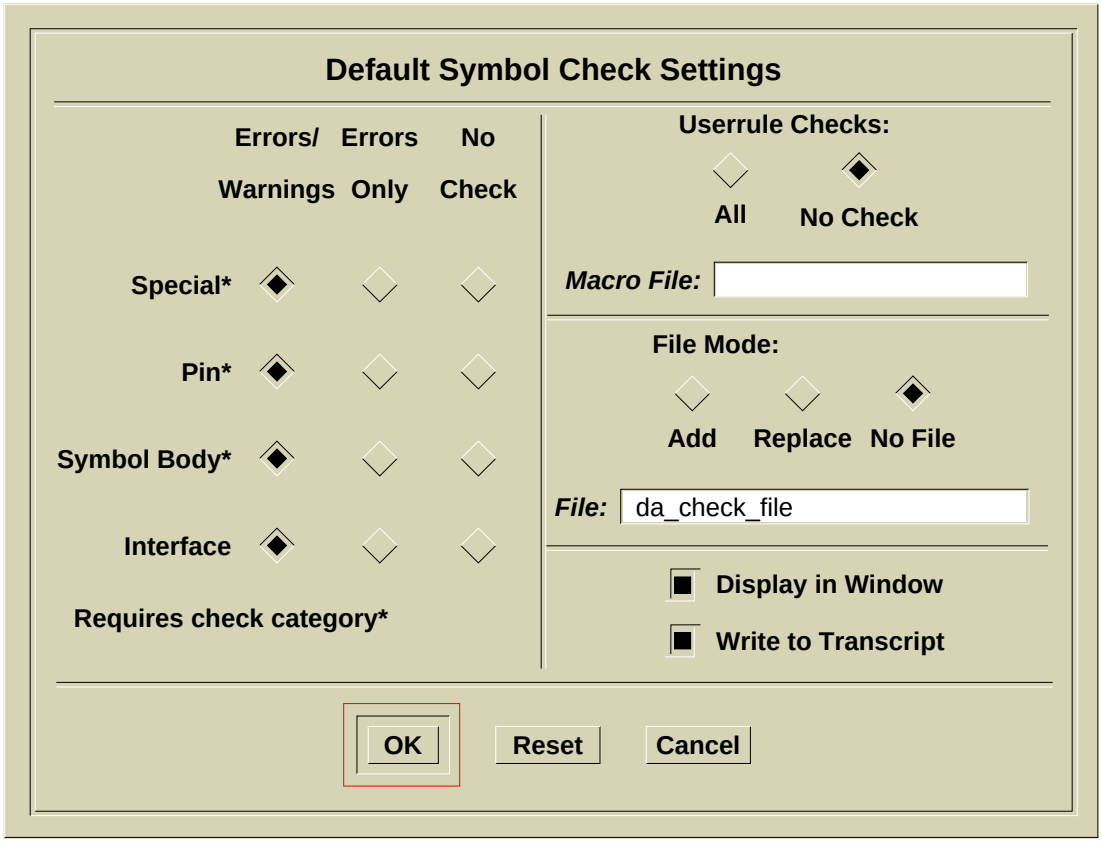
The following optional checks may also be performed:

- **Symbol userrules**. This is a user-defined category. You can create a macro file containing design rules that you want checked, and provide a pathname to the file. When the required checking is complete, the design rules specified in the macro file are checked.
- **Symbol interface**. Verifies that pins and properties match the component interface with which the symbol is registered.

To check using the default check settings, choose **Check > With Defaults**.

Changing Required Checks

- **Resets default checking requirements**
- **Check > Set Defaults... displays:**



- **Three levels of checking:**
  - **Report all errors and warnings**
  - **Report only errors**
  - **Do not check**

Changing Required Checks

You can change the check defaults by choosing the **Check > Set Defaults** menu item. This brings up a Default Symbol Check Settings dialog box as shown on the left.

There are three levels of checking: report all errors and warnings, report only errors, and do not check. By default, all errors and warnings for symbol pins, symbol bodies, special symbols, and symbol interfaces are reported. You can change the check levels of symbol pins, the symbol body, special symbols, and the symbol's interfaces by clicking the appropriate check buttons.

If you want to specify a macro file containing additional design rule checks, click the **All** button under Userrule Checks, and type the pathname in the Macro File text entry box. The default userrule check setting is “No Check.”

Results normally appear in a check status report window, or in a transcript, but they are not saved to a file unless you specify a pathname and click the **File Mode: Add** button.

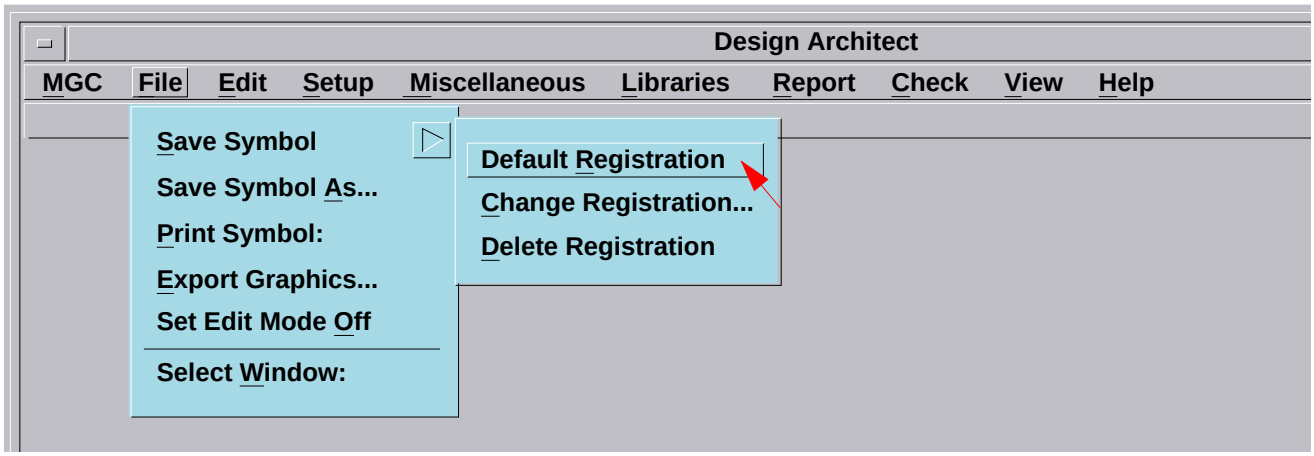
The next time that you choose **Check > With Defaults**, the symbol default check levels will reflect the modifications you made in the dialog box for the duration of the Design Architect session.

Note

If you change the checking level of required checks to **No Check**, Design Architect views the symbol as not passing the required checks. Therefore, you will not be able to instantiate the symbol on a sheet.

Saving the Symbol

- File > Save Symbol



- Always check the symbol before saving
- Unchecked symbols can't be instantiated

Saving the Symbol

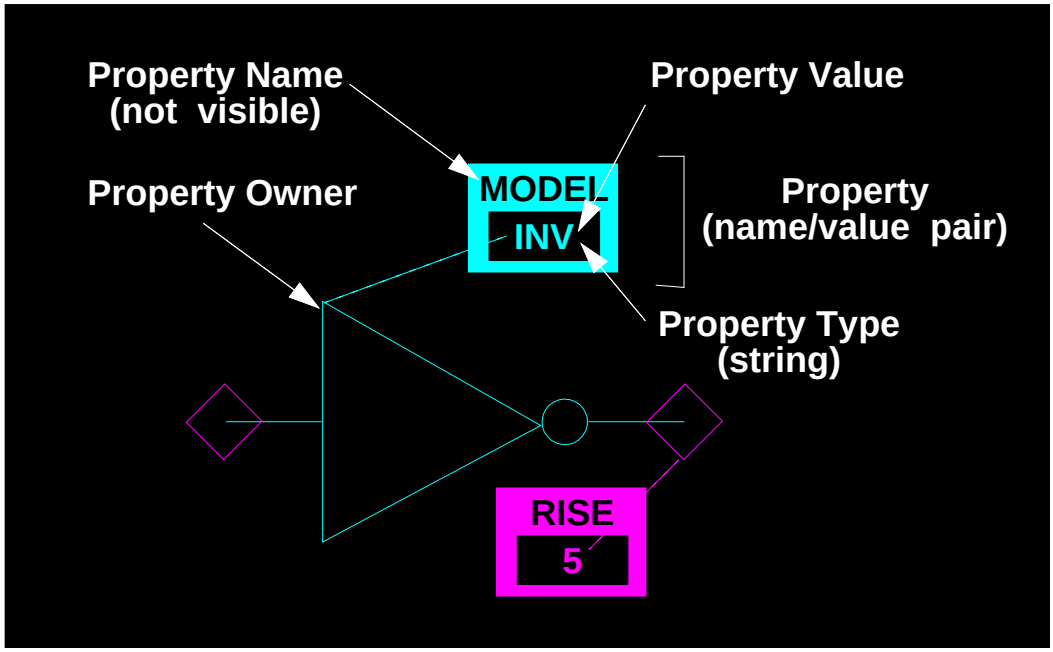
You choose the **File > Save Symbol** pulldown menu item to save your symbol to disk.

Always check your symbol before you save it. If your symbol is not successfully checked, it can still be saved to disk, but it cannot be instantiated.

Lesson 2
Adding Properties

What is a Property?

- A name/value pair
- Typically attached to a design object
- Conveys information that can't be represented graphically
- Can be used to establish horiz/vert connectivity (Structured Logic Design properties)
- Has the following characteristics



What is a Property?

A *property* is a name/value pair that is typically attached to a design object. Properties define design characteristics that cannot be easily represented graphically on a schematic. For example, in the illustration to the left, the output pin on the inverter owns a property called RISE with a value of 5 nanoseconds. This represents the total rise time of the gate. The instance body owns a property called MODEL with a value of INV. This MODEL property tells the logic simulator to use a builtin primitive for an inverter.

As shown in the illustration, properties have the following characteristic:

- **Name**. Typically identifies the purpose of the property value. The property name (and surrounding box depicted in the illustration) is never visible on the schematic or symbol. The name is retrieved through the use of reports that are generated on the owner or value.

- **Value**. Describes the design characteristic in the form of text. The text may or may not be visible on the schematic. If visible, the text takes on the color of the owner. If you select the text value and move it, a rubber banding line will show you the owner object (as shown in the illustration).

  In some cases, a property name may be defined and attached to an owner without defining a value. The value is then defined later in a downstream application. An example is assigning a pin number property (pin_no) to a logical symbol pin without declaring a value, then allowing Board Station to assign a physical pin number when the design is physically packaged.

- **Type**. Identifies the kind of value that is valid for a particular property. The valid types include string, number, expression, and triplet.

- **Owner**. Properties can be restricted to being owned only by certain object types for which the property information is most meaningful. For example, pins own Pin_no properties; the value of Pin_no properties are meaningful only to pins.

Most property names and values are defined when a symbol is created, but additional properties may be added to instances on a sheet.

Property Ownership

- **A property is typically attached to a design object called an “owner”**
- **Properties can be restricted to certain types of owners**
- **Allows you to manipulate properties by specifying the owner object**
- **The following design objects can own properties:**
  - **Symbol Bodies**
  - **Symbol Pins**
  - **Instance Bodies**
  - **Instance Pins**
  - **Nets (wires and buses)**
  - **Comment Graphics (not Comment Text)**
  - **Frames**

Property Ownership

Properties are typically attached to a single object in the design. When you create a property, you can restrict which objects can own that property through the **Setup > Property Owner/Type > Property Owner...** pulldown menu item. Other common Mentor Graphics properties have predefined owners assigned. You can see a list of these properties by choosing the pulldown menu item **Report >Default Property Values...** Once property ownership is defined for a property, Design Architect does not allow that property to be assigned to owners that are not valid for the property name.

In Design Architect, the following objects can own properties:

- **Symbol Bodies**. Pertains to the symbol body graphics in a Symbol window.
- **Symbol Pins**. Pertains to the symbol pins in a Symbol window or a Schematic window
- **Instance Bodies** Pertains to instance bodies on a schematic sheet.
- **Instance Pins** Pertains to instance pins on a schematic sheet.
- **Nets** Pertains to wires or buses on a schematic sheet.
- **Comment Graphics**. Pertains to comment graphics in a Symbol window or a Schematic window. Comment text cannot own a property.
- **Frames**. Pertains to frames on a schematic sheet.

Because extensive property manipulation functions are provided, you can manipulate the attached properties of selected owner object(s). This concept is discussed later in this module.

Property Types

- **A property value must have a property type assigned to it**
- **Legal types are:**
  - **String: IN**
  - **Number (integer, real, exponential): 2.5**
  - **Expression (string or arithmetic): x + 5**
  - **Triplet (3-valued property): 5 10 15**

Property Types

A property value must have a property type assigned to it. A *property type* identifies the property value's data type. The legal property types are:

- **String**. An ASCII character string.
- **Number**. An integer, real, or exponential number.
- **Expression**. A combination of variables, constant values, and arithmetic or logical operators defined by AMPLE expression syntax. For example, the expression (x+5), contains a variable, “x”, a constant value, “5”, and an arithmetic operator, “+”.

  Expressions are typically used to redefine property values in commonly used components without having to redesign the component. Expressions can also be used within the range specification for a net or pin name (net and pin property values). Variables in expressions are evaluated as needed. For example, expressions are evaluated when a sheet is checked, or when a design viewpoint is created with an expression defined.
- **Triplet**. The special property type “triplet” is a 3-valued property used to describe the best-case/typical/worst-case timing values used in timing analysis. The three values of a triplet can be separated by commas or spaces (for example, “5,7,10”). The value, whether entered as a string, number, or an expression type, is evaluated as a number.

  If one value is specified, it is used for the best-case, worst-case, and typical values. If two values are specified, the first value is used for the best-case value, and the second value is for worst-case and typical values.

It is important for you to know what the property type is before assigning a property value to a particular property. For example, if the property type of property “A” is a character string, and you assigned the value of 95, this value is interpreted as a character string “95”, not the numerical value of 95.

Property Text Attributes

- **A property value is also called “property text”**
- **Attributes of property text include:**
  - **Justification**
  - **Orientation**
  - **Height**
  - **Font**

Property Text Attributes

When the value of a property is displayed, the value is called *property text*. Property text has several attributes that define what the text will look like once it is placed on the design. Each property can have its own unique set of attributes. Attributes that can be defined and later modified are:

- **Justification**. Sets the text's horizontal and vertical justification relative to a location point. Horizontal justification can be set to the left edge, center, or right edge of the text string. Vertical justification can be set to the top edge, center, or bottom edge of the text string. The justification point serves as a point around which it can be rotated. The system-defined default is bottom left.
- **Orientation**. Indicates the direction the text faces. Choose 0 to indicate text is oriented horizontally and read from left to right, or 90 to indicate text is oriented vertically and read bottom to top. The system-defined default is 0.
- **Height** A positive, non-zero number that specifies the height in user units. The system-defined default is 0.1875 inches.
- **Font** A registered font family that is valid for the workstation you are using. The system-default font type is “stroke.”

Symbol Property Text Switches

- **Visibility Switch: Determines whether a property value is visible on an instance**
  - **Hidden**
  - **Visible**
- **Stability Switch: Determines if a property value is changeable on an instance**

Switch Type	Change Values on Instance?	Delete on Instance?
Fixed	No	No
Protected	At instantiation time only	No
Variable	Yes	Yes
Nonremovable	Yes	No

Symbol Property Text Switches

Two property switches control whether a graphic symbol property value is visible on the symbol instance, and changeable on the symbol instance.

The *property visibility switch* controls whether the value of the property is visible (**Visible**) or invisible (**Hidden**) on the instance.

The *property stability switch* controls whether the value of the property can be changed on an instance. It can have one of the following values:

- **Fixed**. Values cannot be altered or deleted on an instance at instantiation time.
- **Protected**. Values can be altered on an instance at instantiation time. Once instantiated, the instance-specific property value cannot be changed.
- **Variable**. Values can be altered on an instance at instantiation time and through the Change Property commands.
- **Nonremovable**. Values can be altered on an instance and changed through Change Property commands; they cannot be deleted from the instance.

Other property attributes on an instance can be altered using Change Property commands.

Pin properties are assigned the values Visible and Fixed by default when the Pin property is created. Properties other than pins are assigned Visible and Variable by default. However, you can override these switches at Add Property time, in addition to changing the values of selected properties. You can also change the default values through the Setup Property Text command (discussed later in this module).

SLD Properties

- **Structured Logic Design(SLD) properties are special properties used to define and pass connectivity information**
- **The following list defines SLD properties and their owners:**

SLD Property	Owner	Purpose
NET	**Net Vertex** **Symbol Pin** **(with a "pin and net" owner)**	Establishes horizontal connectivity.
PIN	**Symbol Pin**	The value defines the pin name.
RULE	**Symbol Pin**	Defines which wire(s) get ripped from the bus.
INST	**Instance Body**	The value defines a unique name for the Instance.
CLASS	**Symbol Body** **Instance Body**	The value defines a Special Connection.
GLOBAL	**Symbol Body**	The value defines a design-wide net name.
FREXP	**Frame**	The value defines the FRAME expression.

SLD Properties

Structured Logic Design (SLD) properties are special properties built into Design Architect. They pass object identity and connectivity information about the design to the Design Viewpoint Editor (DVE) and downstream applications. SLD properties are unique in that SLD property values cannot be modified in downstream applications. SLD properties have default property owners. The list below briefly describes these properties.

- **NET**. Design Architect automatically assigns a name of the form N$ to each net. This property specifies horizontal connectivity by assigning unique names to wires, buses, ports, and offpage connectors. If a NET property and/or value is assigned to a Symbol Pin and an owner of “pin and net” is specified, the NET property and value are transferred to the instance pin vertex, when the symbol is instantiated.

- **PIN**. Specifies a unique name for a logical pin on a symbol.

- **RULE**. Specifies which wires are diverted from a bus to an output pin on a bus ripper component.

- **INST**. Design Architect automatically assigns a handle name like I$2 to each instance. The INST property allows you to give a custom name to a particular instance.

- **CLASS**. Specifies special connector devices, such as ports, bus rippers, offpage connectors, and net connectors.

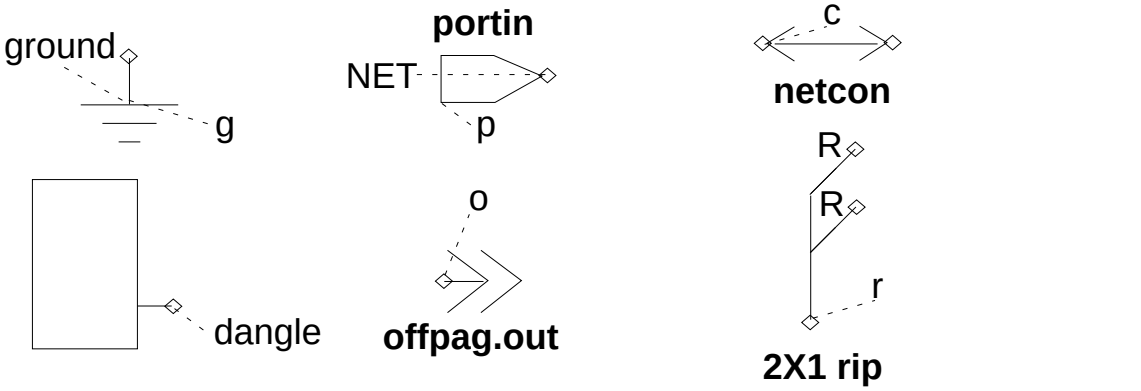
- **GLOBAL**. Specifies net connectivity without drawing the wires on a schematic. Global connectivity is established both vertically and horizontally in the design hierarchy by giving nets the same name as the Global property value. Examples are the $MGC_GENLIB components **vcc** and **ground**.

- **FREXP**. Specifies the frame expression of a Frame. Frame expressions allow frames to be identified by type and value, so that applications which use frames can interpret the information.

Class Property Values

Property Value	Description
c	**Connector:** Connects differently named nets together.
g	**Global:** Connects a net both vertically and horizontally across a hierarchical design.
p	**Port:** Defines an external net on a schematic.
r	**Ripper:** Extracts a range of nets from a bus.
o	**Off-page connector:** Identifies nets by the same name that reside on different sheets of a schematic.
n	**Null:** Defines an object as electrically inert.
dangle	Tells the system that a dangling instance pin or net vertex should not cause a check warning.

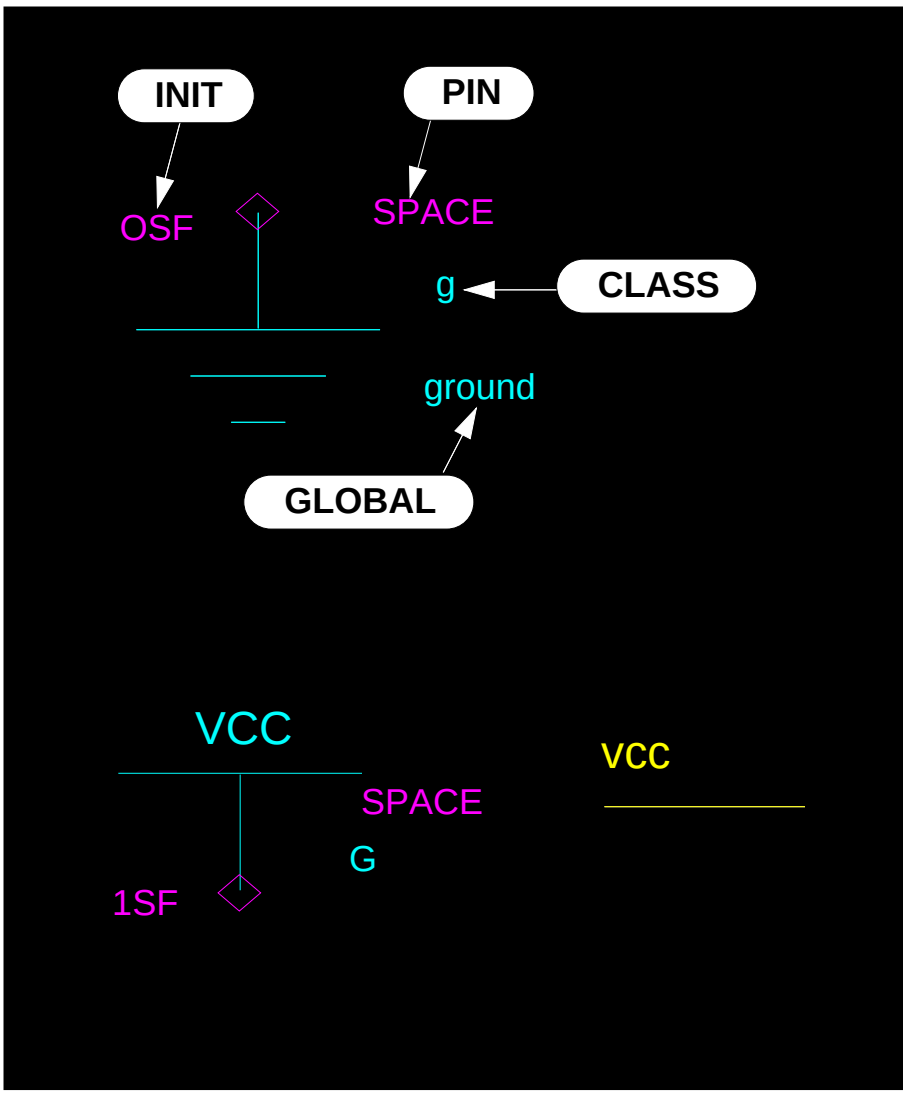
Examples



Class Property Values

The CLASS property tells the system what kind of connection or connector the owner represents. The different CLASS property values are defined on the left. Examples of the different connectors are shown below the table.

Examples of Global Nets



Examples of Global Nets

ground

The ground symbol on the left defines a global net named **ground** for the design. The CLASS property is attached to symbol body. The value **g** tells the system that the instance represents a global net. The GLOBAL property defines the net name which is **ground**. The PIN property specifies the name of the pin and is a required property; the value is **SPACE**, but it could be defined to be any string. The INIT property is attached to the pin and tells the simulator to initialize the pin with a logic 0(zero), with a strength STRONG, and a force type of FIXED. It is common to initialize a global net to a constant value, but this is not a requirement.

VCC

The VCC symbol is similar to the ground in that a CLASS property with a value of **G** is attached to the symbol body. Notice the value can be upper or lower case. The value of the GLOBAL property defines the net name as **VCC**. The INIT property is attached to the pin and causes the simulator to initialize the pin to a logic 1, drive strength STRONG, and a force type of FIXED. To the right of the VCC symbol in the diagram is a net. The net vertex owns a NET property with a value of **vcc**. This causes a connection with the VCC global net, even though there is no physical connection between the net and the pin on the VCC instance.

Attaching Nets to PCB Power Planes

PCB power planes are represented by net names that are defined as “global”. If a net is attached to something other than a “global” net, the net is treated as a normal trace on the signal layer.

Other Global Nets

Global nets can also be defined for things like clocks and set/reset lines. How would you create a global net for a Master Reset line? _____

_____

_____

Common Digital Simulation Properties

- **Properties on Symbol Pins**
  - **PINTYPE**
  - **RISE**
  - **FALL**
  - **DRIVE**
- **Properties on Symbol Bodies:**
  - **MODEL**
  - **MODELFILE**
- **The instance-specific property values can be changed in the downstream analysis tool**
- **You can back annotate changed values to the source schematic using Design Architect**

Common Digital Simulation Properties

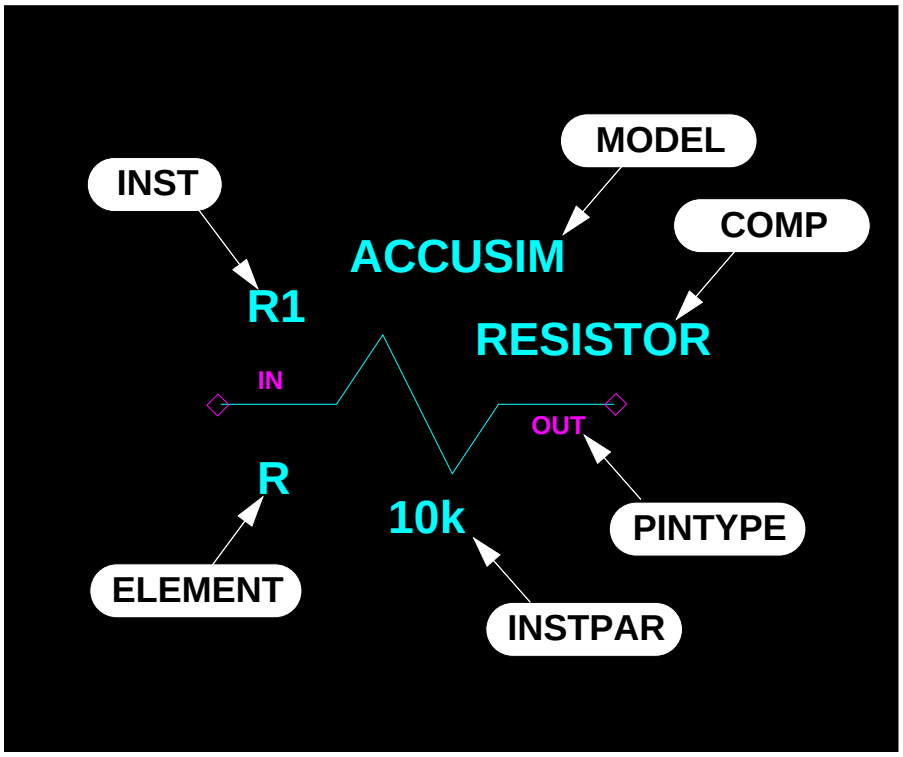
Mentor Graphics provides a list of predefined properties that are reserved for Mentor Graphics applications. This list includes properties with user-defined values which are used for the downstream applications and Structured Logic Design (SLD) properties.

Many downstream applications require a minimum set of properties that must be attached to the design. You must add or modify these properties to your design before you begin evaluation in any of the downstream applications. Once in the downstream application, you can change instance-specific property values and *back annotate* them to the design viewpoint. They can then be merged to the source schematic sheet at a later time using Design Architect. The following is a list of common properties that are used by the QuickSim digital simulator:

- **PINTYPE**. Specifies the direction of a pin. Possible values are IN, OUT, and IXO. This value may also be omitted.
- **RISE**. Specifies minimum, typical, and maximum rise delay for an instance. The time is specified in nanoseconds.
- **FALL**. Specifies minimum, typical, and maximum fall delay for an instance. The time is specified in nanoseconds.
- **DRIVE**. Specifies the output pin's drive strength. Some possible values are SSS (for CMOS, TTL, and ECL technologies), SRR (for NMOS technologies), and RRS (for PMOS technologies).
- **MODEL**. Specifies which functional and timing descriptions are to be used for digital simulation. The MODEL property value is matched against the model labels in the model table to determine which model is chosen for a particular instance.
- **MODELFILE**. Specifies one or more pathnames of text files containing programmable logic device, memory, or analog device information.

Common Analog Simulation Properties

- The analog properties used depend on the type of analog device
- The following are common analog properties for a resistor:



Common Analog Simulation Properties

The analog-specific properties attached to a particular analog device depend on the type of device and the simulator being used. In total, there are more than thirty different analog-specific properties that may be assigned.

The illustration to the left shows typical analog properties assigned to a resistor. The properties are defined as follows:

MODEL Used in conjunction with the ELEMENT property to identify the functional description to be used for analog simulation.

ELEMENT Specifies a built-in instance type that is recognized by the analog simulator. This property is used in conjunction with the MODEL property to identify the functional description to be used for analog simulation.

COMP Provides a unique name, usually to identify a specific manufacturer's component.

INSTPAR Used to specify analog device parameters. In this case, the value of the resistor is 10k ohms.

INST Used to give a unique name to this particular instance. In this case, the resistor is labeled R1.

PINTYPE Specifies the direction of the pin. Possible values are IN, OUT, and IXO. This value may also be omitted.

Common PCB Layout Properties

- **The following properties must be added in Design Architect in order for Board Station to map logical symbols to physical parts:**
  - **All Symbol Pins must own a PIN_NO property.**
  - **All Symbol Bodies must own a COMP property.**
  - **All Symbol Bodies must own an instance-specific REF property.**
- **The values for these properties can be assign for the first time or changed in Board Station**
- **You can back annotate changed property values to the source schematic using Design Architect**

Common PCB Layout Properties

Board Station requires a minimum set of properties that must be attached to instances in order to map them to physical devices. You must add these properties in Design Architect before you invoke Board Station tools on the design. Although the properties must be defined and attached to the right owners, assigning values to the properties may be done in Board Station.

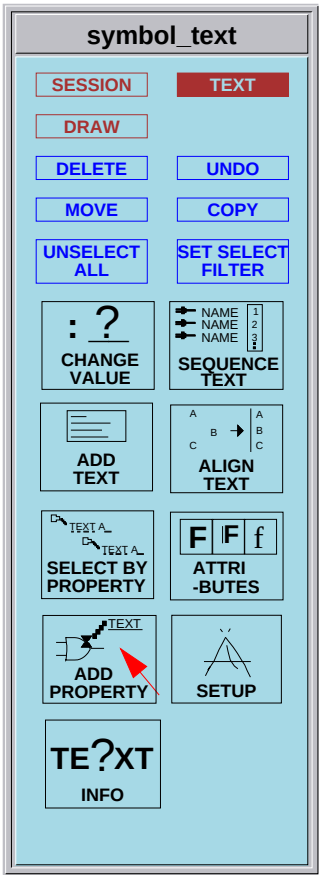
When these values are assigned for the first time or changed in Board Station, they are captured in a back annotation file. The back annotated properties may be merged back to the source schematic at a later time using Design Architect. This process will be discussed in more detail in a later module.

Board Station requires that the following properties must be on logical instances in order to map them to physical devices:

- **PIN_NO** Specifies the physical pin number to which the logical symbol pin is assigned.
- **COMP** Provides a unique name to help you identify the various components in a design. An instance with a COMP property is considered primitive by the PCB layout tools.
- **REF** Specifies which components are to be packaged together in the same physical package. This allows you the convenience to design with single gates, but then use a common REF property on those gates located in the same physical package. Some components use the Uxxx designation.

Adding Properties to Symbol Graphics

- Add properties to selected pins or symbol body
- Add properties to “logical” symbol
- Use the “text” palette



Adding Properties to Symbol Graphics

Properties can be attached to the symbol body, a symbol pin, or a comment object. It is also possible to add properties that have no graphic owner. This type of property is called a *logical symbol* property. These are properties not attached to the symbol body graphics, but rather owned by the “logical symbol”.

Using the **ADD PROPERTY** icon in the palette or the Shift-F5 function key only lets you add properties one at a time.

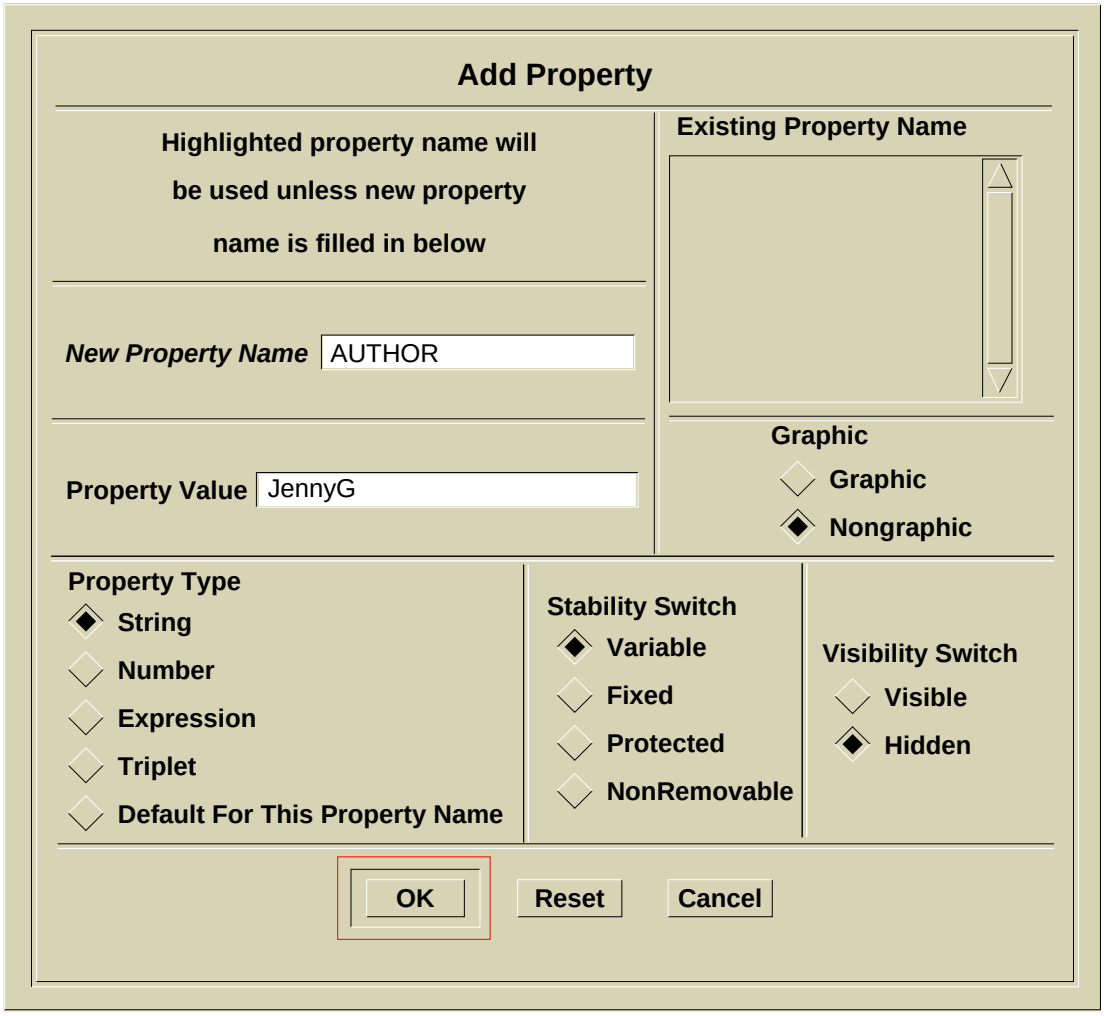
The **Properties > Add >** menu items provide methods of adding multiple property name/value pairs to objects. The following table shows the differences.

Menu Path	**Property Attributes (like “type”)**	**Selection Set**
Add Multiple Properties...	must be the same	same
Repeat Adding Single Properties > Use Current Selection...	can be different	same
Repeat Adding Single Properties > Use Changing Selection...	can be different	different

Adding “Logical Symbol” Properties

1. Unselect All

2. (popup)Properties(Logical) > Add Single Property



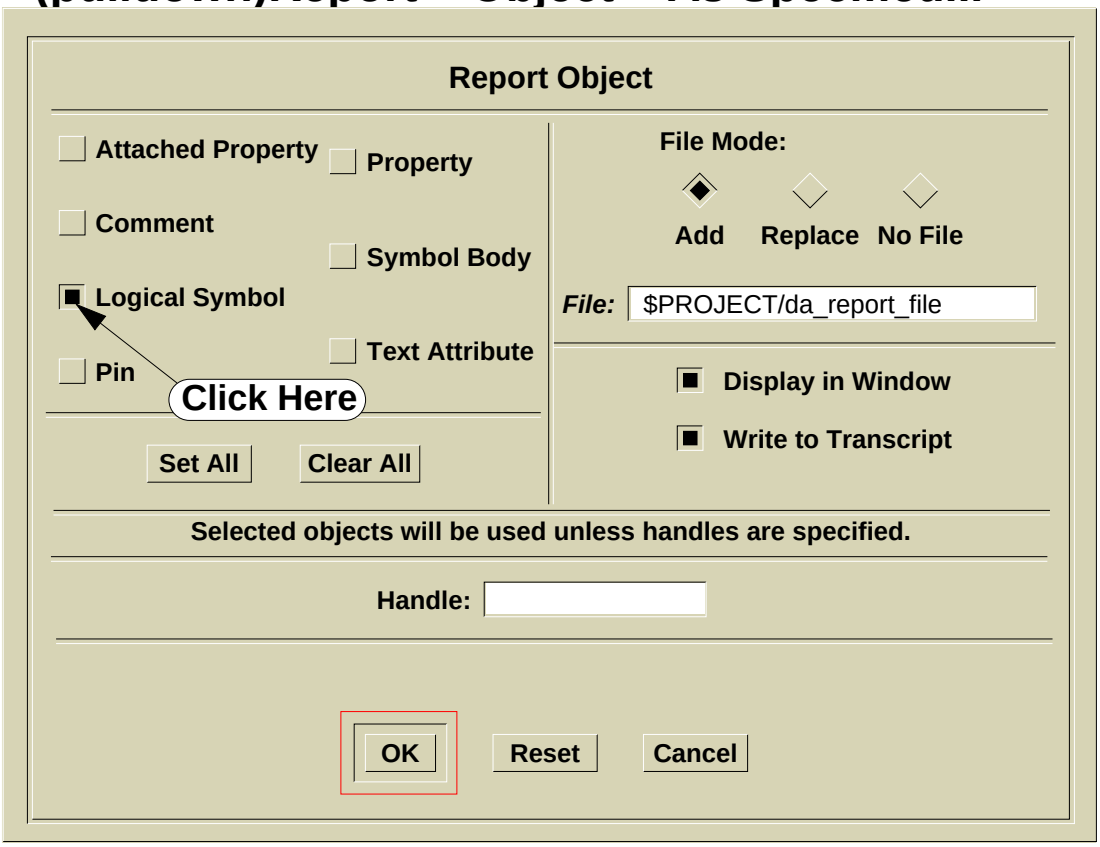
Adding “Logical Symbol” Properties

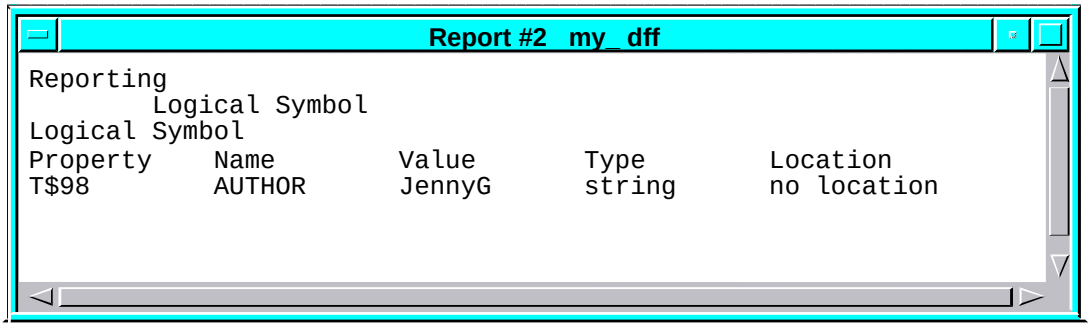
Logical symbol properties are properties that are not attached to any design object on the symbol. They “free float”. If they are made “Graphic”, they show up in the Symbol Editor window in the “gold” color. If they are defined as “Nongraphic”, they are invisible and the only way to see them is to generate a report on Logical Symbol properties.

Logical symbol properties are usually defined to hold information that is normally not to be seen by the end user. In the example on the left, the property AUTHOR is defined as a logical symbol property in order to identify the creator of the symbol.

Reporting On and Deleting "Logical Symbol" Properties

- (pulldown)Report > Object > As Specified...





- Edit > Edit Operations > Delete > Property...

Reporting On and Deleting "Logical Symbol" Properties

The only way to see nongraphic logical symbol properties is to generate a report as shown on the left. From the menu bar, choose **Report> Object> As Specified...**, click the **Logical Symbol** button on the form, and click **OK**.

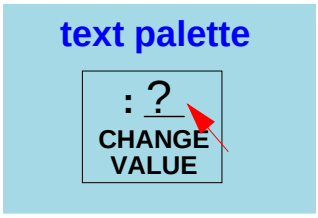
If you create a symbol, add properties to the symbol body graphics, then delete the graphic object, the properties are not deleted but turn into logical symbol properties. If you then recreate the symbol body graphics and try to add the same properties, the system won't let you because the properties are already defined as logical symbol properties.

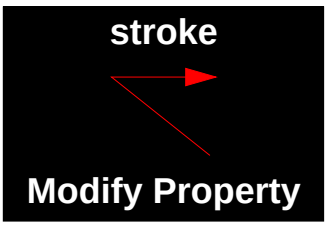
The only solution to the above dilemma is to first delete the logical symbol properties (by name), then re-attach the properties to the newly created symbol body graphics.

The pulldown menu path **Edit > Edit Operations > Delete > Properties...** is the only way to delete nongraphic logical symbol properties.

Changing Property Values

- **Ways to select properties**
  - **By owner** **Select > Property Owner**
  - **By text** **Select > Area > Property**
  - **By name** **Select > By Property>Name**
- **Commonly used icon and stroke**





- **Commonly used popup menu items:**
  - **Change Values**
  - **Change Height**
  - **Change Attributes**

Changing Property Values

Selecting Properties

When you change a property value or attribute, at least one object must be selected. The object can be the *owner* of the property, such as a net vertex. a pin or an instance body.

You can also change property values and attributes by selecting the property text itself. In the example on the facing page, you choose the **Select > Area (All) > Property** to select the property text in a bounding box.

Finally, you can select property text by specifying the property name. You choose **Select > By Property > Name**, then specify the property name.

Changing Property Values

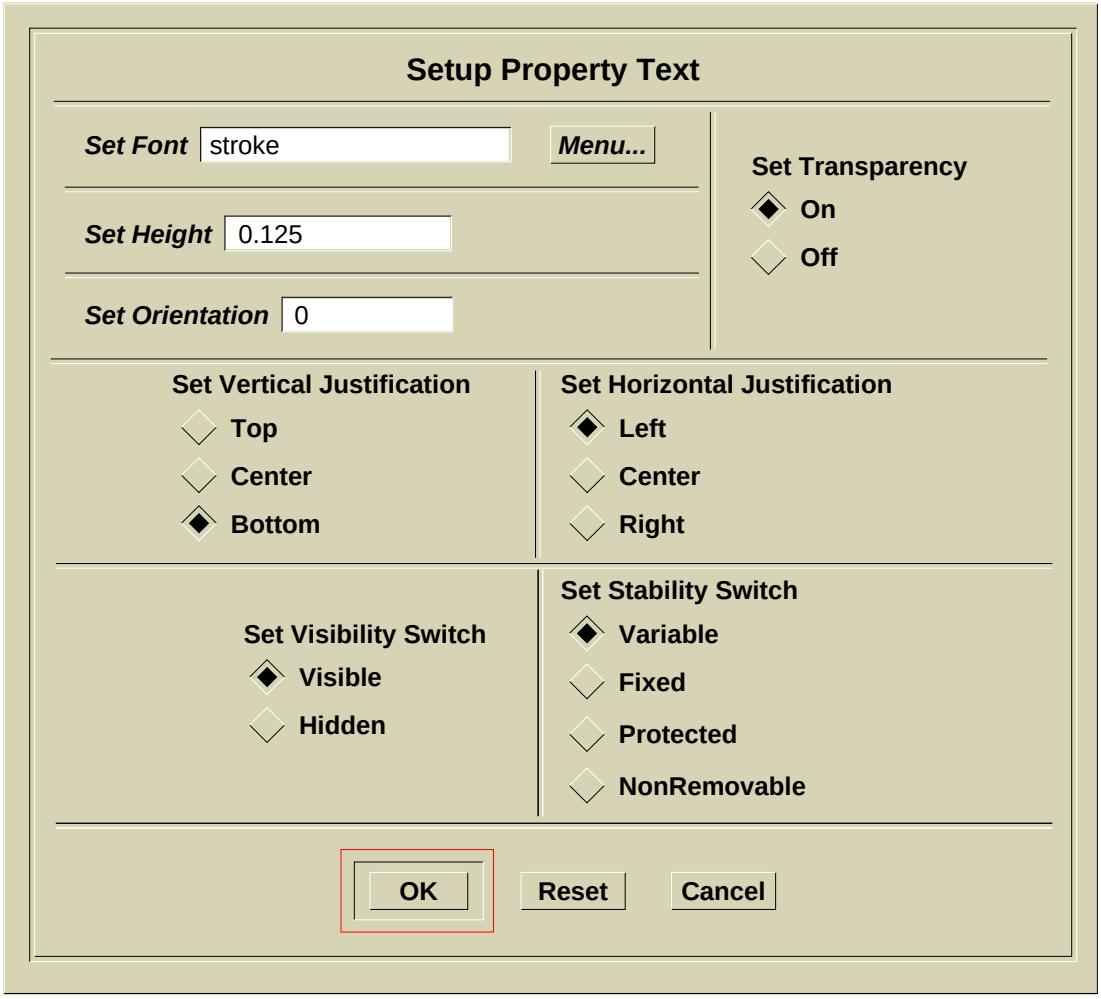
A quick way to change a property value after it is selected in to click the CHANGE VALUE icon or draw the Modify Property Stroke.

Changing Property Attributes

Changing property attributes, such as height, is more easily done by using the popup menu items. Three choices are shown on the left.

Setting Up Property Text Attributes

- Changes the default values for property attributes
- See results next time a property is added
- Setup > Property Text displays (schematic version):



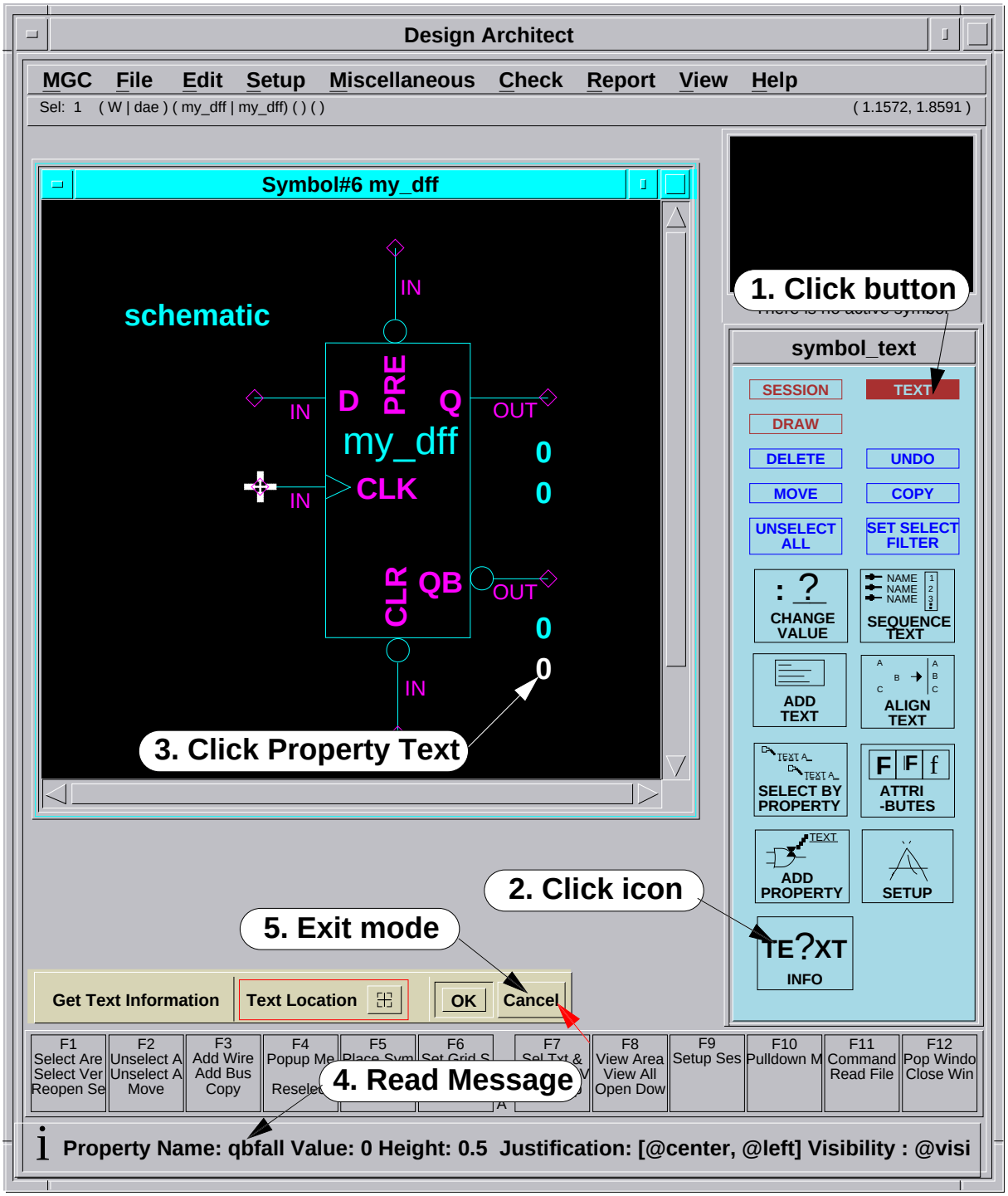
Setting Up Property Text Attributes

The **Setup > Property Text** menu item lets you change property text attributes used when adding properties in the Symbol Editor and the Schematic Editor. After the menu item has been chosen, a Setup Property Text dialog box is displayed. You can change the following attributes:

- **Font**. Name of a registered font family available on your workstation.
- **Height**. A positive, non-zero number that specifies the height of the property text.
- **Orientation**. Value of 0 (horizontal) or 90 (vertical) that specifies the orientation.
- **Transparency**. If text transparency is on, objects under a text string are visible; if text transparency is off, objects under a text string are hidden.
- **Vertical Justification**. Specifies the vertical justification.
- **Horizontal Justification**. Specifies horizontal justification.
- **Visibility**. Specifies whether the values of instance-specific properties are visible or hidden on the schematic sheet.

The results of changing the default values are displayed the next time property text is added.

Quick Report on Property Text



Quick Report on Property Text

A quick way to generate a report on unknown property values is to use the TE?XT icon on the text palette. The procedure is as follows:

1. Click the **TEXT** button on the palette.
2. Click the **TE?XT** icon. The **Get Text Information** prompt bar appears.
3. Click on a piece of property text.
4. Read the message about the text in the message window.
5. Keep clicking on pieces of unknown text until you are satisfied.
6. Click the Cancel button on the prompt bar to exit the **Get Text Information** mode.

Lab Exercises

Print Out the Lab Exercises

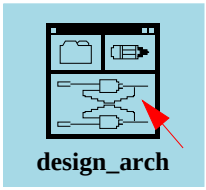
If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Creating a Symbol

In this lab exercise, you will create the symbol for the schematic sheet that you created in the last module.

Invoke Design Architect

1. Double-click the **design_arch** icon in the Design Manager Tools window
   .



   (or, type *$MGC_HOME/bin/da* in a shell).

2. Click the Maximize button to fill the screen with Design Architect.

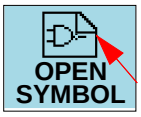
3. Verify the setting of the current working directory.

   MGC > Location Map > Set Working Directory:

   It should read <*home_directory*>**/training/da_n/card_reader**. If is doesn't, set it to this value and click **OK**; otherwise click **Cancel**.

Open the Symbol Editor on the my_dff Component

1. Click the **OPEN SYMBOL** icon.



   The Open Symbol dialog box is displayed in the DA session area.

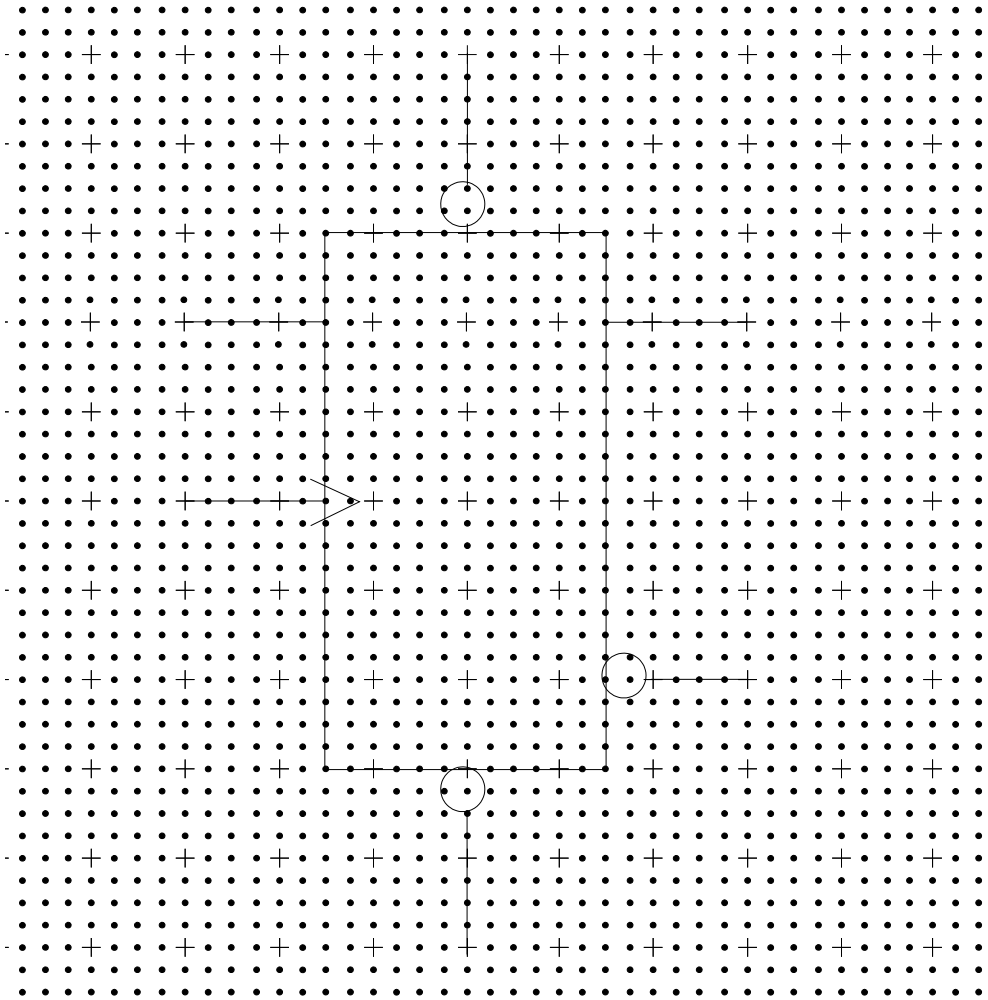
2. Click the Navigator button, navigate to and select the **my_dff** component, then click OK.

Design Architect opens a new (blank) Symbol Editor window on the **my_dff** component. The symbol is named my_dff by default, because you did not specify an alternate name in the dialog box.

3. Click the Maximize button on the Symbol Editor window.

Creating a Symbol Body

Use the following figure to determine the size of the rectangle, circles, and lines that you will use to create a symbol body. Place the symbol graphics exactly as shown in the figure.



Create a Rectangle

1. Click on the **ADD RECTANGLE** icon. Press, but do not release, the Select mouse button at the location of the first corner of the rectangle. Drag the mouse button to the opposite corner and release.

2. Draw a  stroke.

3. If the rectangle is not exactly as shown, click the STRETCH icon, click the mouse pointer on an edge you want to move, then move the pointer to the new edge position and click.

Create Circles

1. Click on the **ADD CIRCLE** icon. Press, but do not release the Select mouse button at the center location of the circle. Drag the mouse button to the perimeter of the circle and release it.

2. With the circle still selected, draw a  stroke to make a copy and place it in the second location for a circle.

3. Repeat the above step for the third circle, then draw a  stroke to unselect all.

Create Lines

1. Click on the **ADD POLYLINE** icon. Draw the upper three whiskers by clicking the Select mouse button at one end of the whisker and double clicking that the other end. After the first line is drawn, use the copy stroke to create and place the other two lines.

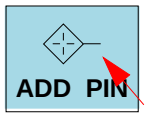
2. Perform this action for as many times as there are whiskers. Make sure that you end each line on a “+” pin grid. Pins will be attached to the end of these lines and pins must snap to these grid points.

3. Draw the “>” polyline by clicking once at the starting point, once at the tip, and twice at the end.

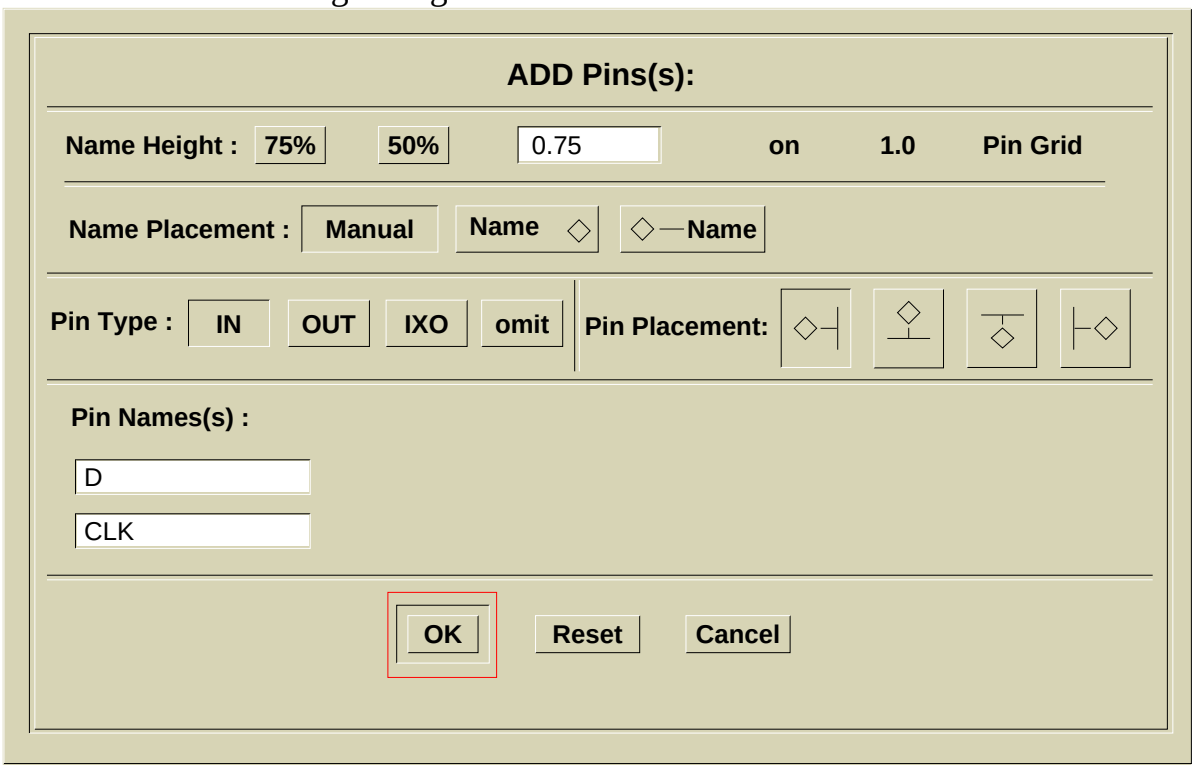
4. Unselect All with a  stroke

Add Pins to the Symbol Body.

1. Click on the **ADD PIN** icon.



2. Fill in the following dialog box as shown:

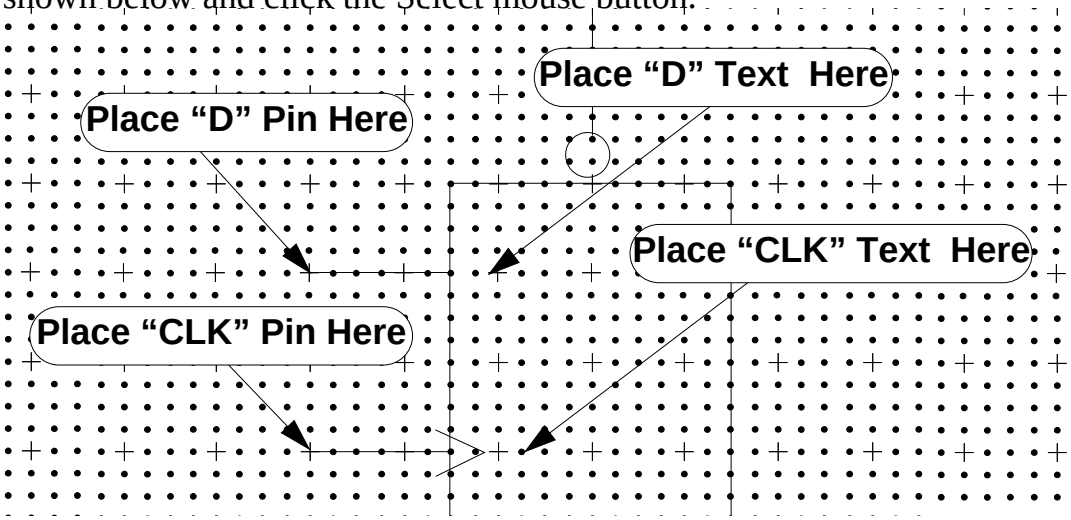


(Make sure you click the **Manual** button.)

3. Click **OK** or press **RETURN**.

The dialog box disappears and the Add Pin prompt bar is displayed as shown below.

4. Move the cursor to the desired location of the pin at the end of the line as shown below and click the Select mouse button.



   The location cursor moves to the Text Location text entry box. You will see text “D” appear near the pin location.

5. Move the cursor to the desired location of the text, as shown above, and click the Select mouse button.

   A diamond-shaped object representing a pin is placed at the end of the line. The Pin Name (D) is positioned to the right of the pin, and the PINTYPE property value (IN) is displayed.

   The prompt bar disappears and another Add Pin prompt bar is displayed. The **Next Pin to Place** entry box is filled in with “**CLK**”. The **Location Info** entry box is filled in with “**left**”. The location cursor is on the **Pin Location** prompt text.

6. Move the cursor to the desired location of the pin at the end of the line, as shown above and click the Select mouse button.

   The location cursor moves to the **Text Location** entry box. You will see text “CLK” appear near the pin location.

7. Move the cursor to the desired location of the text, as shown above, then click the Select mouse button.

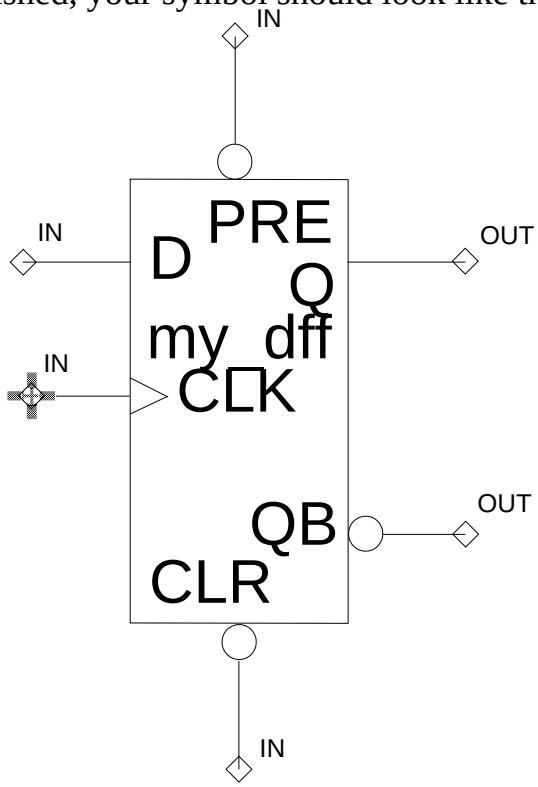
A diamond-shaped object representing a pin is placed at the end of the line. The Pin Name (CLK) is positioned to the right of the pin, and the Pintype property value (IN) is displayed.

8. Continue adding the Pin and Pintype properties using the following information.

Pin Names	PinType	Pin Placement
PRE	IN	Top
CLR	IN	Bottom
QB	OUT	Right
Q	OUT	Right

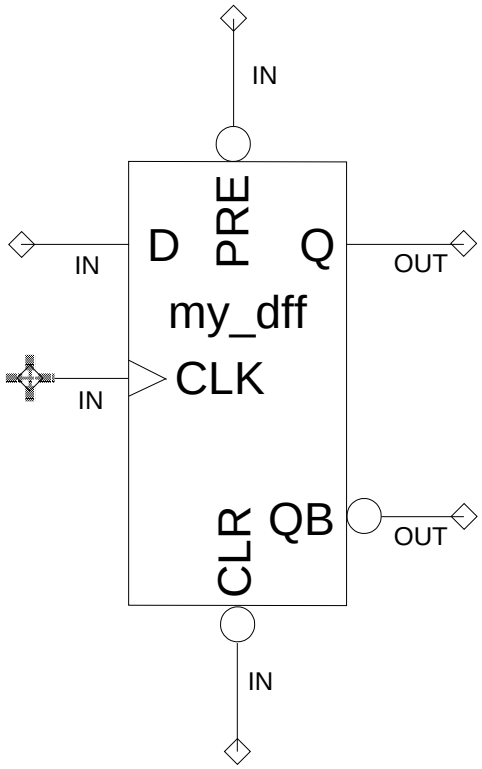
9. Add **my_dff** symbol text by clicking on the TEXT palette button and the ADD TEXT palette icon. Enter the text into the prompt bar entry box.

10. When you are finished, your symbol should look like the following:

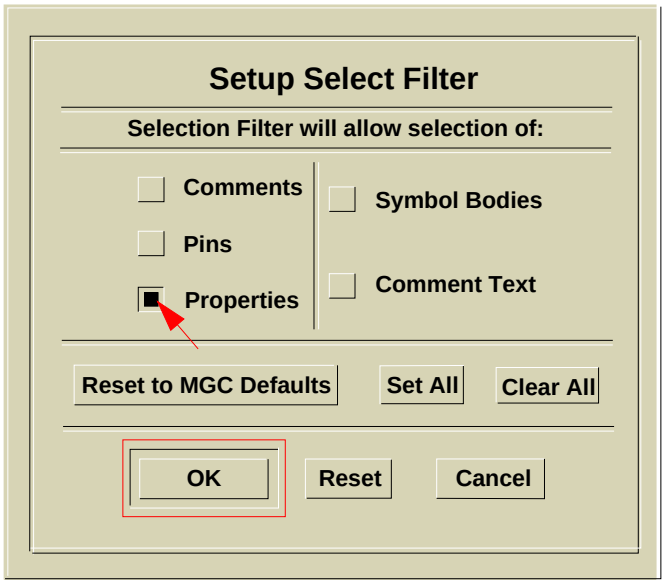


Resizing, Rotating, and Repositioning Property Text

Next, you will resize, rotate, and reposition property text to make you symbol look like the following illustration:



1. Set the Selection Filter for Property Text only by drawing a ⌐ stroke.



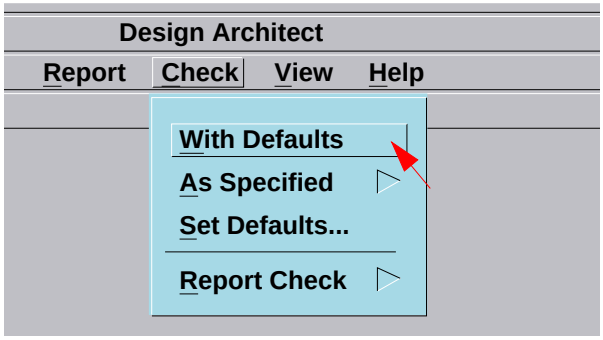
2. Click the **Clear All** button, then the **Properties** button
3. Draw a → stroke to execute the form.
4. Now draw a selection box around the property text on the interior of the symbol rectangle. All the Pin property text is selected.
5. Place the mouse pointer on the symbol text my_dff and tap the F1 function key. The symbol text should be selected and added to the selection group.
6. Press the Right mouse button and choose the **Change Height > 0.5 x Pin Spacing.** The text is reduced in size to 1/2 the pin grid spacing.
7. Draw a “U” stroke ⌴ to unselect all.
8. Click on the “PRE” property text and draw a ⌴ stroke. The text is rotated 90 degrees.
9. Draw a “shark fin” stroke ↘, then move the PRE text to the position shown in the symbol illustration on the previous page.
10. Draw a “U” stroke ⌴ to unselect all.

11. Repeat the above procedure to rotate and move the CLR text.

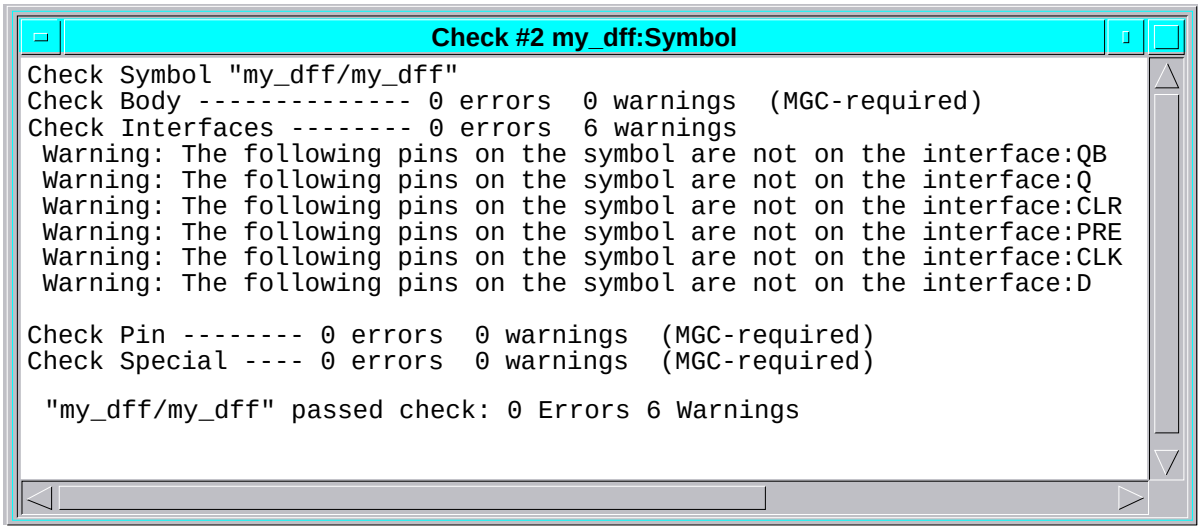
12. Individually select and move the remaining pin and pintype property text to the positions shown in the symbol diagram.

Check the Symbol

1. Using the default checking levels, check your symbols for errors and warnings. Choose the following pulldown menu item:



The Check Status window should look like this:



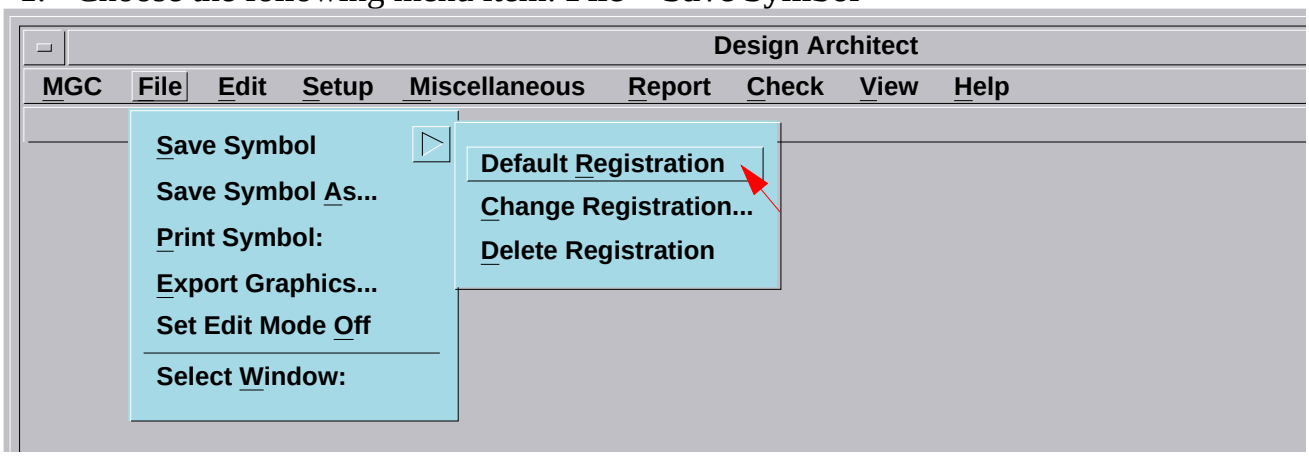
Notice that the Check Status window displays several warnings. These warnings are always given when pins are changed or added to a symbol. They are normal when saving a symbol for the first time because the pins list in the component interface is changed from zero pins to a number matching the new pins on the symbol.

a. If your check results in errors, you can identify handle names (like I$3) by clicking the handle name in the Check Status window. The object associated with that handle name is selected on the sheet.

b. Close the Check Status window. The symbol window is automatically reactivated.

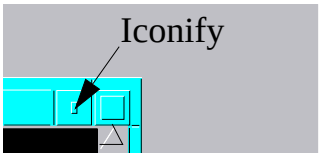
Save the Symbol

1. Choose the following menu item: **File > Save Symbol**



Iconify the Symbol Window

1. Iconify the Symbol Window

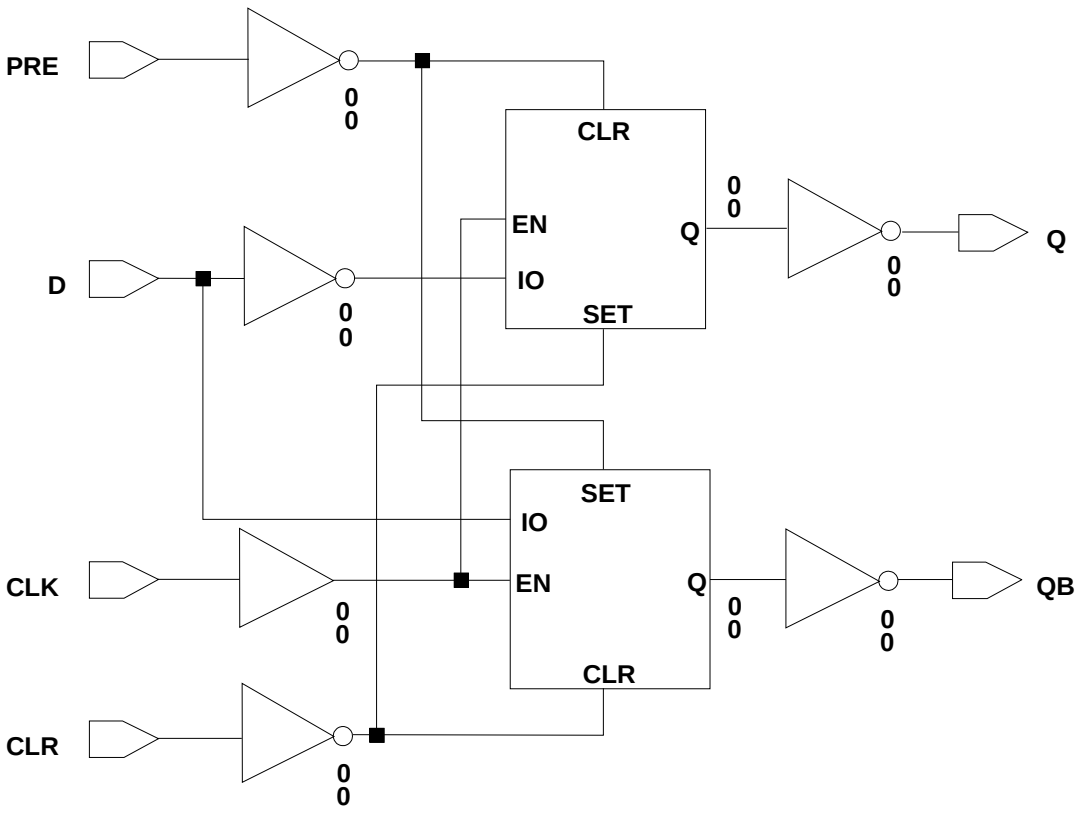


Exercise 2: Adding Properties to a Schematic

In this lab exercise, you will modify properties on the **my_dff** schematic sheet that you created in the previous module.

Open the my_dff Schematic

1. Click on the DA Session Window so that the Session palette appears.
2. Open a Schematic window on the **my_dff** component.
3. Maximize the Schematic Window
4. Draw the ↖ stroke to view the entire sheet. The schematic should look like the following:



Change the Values of the Rise and Fall Properties

Notice that the current values of the Rise and Fall properties on the **inv** output instances are set to 0. In this exercise, you will change them to the expressions; (QRISE) and (QFALL) for the top output inverter; (QBRISE) and (QBFALL) for the bottom output inverter.

Use the following method to change the property values.

1. Set the selection filter to **Properties** (only) and with the Select mouse button draw a bounding box around the Rise and Fall properties of the output **inv** instances. The four 0s should be highlighted, and the select count should be 4.

2. Click the TEXT palette button, then click the CHANGE VALUE icon.

3. Fill in the prompt bar as follows:

4. Click **OK**. The top property value is changed, the next to the top property value is selected, and prompt bar reappears.

5. Fill in the prompt bar as follows:

6. Click **OK**

7. Fill in the next prompt bar as follows:

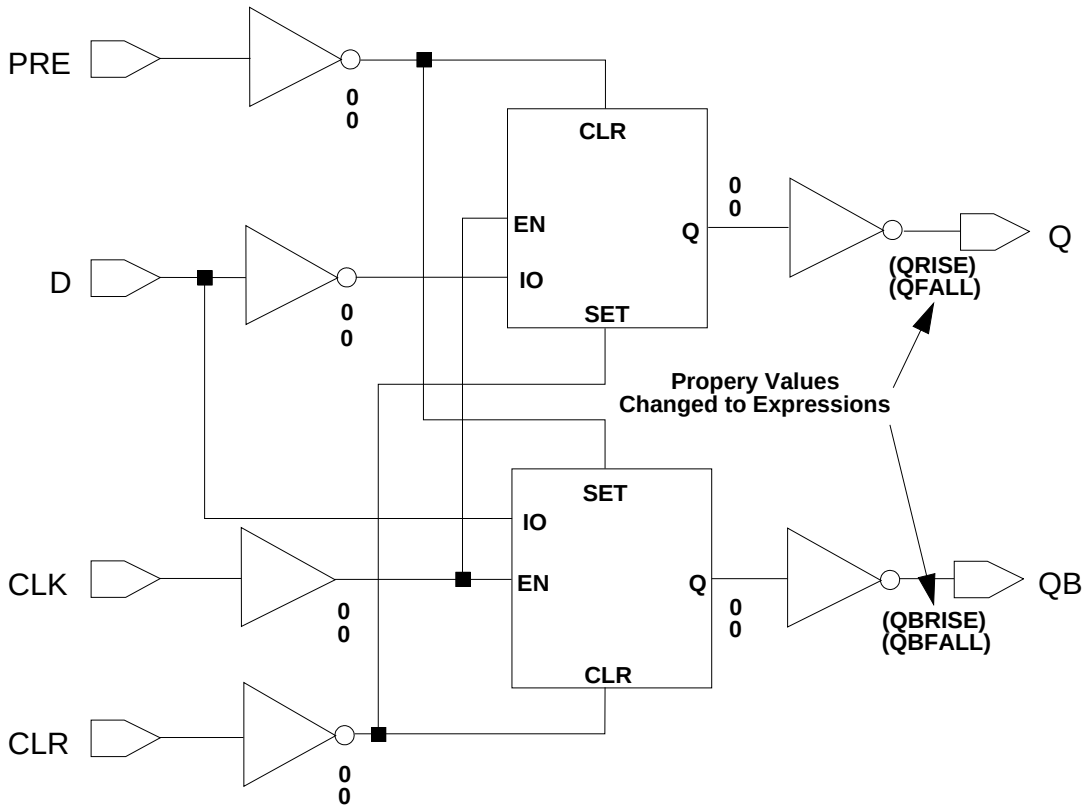
8. Click **OK.**

9. Fill in the next prompt bar as follows:

10. Click **OK**.

11. Unselect All before going on to the next step.

    The results of this change should appear as follows:

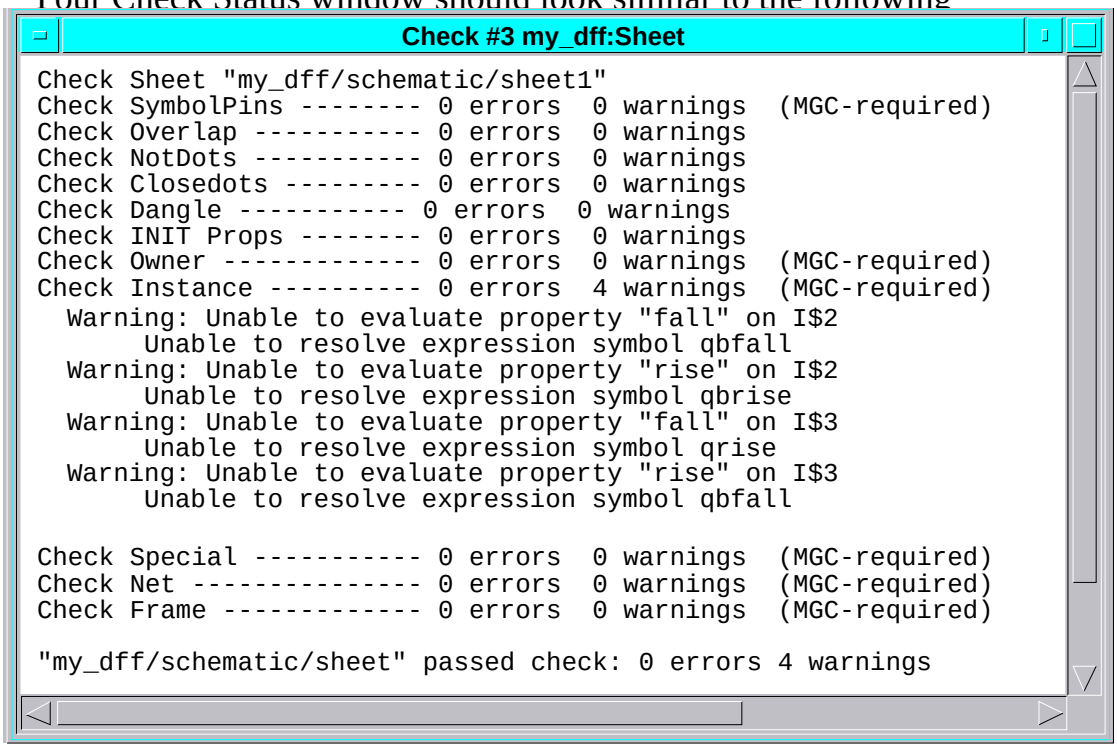


Check the Sheet

1. Using the default checking level, check your sheet for possible errors or warnings:

   Check > Sheet > With Defaults

Your Check Status window should look similar to the following



Notice that you received warning messages about the current values of the Rise and Fall properties. These messages indicate that the Rise and Fall property values are expressions and can't be evaluated at this time. This is normal.

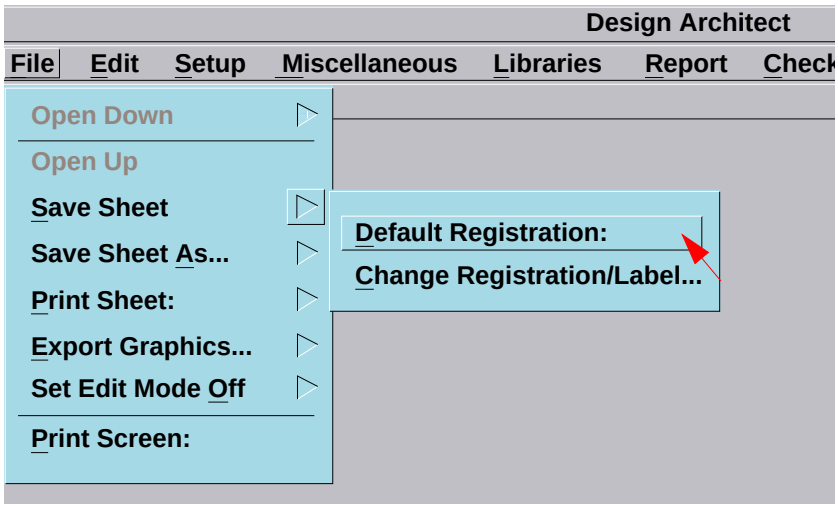
If your check results in errors, you can identify handle names (like I$2) by clicking the handle name in the Check Status window. The object associated with that handle name is selected on the sheet.

2. Close the Check Status window with a → stroke. The schematic window is automatically reactivated.

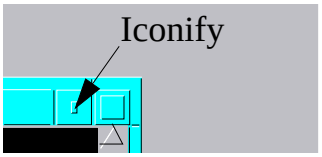
Save the Sheet

1. Save the schematic to disk by executing **File > Save Sheet > Default Registration** from the pulldown menu.

   .



2. Iconify the Schematic Window

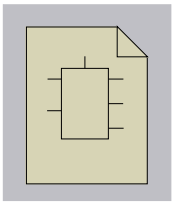


Exercise 3: Adding Properties to a Symbol

In this exercise, you will complete the symbol that you began in Exercise 1 by adding additional properties to the symbol body.

Expand the Symbol Window

1. At the end of Exercise 1, you iconified the Symbol Editor Window for **my_dff**. Find this icon in the DA Session window and double-click on it. The window

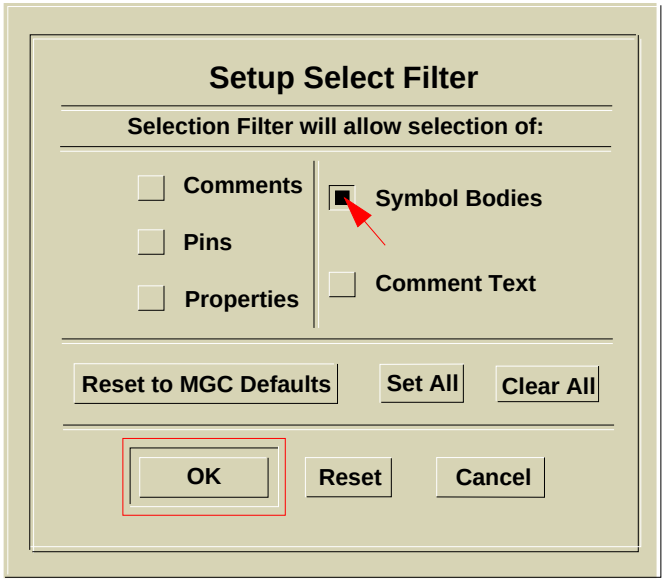


should expand to its original size.

2. Draw an Unselect All stroke to make sure that all objects are unselected.

Set the Select Filter

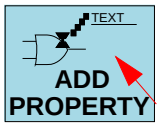
1. Set the selection filter to Symbol Bodies



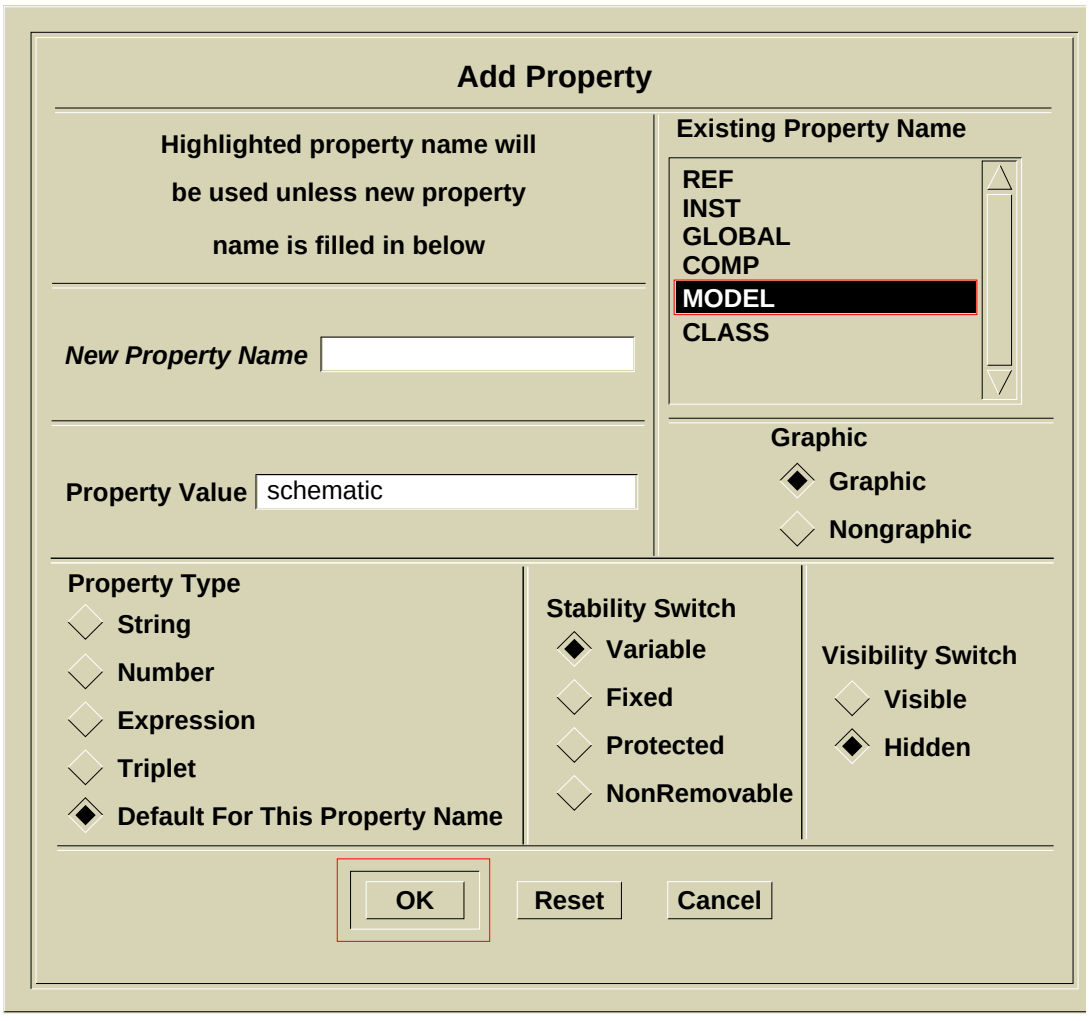
Add a MODEL Property

a. Click on the symbol body to select it.

b. Add a MODEL property to symbol body by clicking on the ADD PROPERTY icon.



Fill in dialog box as shown in the following illustration:.



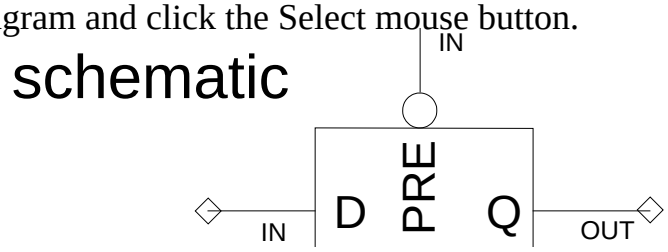
Notice that the Existing Property Name list contains names of properties that are typically owned by the selected object. If the property that you want to add does not exist in this list, type the property name in the ***New Property Name*** entry box.

In this case, click on the MODEL entry in the **Existing Property Name** scrolling window. Now you only need to change the **Property Type** when you are adding a property that does not exist in the list

Make sure that you don't forget to change the Visibility Switch to **Hidden**.

c. Click **OK.** The **Add Property** prompt bar appears.

d. Move the ghost image of the text to the location shown in the symbol diagram and click the Select mouse button.



The text “schematic” appears next to the symbol body.

Why is the “schematic” text visible if you specified that it be Hidden?

_____

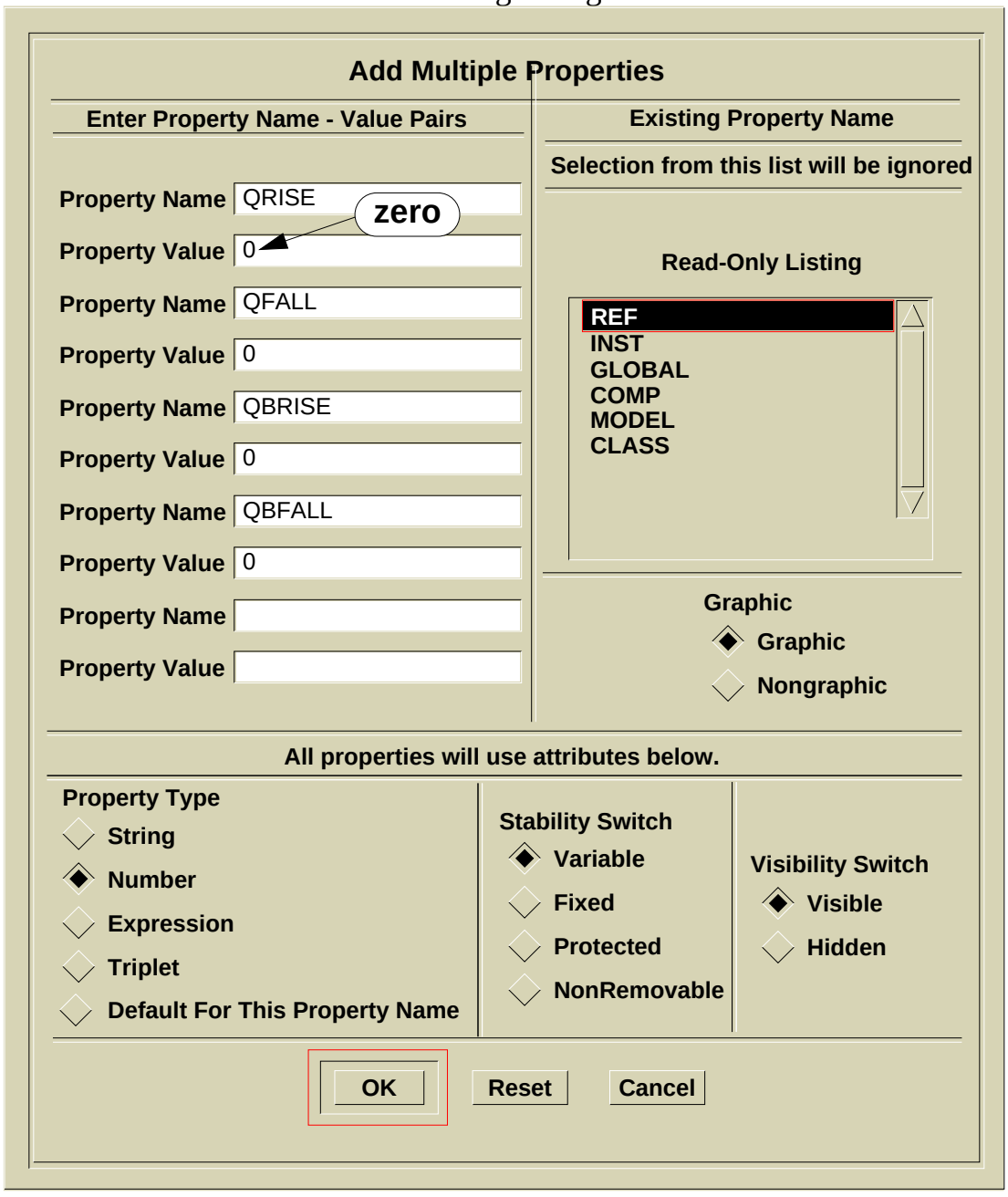
Add Parameters as Property Values

Parameters are defined as values that are passed to variables in an expression from an outside source. In the last exercise, you defined four single variable expressions for the RISE and FALL properties on the Q and QB output of the schematic. In this exercise, you are going to attach property names to the symbol body that match the variable names in the expressions. When the **my_dff** schematic gets “evaluated” by a downstream analysis tool, the values assigned to the properties that are attached to the **my_dff** symbol will be passed to the expressions on the sheet so that the rise and fall times can be resolved to constant values. Add the properties to the symbol body as follows:

1. With the symbol body selected, choose the following popup menu item:

Properties > Add > Multiple Properties...

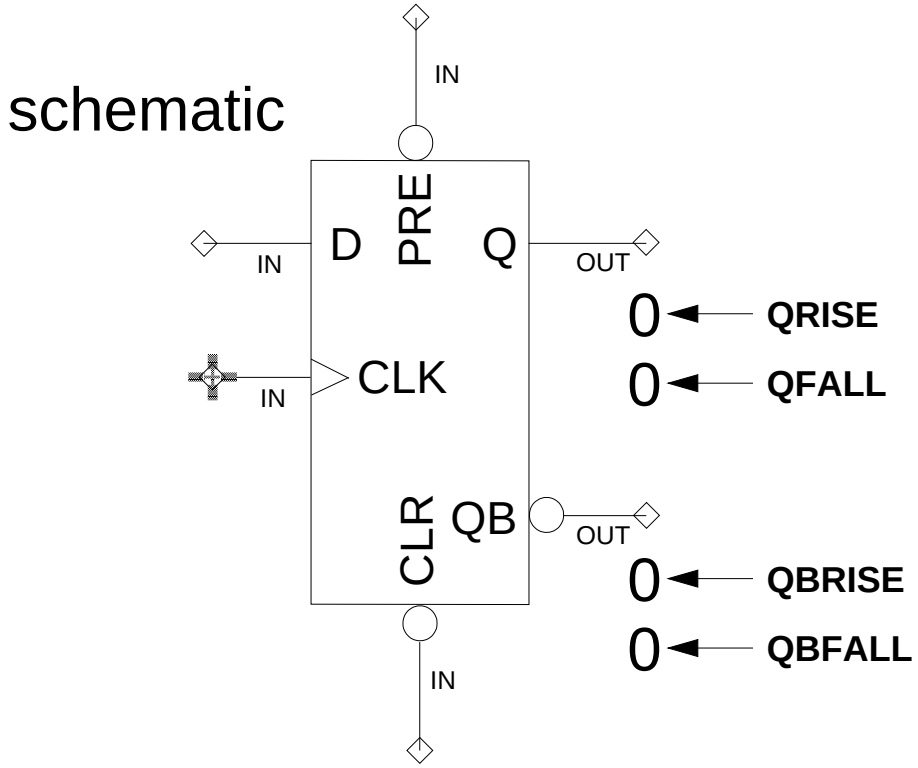
2. Enter the values as shown in the following dialog box:



3. Click the **OK**.

   The dialog box disappears and the Add Property prompt bar is displayed.

4. Position the four new property values as shown in the following figure:



5. Unselect All.

Change the Height of the Newly-Added Property Text

Change the height of the new property text as follows:

1. Place the mouse pointer over each piece of new property text and tap the F1 function key. This allows you to bypass the select filter and select whatever object is underneath the pointer.

2. Press the Right mouse button and choose the **Change Height > 0.5 x Pin Spacing.** The text is reduced in size to 1/2 the pin grid spacing.

3. Draw a “U” stroke to unselect all.

Verify that the Property Values are Placed Correctly

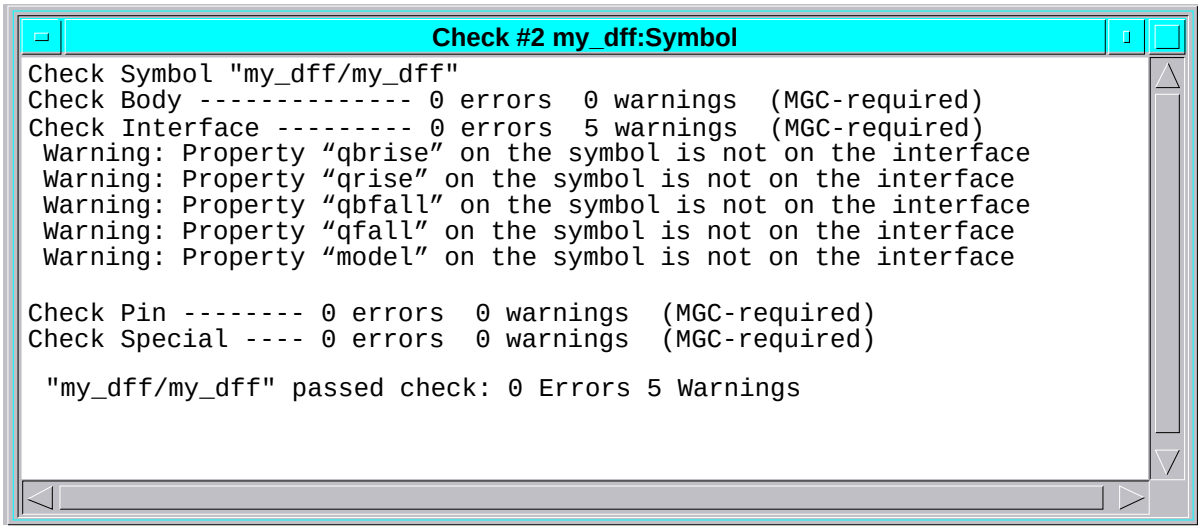
Since all four property values are the same value(zero), you can't tell just by looking at them that they are placed correctly. Do a quick check as follows:

1. Click the TE?XT icon:
2. Select the top piece of property text that you just added and read the message in the message window. The message should verify that the property is "qrise".
3. Select the property text that is second from the top. The message should verify that the property is "qfall".
4. Select the next two property values, one-at-a-time, and verify that they are qbrise and qbfall, respectively.
5. Click the **Cancel** button on the prompt bar to exit TE?XT mode.

Check the Symbol

1. Check your symbol for errors or warnings. **Check > With Defaults**

   The following Check Status window is displayed showing the results of the symbol check. Notice that the check window displays several warnings. These warnings indicate that the symbol has changed, but the component interface table has not yet been updated. This is normal.

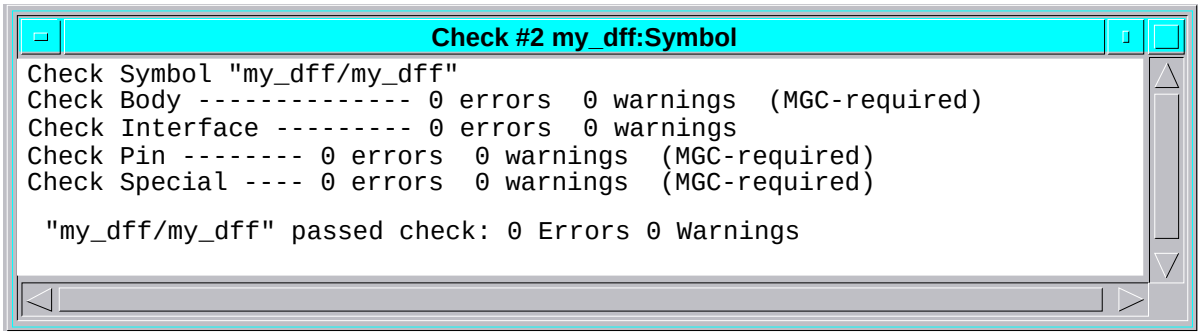


a. Close the Check Status window. The symbol window is automatically reactivated.

Save the Symbol

1. Select the following pulldown menu item: **File > Save Symbol**

2. Check the symbol again. The Check window is shown below.



Notice this time there are no errors or warnings. When the symbol was saved, the component interface table was updated to match the new information on the symbol.

3. Close the Check Status window, then close the Symbol window.

Resave the my_dff Schematic

When you resave a symbol that has changed, the component interface table is updated. Because the ports on the schematic may no longer match the pins on the symbol, the schematic model is automatically marked “Not-Valid”. In order to run the Validation routine and verify that the schematic ports still match the pins on the symbol, you must check and resave the sheet.

1. Double click on the Schematic window icon in the DA Session Window.

2. From the pulldown menu choose: **Check > Sheet > With Defaults.**

3. Close the Check Window with a → stroke.

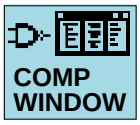
4. From the pulldown menu choose: **File > Save Sheet> Default Registration**.

5. Close the Schematic Window

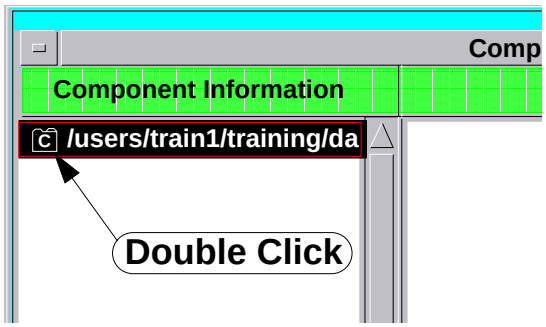
Exercise 4: Browsing the my_dff Component in the Component Window

It is helpful to understand the internal structure and content your design. You will be observing and changing this structure throughout this training course. The following exercise will give you more practice using the Component window.

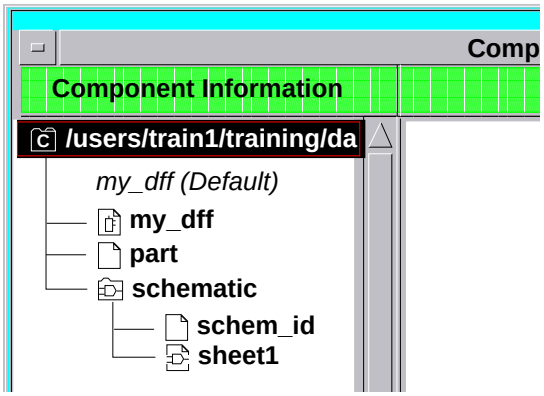
1. Click on the COMP WINDOW icon:



2. Select the **my_dff** component in the Navigator window and click **OK:**

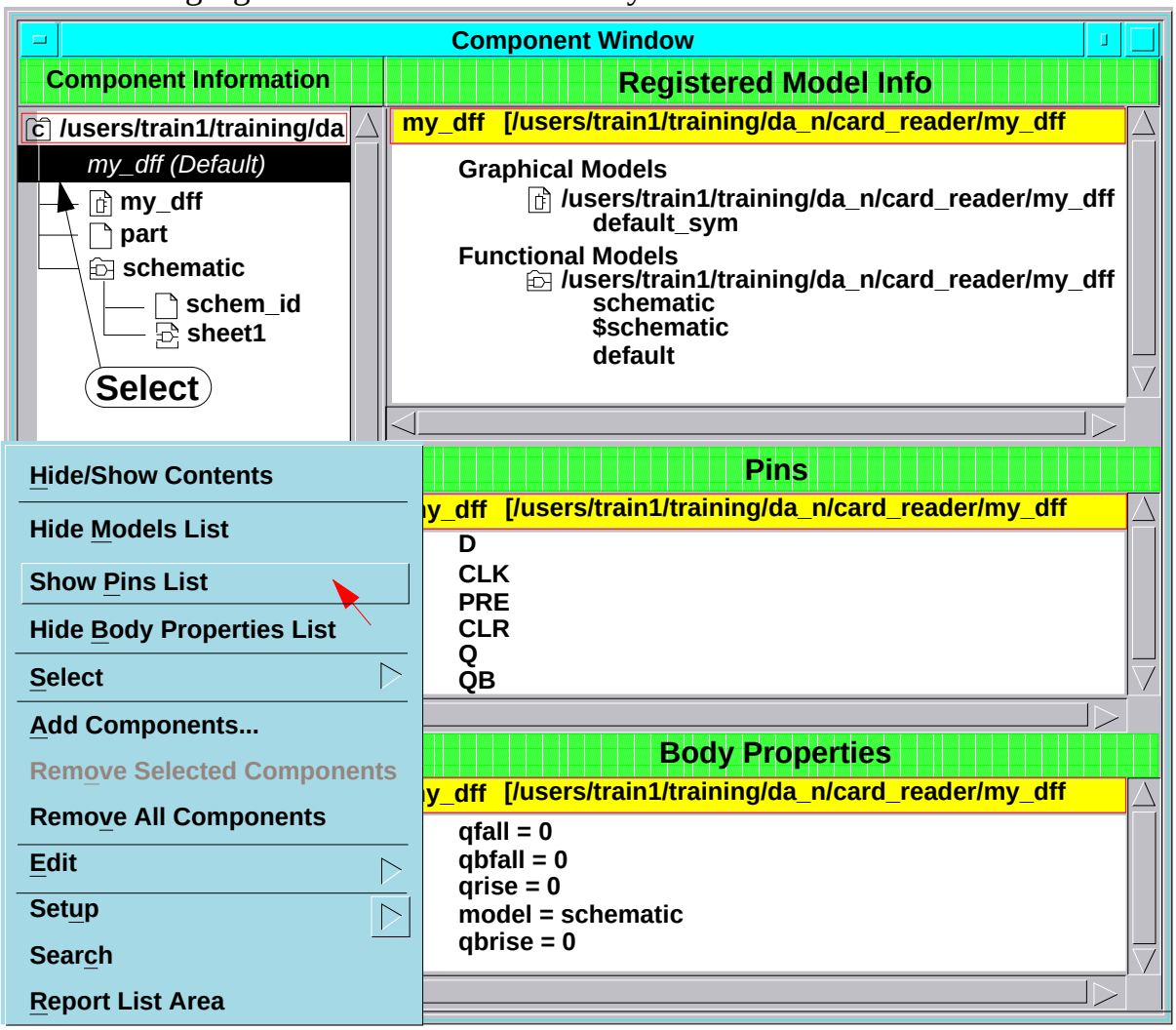


3. Double click on the component icon, then on the schematic icon:



Notice that the component now contains three objects, the **part** object, the **schematic**, and the new **symbol** object

4. Select the component interface name ***my_dff (Default)***, then from the Component Information window popup menu choose **Show Pin List**. The following figure shows the information you should see in the window:



Notice that the symbol model is now listed in the Registered Model Info window, the symbol pins that you added to the symbol are listed in the Pins window, and the symbol body properties that you added to the symbol graphics are listed in the Body Properties window.

5. Close the Component Window.

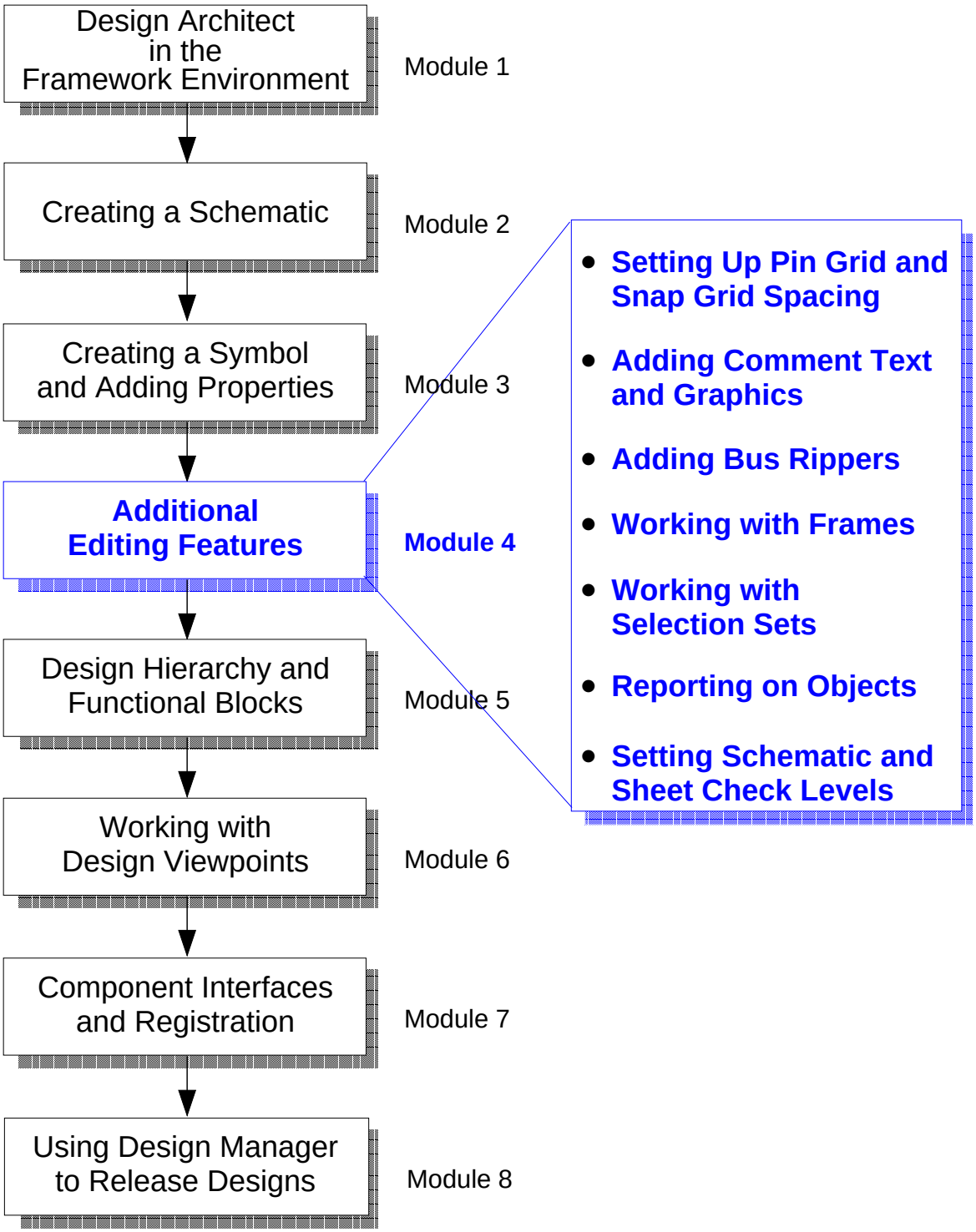
End of Lab Exercise

This concludes the lab exercises for Module 3. If you have time, turn to **Appendix A - Customizing Exercises** and do the following:

1. **Exercise 3** - learn how to add a Navigator button to the **$set_working_directory()** dialog box.
2. **Exercise 4** - learn how to change the Modify Property stroke to a stroke that is easier to draw.

Module 4
Additional Editing Features

Module 4 Overview



Lesson 1
Additional Editing Features

Setting Up the Page

- Unlimited page size
- Pin spacing specifies the distance between pins measured in user units
- User units define the coordinate system
- Instances take on the units of sheet
- Default symbol pin grid: 1 pin
- Default sheet pin grid: 0.25 inches
- Setup > Net/Comment/Page > Page:

Setting Up the Page

The logical size of a sheet in Design Architect is virtually boundless. You can control the actual physical size by specifying the distance between points on the pin grid. The reason you specify *pin spacing* in *user units* is to control the scale of printouts or to meet a Company standard.

There is always a one-to-one logical mapping between the pin grid of the Symbol Editor and the pin grid of the Schematic Editor, regardless of the spacing specified for the grid in the different editors. For example, if two pins on the symbol are 5 grid spaces apart in the Symbol Editor, there corresponding instance pins will be 5 grid spaces apart on the pin grid in the Schematic Editor.

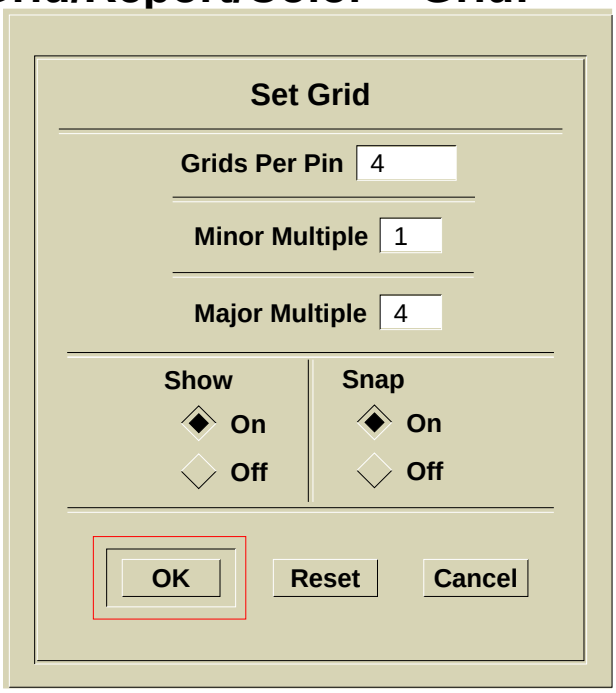
To change the physical units specified for the pin grid, you choosing the **Setup > Other Options > Page** menu item in the Symbol Editor and the **Setup > Net/Comment/Page > Page** menu item in the Schematic Editor.

Pin spacing is a real number that specifies the distance between pins and is measured in user units with a value of inch, centimeter (cm), millimeter (mm), or pin. “Pin” is non-measurable, and is most commonly used in the Symbol Editor. The default pin spacing in the Symbol Editor is 1 pin, for the Schematic Editor it is 0.25 inches.

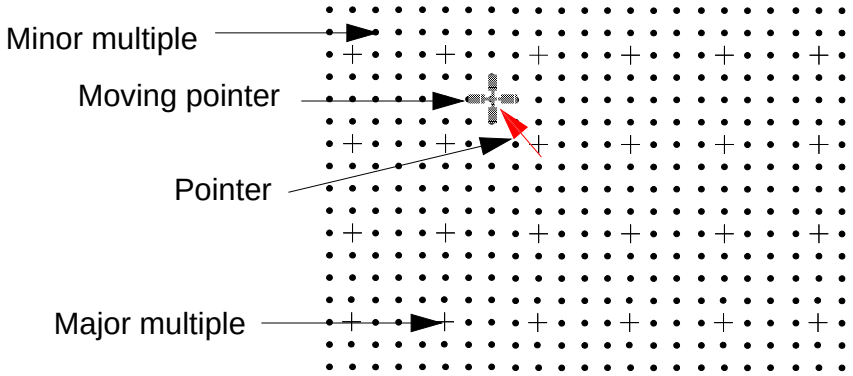
After the **Setup > ... > Page** pulldown menu item has been executed, the Setup Page prompt bar is displayed in the active window as shown on the left. You can change the value for the user units by clicking the choice stepper button to the right of the **User Units** field.

Setting Up the Grids

- **Pin grid: constrains electrical objects**
- **Snap grid: constrains non-electrical objects**
- **Setup > Grid/Report/Color > Grid:**



- **Grid looks like this:**



Setting Up the Grids

Two grid patterns help you locate and position objects and text on a sheet. The *pin grid* constrains electrical objects, such as nets, symbol instances, and pins, to the pin spacing established through the **Setup > ... > Page** menu item. The *snap grid* controls placement of non-electrical objects, such as comment graphics, comment text, symbol text, and property text, and is defined in terms of the pin grid.

When you choose the **Setup > Grid/Report/Color > Grid** menu item, the Set Grid dialog box appears with the current grid settings. The following list describes the information shown in the dialog box on the left.

- **Grids Per Pin**. Number of snap grid points per pin spacing. The default is 4.
- **Minor Multiple**. An integer specifying the number of grid locations between displayed grid points (dots). The default is 1.
- **Major Multiple**. Specifies every Nth displayed grid point with a cross (+), and is normally constructed to be on the pin grid. The default is 4.
- **Snap**. Restricts cursor placement to grid points.
- **Show**. Displays the grid points specified by the minor multiple.

The illustration on the facing page shows a graphical description of the grid. Note the two types of pointers: the *pointer* smoothly tracks the mouse, and the *moving pointer* indicates the nearest grid point and restricts cursor movement so that electrical and comment objects align with grid points. If snap is on, both the pointer and the moving pointer are visible; if the snap is off, only the pointer is visible.

In the Symbol Editor, symbols are created according to the measures of the pin grid, and scaled when instantiated on a sheet. In the Schematic Editor, instances are scaled to fit the current pin grid (as defined by the pin spacing) of the schematic being edited.

Comment Text and Graphics

- **Provides non-electrical information**
- **Non-property text that has no owner or name**
- **Comments on sheets:**
  - **Sheet border and title blocks generated at sheet creation time and Edit > Add Sheet Border**
  - **Created other comment object with Edit > Edit Commands > Add Comment**
  - **Convert electrical objects to comment objects**
  - **Cannot convert back unless you “undo”**
- **Comments on a symbol**
  - **Add symbol graphics and text; then Convert to Comment**
  - **Comment text is not displayed with instance; symbol text is**
  - **Can convert back, but not everything is reconverted**

Comment Text and Graphics

When creating schematic designs, you often need to place design reference information and notes on the schematics, or create borders and title blocks for the design. To place this non-electrical information into your design, you use *comment text and graphics*. Comment text is non-property text that does not require an owner or a name. Examples of comment objects include: a sheet border, a title block, references above the title block, and the circuit name under the circuit.

In the Schematic Editor, a sheet border and title block can be automatically generated at sheet creation time or can be added after the sheet has been created through the **Edit > Add Sheet Border** menu item. All other comment objects can be generated with the menu items found in the **Draw > Add** menu or the **schematic_draw** palette.

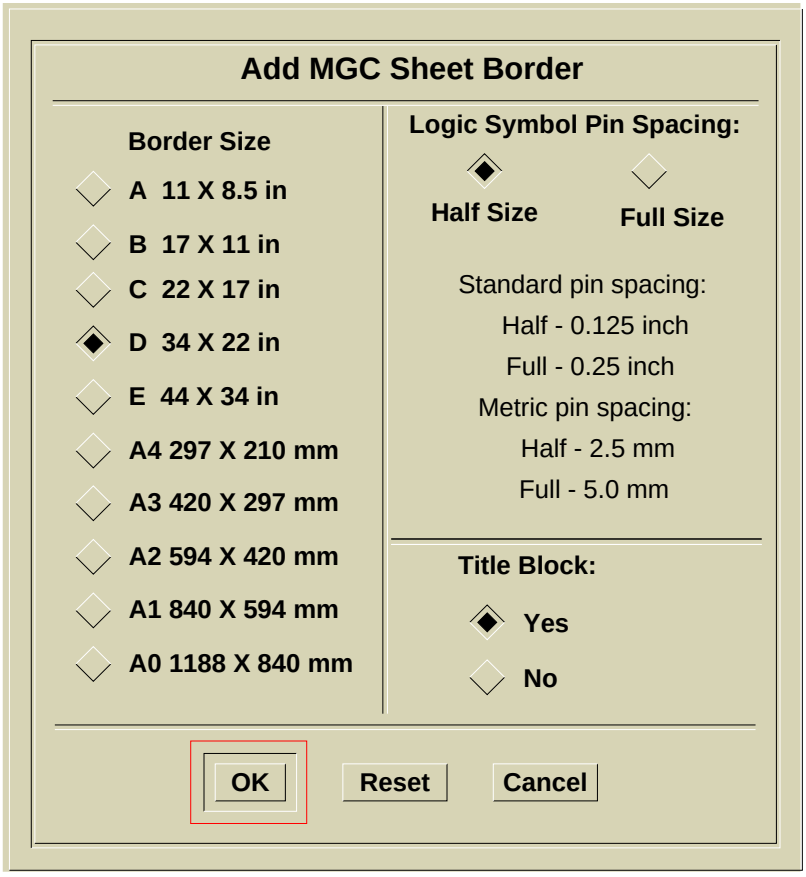
You can convert electrical objects to comment objects by choosing **Edit > Convert to Comment**. This converts nets and instances to comment objects. Visible property text becomes properties on comment objects. You cannot reconvert the “converted” comment objects back to electrical objects once they have been converted unless you “undo” all functions up to and including the Convert to Comment command.

When creating comment graphics and text in the Symbol Editor, you (1) choose the menu items from the ADD popup menu as if you are adding symbol objects to the symbol window, (2) select the symbol graphics and text that you want to convert, and (3) choose **Edit > Convert to Comment**. This changes your symbol text and graphics to comment text and graphics. Comment text is different than symbol text. Symbol text is displayed as part of the symbol when the symbol is instantiated on the sheet; comment text and graphics are not displayed when the symbol is instantiated.

You can reconvert “converted” comment objects back to symbol text and graphics by choosing **Edit > Remove Comment Status**. Any formerly electrical information (such as a pin) is not restored unless you “undo” all functions up to and including Convert to Comment. Converted comment objects from symbol body/text retain the attributes that they had when they were symbol objects.

Add a Sheet Border

- **(pulldown menu) Edit > Add Sheet Border**



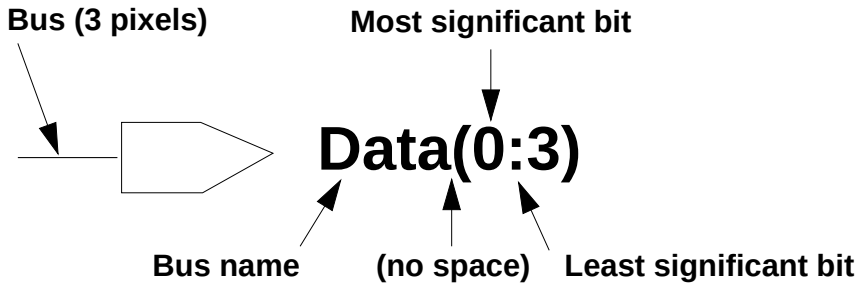
Adding a Sheet Border

Built-in Mentor Graphics userware allows you to add a sheet border in the form of comment text and graphics. You can choose from a variety of sizes as shown in the figure on the left.

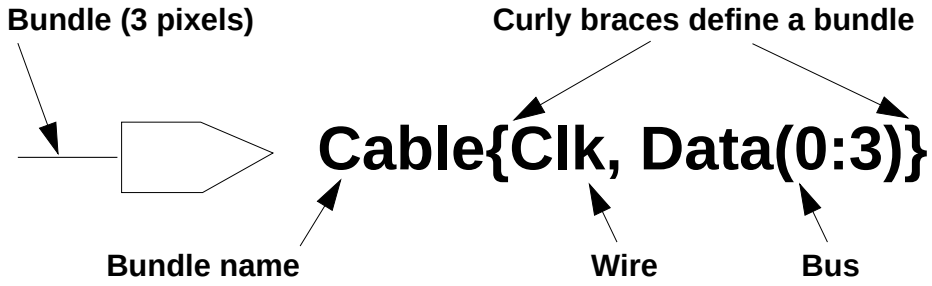
This userware can be customized to match your company specifications. Refer to the *$add_sheet_border()* function description and Appendix A, “Custom Userware” in the *Design Architect Reference Manual* for information on how to customize sheet borders.

Creating a Bus/Bundle

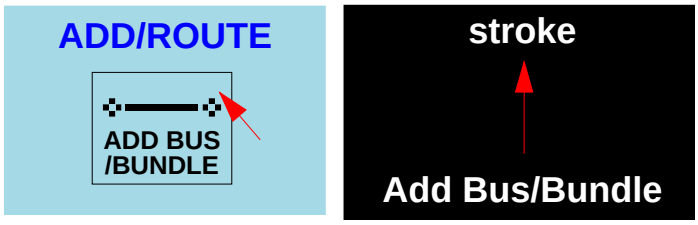
- **Bus - Same electrical meaning as a set of individual wires bound together in order**
- **Bundle - an ordered collection of wires, buses, and bundles on a single schematic**
- **A bus must have a net name in the following form:**



- **A bundle has a net name in the following form:**



- **To add a Bus/Bundle:**



Creating a Bus/Bundle

Buses let you represent a collection of wires without drawing them individually. Buses have a defined width derived from the number of elements in the bus. The string **Out(0:3)** defines a bus with a width of four wires. Each wire is referenced sequentially **Out(0)**, **Out(1)**, **Out(2)**, and **Out(4)** through the array. The most significant bit is on the left (zero) and the least significant bit is on the right (3). In Design Architect, a net is defined as a bus when you add a NET property to a net vertex and assign a value as shown on the facing page. The graphical rendering of a bus has no electrical meaning, but is used to increase the readability of the schematic. A bus is generally represented as a solid line that is three pixels in width instead of one pixel in width.

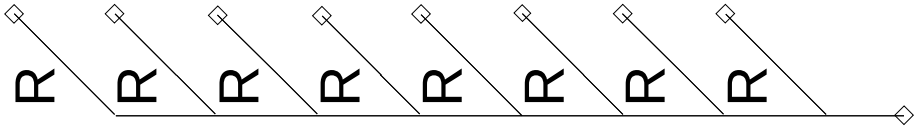
Bundles are a way to collect arbitrary set of wires, buses, and other bundles together on a single schematic. The nets in a bundle do not need to be related to each other in any way other than they must exist in the same schematic. A single net can be a member of any number of bundles, however no two bundles can have the same name and different member sets.

Bundles can be explicitly or implicitly named. In the example on the opposite page, the bundle is named "**Cable{Clk, Data(0:3)}**". A bundle could also have been created just by defining the NET property value to be **{Clk, Data(0:3)}**.

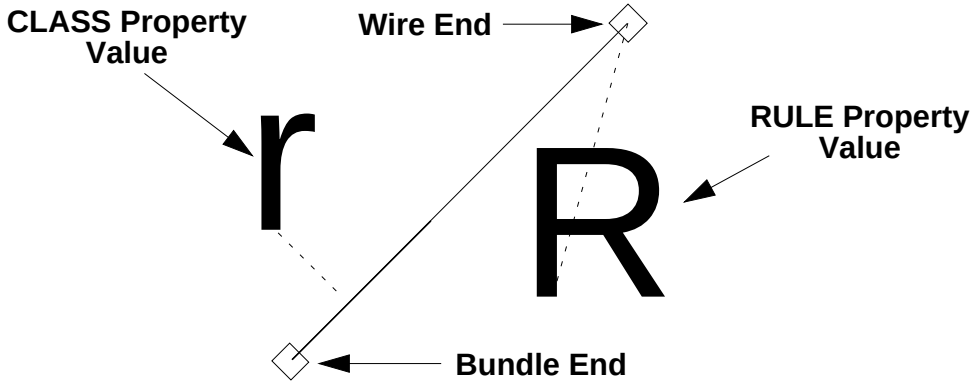
Once one bundle on a schematic is explicitly assigned a name like **Cable{Clk, Data(0:3)}**, you may assign the bundle name to other nets on the schematic just by specifying **Cable{}**.

Explicit Rippers

- **Connect individual wires or sub-buses from a bus or bundle to destination bus, bundle, or pin.**
- **A number of explicit symbols are available in the $MGC_GENLIB/rip component**
- **Example of an 8X1 Ripper:**



- **Each ripper has a Class property value of “r”**
- **Example of a 1X1 ripper**



Explicit Rippers

Design Architect allows you to connect individual wires, sub-busses and bundles to other buses or bundles using explicit or implicit bus rippers. In order to understand implicit bus rippers, it is helpful to first understand explicit bus rippers. Explicit bus rippers are primarily used in situations where two connecting wires have different NET names. Explicit bus rippers are symbols that are instantiated on a sheet. One end (the bundle end) connects to a bus or bundle. The other end connects to a wire, sub-bus or sub-bundle.

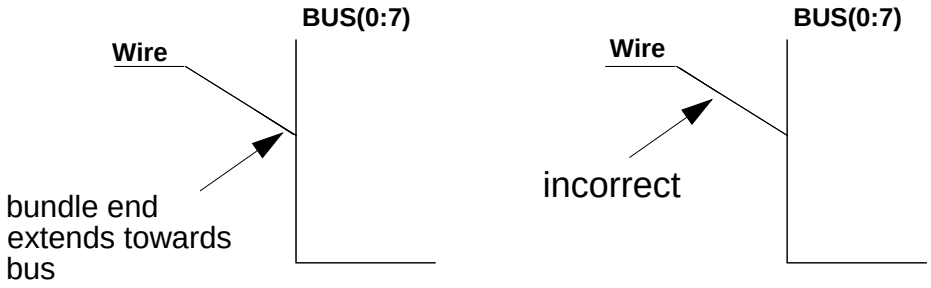
You can find the bus ripper component in *$MGC_GENLIB/rip*. The first example shown on the facing page displays the 8X1 bus ripper symbol. In addition, the following ripper symbols are available within the **rip** component: 1X1, 1X2, 1X3, 1X4, 1r, 1r2, 4X1, 3X1, 2X1, and 16X1.

Each bus ripper has a Class property value of “r”, indicating that the component is used to extract a range of lines from a bus. Each pin on a ripper symbol has a Rule property. The Rule property, called the “Ripping Rule” identifies the bus lines that the ripper pin taps. When the bus ripper symbol is first instantiated, each Rule property is set to a default value of “R”.

Each bus ripper symbol has at least two pins: the “wire” end and the “bundle” end, as the figure on the facing page illustrates. The bundle end is actually a pin that has a Pin property value called “bundle”. The wire end is also a pin, and (for Mentor Graphics-supplied bus rippers) has a Pin property value called “wire”.

Manually Connecting a Wire to a Bus

- **Manual Connection**
  - **Bundle end of ripper must be graphically connected to the bus**
  - **Wire end of ripper must be graphically connected to a single wire or sub-bus**



  - **If a ripper is installed backward, an error occurs when a Check command is executed**

Manually Connecting a Wire to a Bus

Automatic Connection

When you attach a single wire to a bus, or a bus to a single wire, the Schematic Editor automatically inserts an instance of the 1X1 ripper from the *$MGC_GENLIB/rip* component.

Manual Connection

When you instantiate a bus ripper, then connect it to a source bus manually, you must follow these connection rules:

1. The bundle end must always be graphically connected to the bus you want to "tap." If you are connecting two buses together, then the bundle end must be connected to the source bus (the bus whose wires you want to tap).

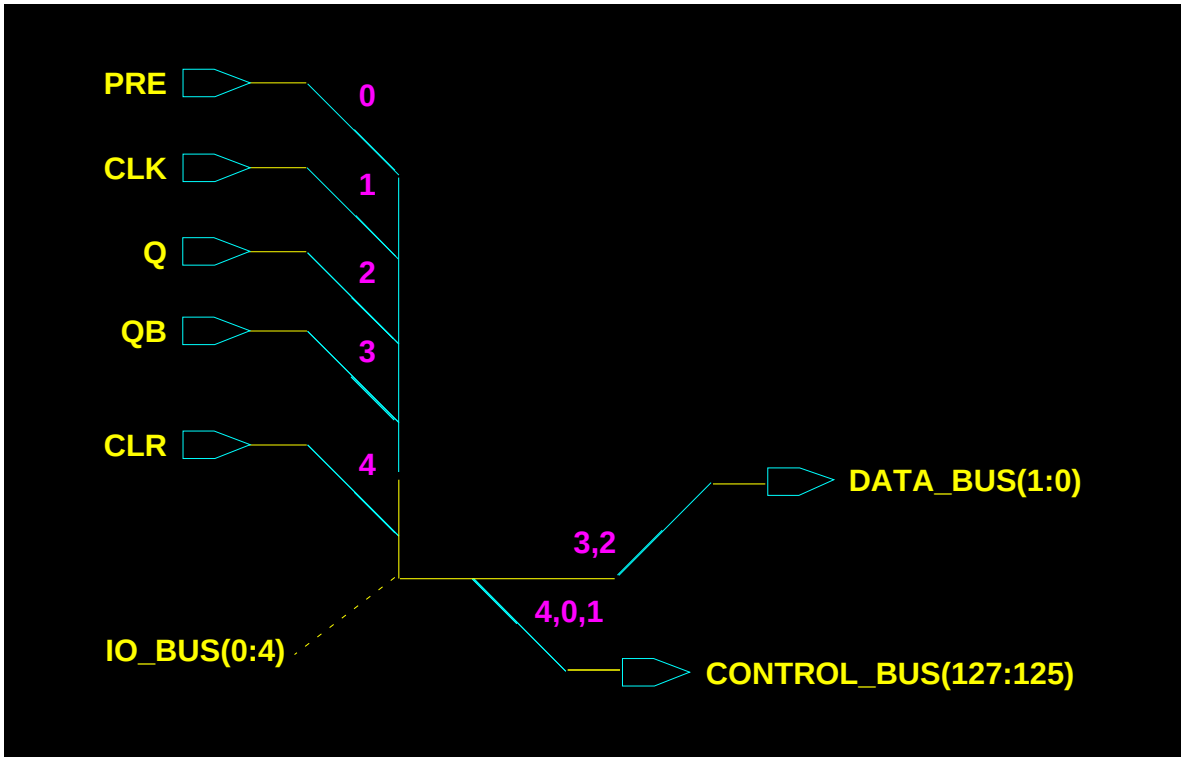
2. When you connect the wire end, it must be connected to a single net that represents a single wire or a range of tapped wires (destination bus).

   If you are connecting a source bus to a destination bus (sub-bus), the wire end must be connected to the destination bus.

The illustration on the facing page shows how the bundle and wire ends must be connected to a bus. The bundle end must be connected directly to the bus you want to tap. If the ripper is installed backward, an error message is issued when you check your sheet.

Defining the Rule Property

- Each RULE property must be unique
- Connecting a single wire, change Rule property value to a single bit number
- Connecting multiple wires, change Rule property value to specify each bit separated by commas



Defining the Rule Property

You must change each Rule property value on a ripper pin to a unique value. This identifies what line or lines of the source bus are connected to an attached net. If you want to use the bus ripper to extract just one wire, you must change the value of the Rule property to the bit position on the bus to be extracted. If you want to use the bus ripper to extract several wires, you must change the value of the Rule property to match all the bits that you are extracting, as shown in the left by the value “4,0,1”. The wire on the left (4) is considered the most significant bit.

The example on the facing page shows that five wires (PRE, CLK, Q, QB, and CLR) are connected to a bus called IO_BUS(0:4). The bus is defined by the NET property attached to the net vertex at the bottom-left corner.

Three control lines are ripped from the IO_BUS and connected to a sub-bus called CONTROL_BUS(127:125).

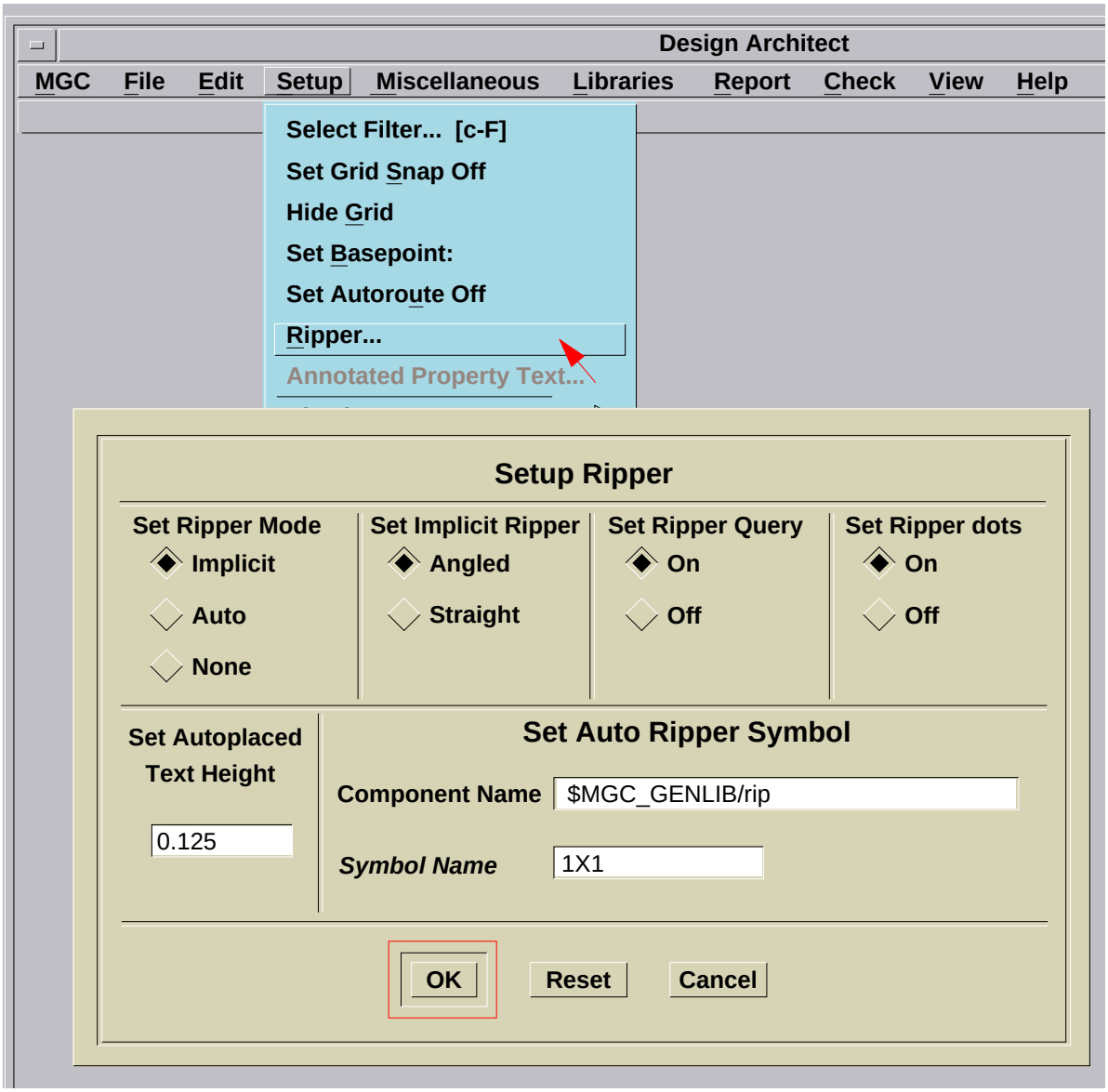
- wire 4 (the CLR wire) is connected to CONTROL_BUS(127)
- wire 0 (the PRE wire) is connected to CONTROL_BUS(126)
- wire 1 (the CLK wire) is connected to CONTROL_BUS(125)

The QB and Q wires are connected to DATA_BUS(1) and DATA_BUS(0), respectively.

Consider the following RULE property value example: **63:60, 34, 45, 0:3**

In this example, 10 wires from a 64-bit bus are ripped and turned into a sub-bus. The high-order bits 63, 62, 61 and 60 are specified as a range with wire 63 the most significant. Wire 34 is ripped next followed by wire 45. The last four wires are specified as a range with wire 0 the most significant of the four. If the ripper pin with this RULE property value is connected to the bus DATA(0:9), then wire 63 on the source bus is connected to DATA(0) and wire 3 on the source bus is connected to DATA(9).

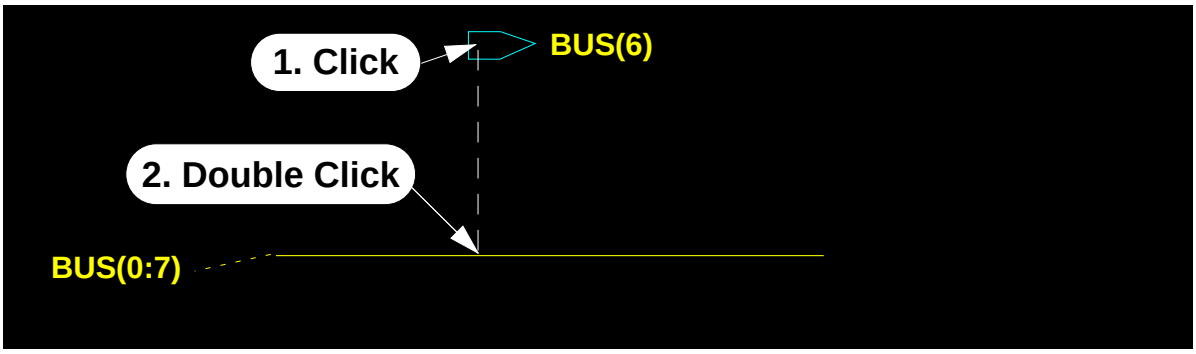
Setting up the Ripper

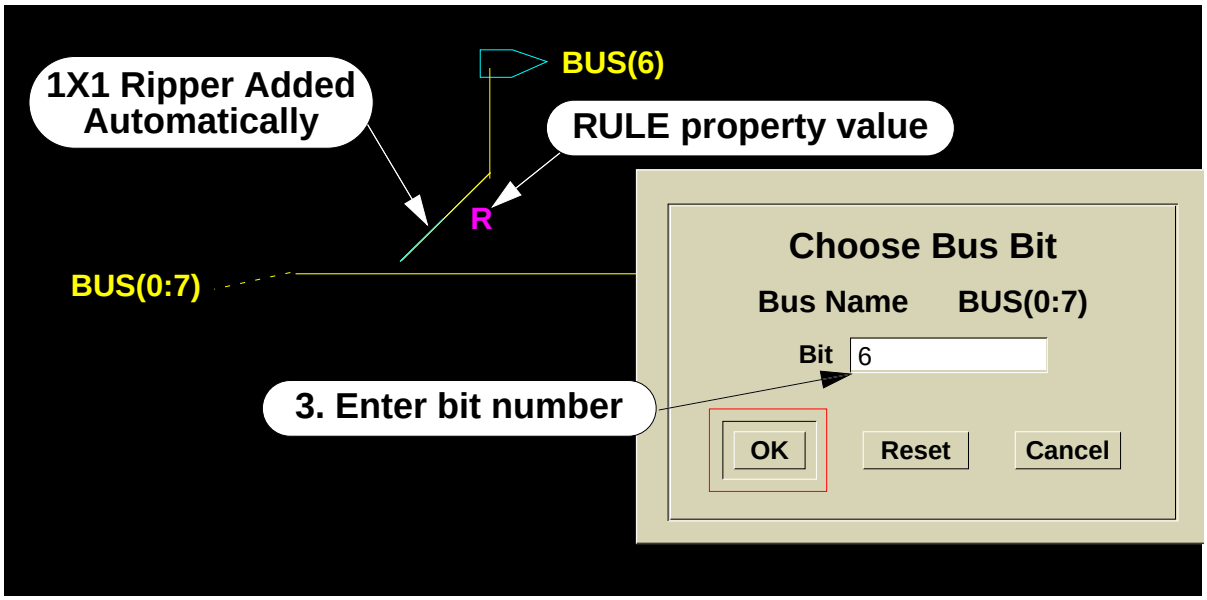


Setting up the Ripper

The illustration on the opposite page shows the options you have in setting up bus rippers. The Schematic Editor will produce implicit bus rippers by default. If you choose **Automatic**, the specified explicit bus ripper is automatically added each time you connect a net to a bus or bundle. If you set the mode to **None**, you must manually add bus rippers to the schematic just like you would any other instance.None

Automatically Connecting a Bus Ripper

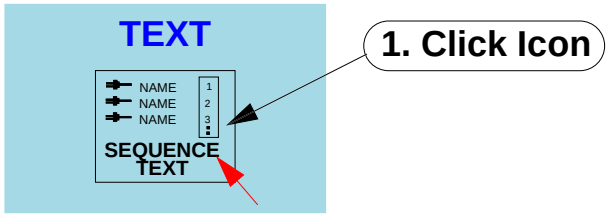


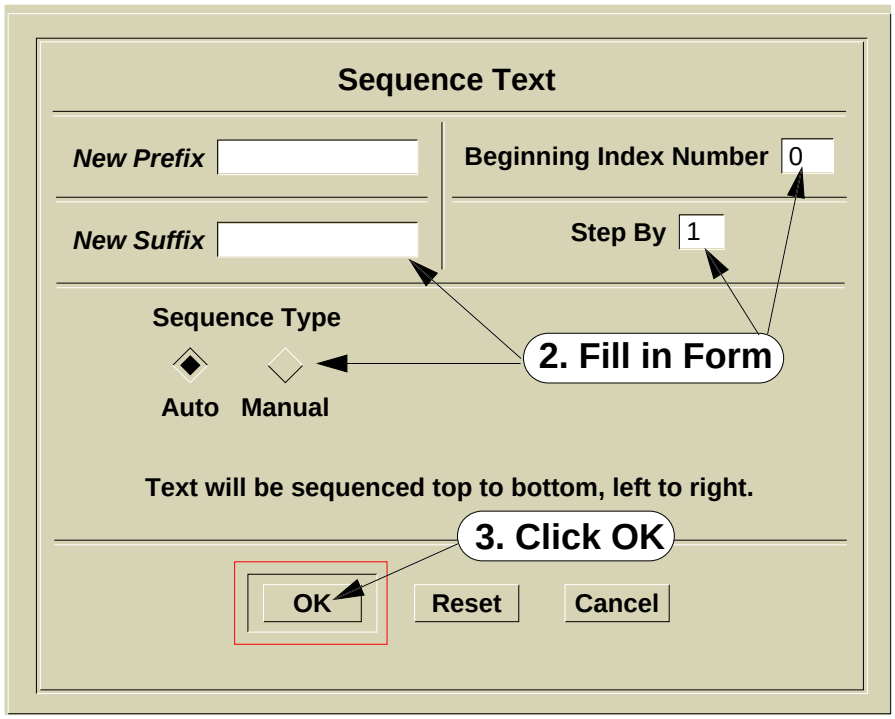


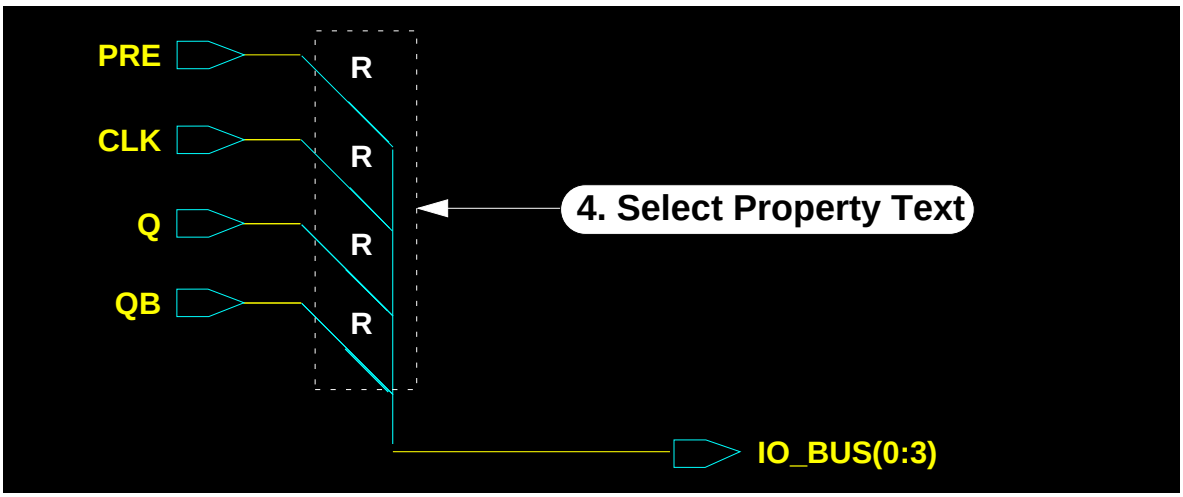
Automatically Connecting a Bus Ripper

If you specify the Ripper setup to be **Automatic**, the specified ripper symbol is automatically added each time you connect a net to a bus or bundle. A popup form appears requesting a value for the RULE property. If you are connecting a net to a bundle, the value of the RULE must match the name of an element in the bundle.

The Sequence Text Function





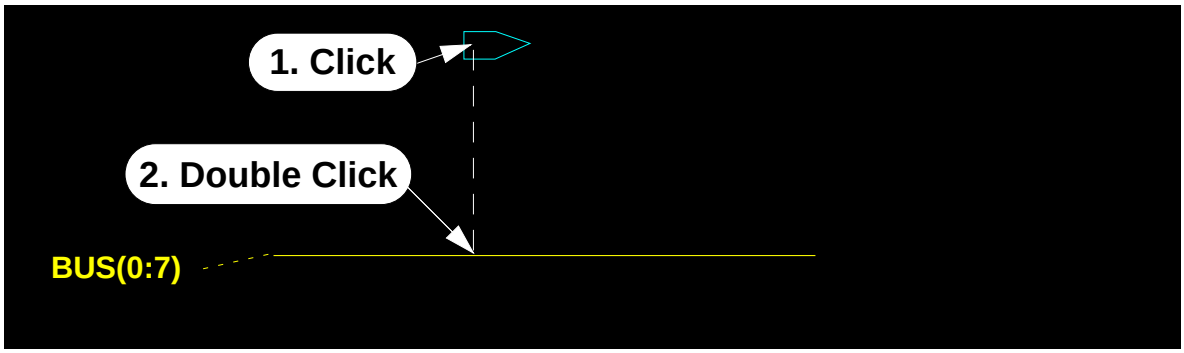


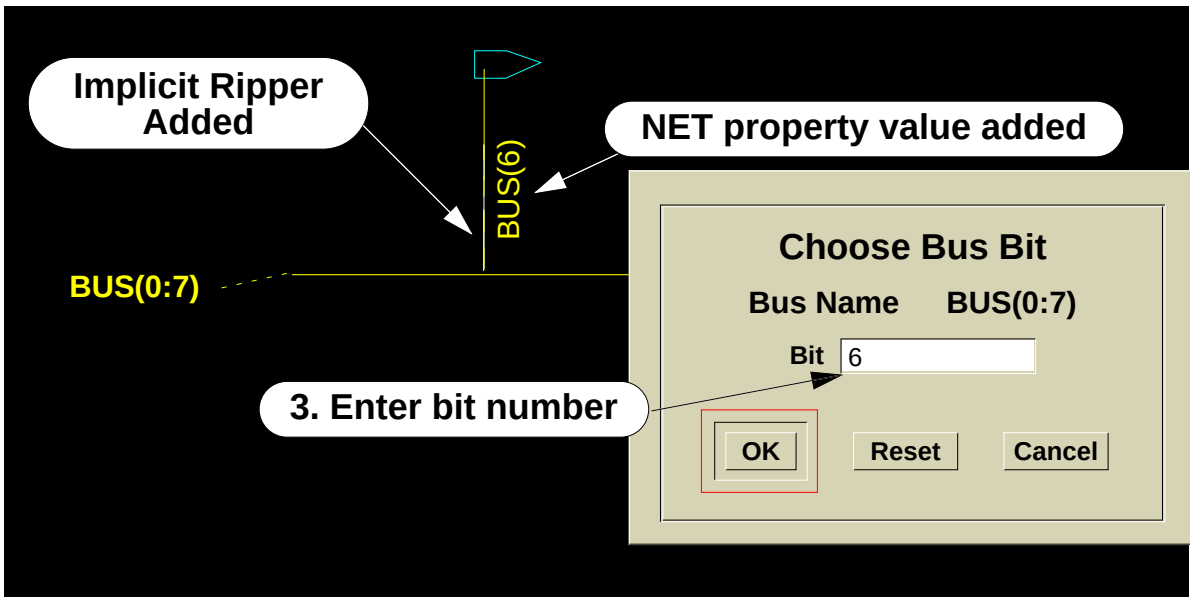
The Sequence Text Function

The sequence text function provides a quick way to assign values to properties such as RULE properties. The procedure is as follows:

1. Click the SEQUENCE TEXT icon on the **schematic_text** palette.
2. Fill in the form. Specify the beginning index number and the increment for each step. A Prefix or Suffix can also be specified. For example, a prefix of “D” generates numbers like D1, D2, and so on. If you click **Manual**, you assign the incrementing numbers by clicking on each piece of property text, otherwise the numbers are assigned automatically top to bottom, left to right.
3. Click on OK.
4. Select all the property values to be assigned with the bounding box, or for manual assignment, click on each piece of text, one-at-a-time.

Implicit Ripper





Implicit Ripper

When you specify the Ripper setup to be **Implicit** (the default), the net is connected directly to the bus or bundle as shown on the opposite page. Instead of a RULE property, a NET property is used to specify by name which net is ripped from the bus or bundle.

Frames

- **Graphical boxes that enclose a collection of circuitry**
- **Provide the ability to repeatedly or conditionally include a circuit in a design**
- **Used on schematic sheets only**
- **Number of iterations/conditions controlled by parameters found in the frame expression**
- **Frame expression defined by the FREXP property**
- **Frame expression types:**
  - **IF**
  - **FOR**
  - **CASE**
  - **OTHERWISE**
- **Choose ADD > Frame**

Frames

A frame is a graphical box that encloses a collection of circuitry. Frames provide you with the ability to repeatedly or conditionally include a circuit in a design. Frames are used on schematic sheets only.

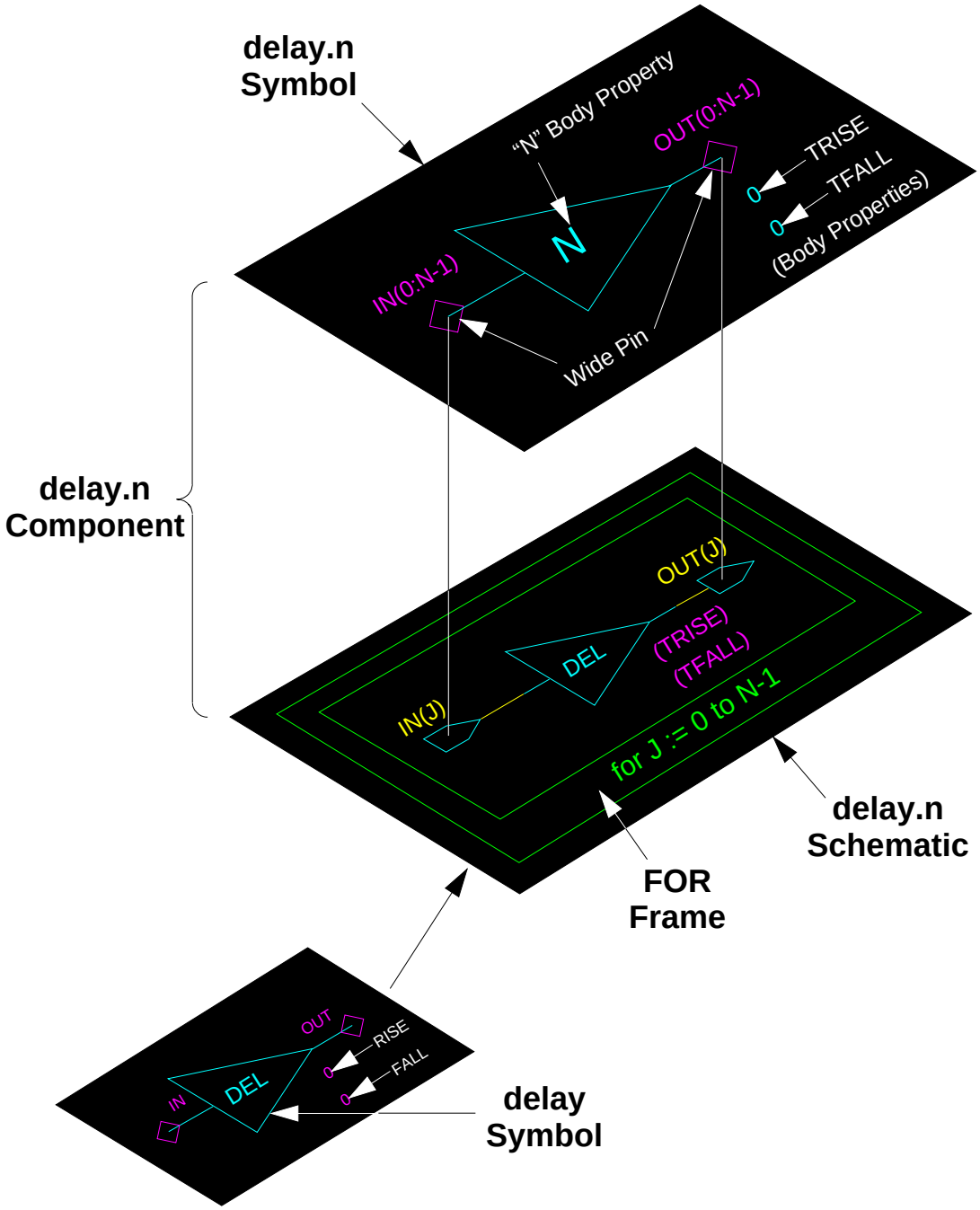
The number of iterations, or the conditions determining the inclusion or selection, are controlled by parameters assigned in the frame expression. The frame expression is the value of the FREXP property which is owned by the frame. The frame expression uses similar constructs to those used in high-level programming languages, but does not follow the standard AMPLE syntax. All frames must have the FREXP property assigned to them with a valid property value. The value assigned must adhere to a specific syntax, which uses such key words as FOR, IF, CASE, and OTHERWISE.

FOR frames are used when you want to repeat the same circuit over and over, not only in the same design but in different designs requiring a different number of copies of the frame. IF frames let you conditionally include circuitry in your schematic. The evaluation of an IF frame expression results in TRUE or FALSE conditions.

CASE frames allow you to define cases when a portion of a circuit is included in a schematic. If the CASE frame expression evaluates to TRUE, the circuitry is added. If it evaluates to FALSE, the circuit is not included; and if an OTHERWISE frame exists, the OTHERWISE circuit is included.

You may add a frame to you schematic by choosing the **ADD > Frame** popup menu item.

Frame Example



Frame Example

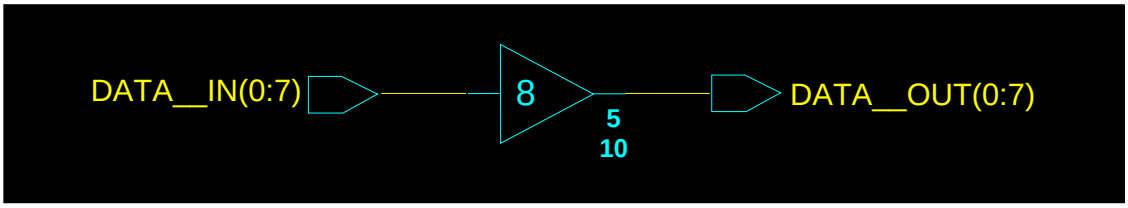
The illustration on the left shows how a FOR frame can be used to create an instance for a bus of varying width. The $MGC_GENLIB components **delay** and **delay.n** are used in this example.

Starting at the bottom of the illustration, the **delay** symbol is used to represent a given amount of delay on a net. The RISE and FALL properties are owned by the OUT pin and are set to a 0 value.

Moving up one level, the **delay** symbol is instantiated on a sheet in the **delay.n** component. The values of the RISE and FALL properties are defined to be expressions TRISE and TFALL, respectively. The instance is enclosed by a FOR frame with an expression that expands the Frame N times when the component is evaluated by a downstream tool. The port names on the sheet are defined as array elements that follow the incrementing value of J as the frame expands. If N is defined to be 4, then this schematic is evaluated the same as if the circuit were included four times on the sheet.

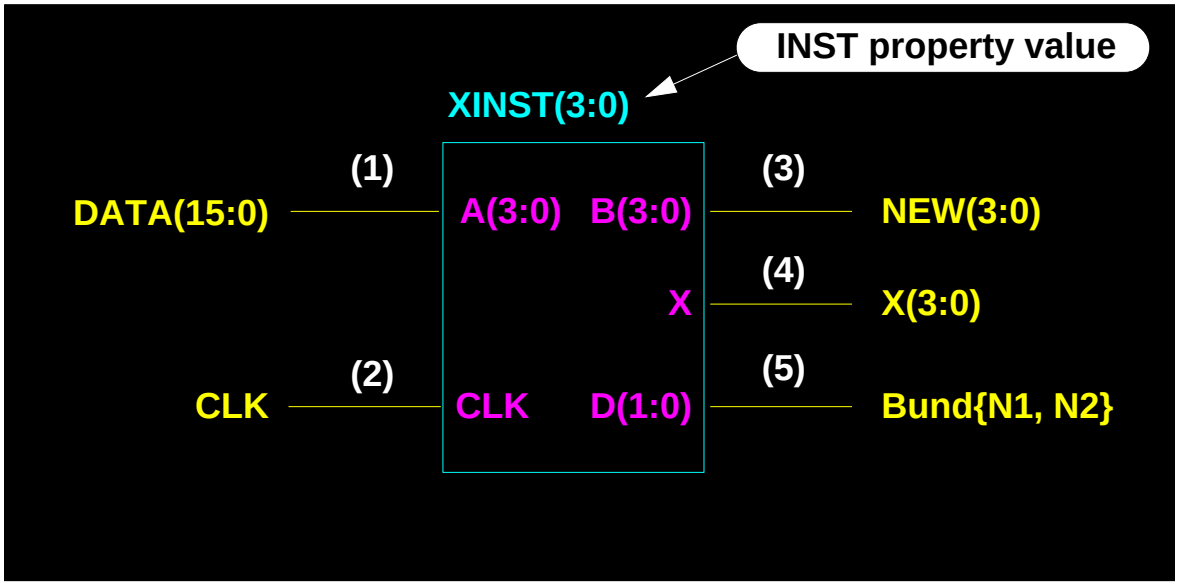
Moving up one level, the symbol for **delay.n** is shown at the top of the illustration. The symbol owns three body properties N, TRISE, and TFALL that contain values that will be used as parameters for the symbol pins and the sheet below. The symbol pins are called “wide” pins, because the names are defined in the form of a bus. The names also contain an unknown value “N” which is defined by the N property on the symbol body.

The following illustration shows how the **delay.n** component might be used.



In this example, the delay.n instance is connected to buses that are 8-bits wide. The N property is set to 8. The total delay for each bus wire is specified as 5ns rise and 10ns fall. At evaluation time, a delay instance will be generated for each wire on the input and output buses.

Repeating Instances



Repeating Instances

A repeating instance is a short-hand way to specify a FOR Frame. It allows a single instance to be repeated by naming the instance with a one dimensional range, using the “INST” property (e.g. INST = XINST(3:0)). Appending an optional range to the “INST” property value defines the number of times the instance will be repeated in the evaluated model, and how the nets will be connected to each repeated instance. Connections are implied by the ratio of the dimensions of a connected wire or bus to the dimensions of the pin of the repeated instance.

A FOR Frame with the expression “for I28_REPEAT := 0 to 3” will be created by Design Architect when this schematic is evaluated within the context of a Design Viewpoint. Four instances named XINST#0, XINST#1, XINST#2, and XINST#3 will be generated. Each instance will have the same set of pins (A(3:0), B(3:0), CLK, X, and D(1:0)), but some pins will be attached to different nets as follows:

1. The pin XINST#0/A(3:0) will be attached to the net DATA(3:0), the pin XINST#1/A(3:0) will be attached to the net DATA(7:4), the pin XINST#2/A(3:0) will be attached to the net DATA(11:8), and the pin XINST#3/A(3:0) will be attached to the net DATA(15:12).

2. The net CLK will attach to the CLK pin on each repeated instance.

3. The pin XINST#0/B(3:0) will be attached to the net NEW(3:0), as will the pin XINST#1/B(3:0), and so on.

4. The pin XINST#0/X will be attached to the net X(0), the pin XINST#1/X will be attached to the net X(1), and so on.

5. The pin XINST#0/D(1:0) will be attached to the NetBundle Bund{N1, N2}, as will the pin XINST#1/D(1:0), and so on.

Selection Sets

- **Open selection set; list of currently selected objects**
- **Closed selection set; list of objects in previous selection set**
- **Added to list: graphics, text, instances, nets, and selected objects**
- **Selection set closed when objects are manipulated**
- **Closed selection set accessed by:**
  - **Select > Reopen Selection**
  - **Select > Reselect**

Selection Sets

Two selection sets are maintained:

1. **The open selection set**. Contains a list of the currently-selected objects.
2. **The closed selection set**. Contains a list of objects that were selected in the previously-opened selection set.

Objects placed in an editor window, such as instances, nets, comments, and properties are added to the open selection set at creation time (if auto-selection is on and the additive selected mode is used). Objects that are explicitly selected are also added to the open selection set. The open selection set becomes closed when objects are manipulated by commands like Move, Copy, and Rotate. After the command is executed, a new selection set is opened for the next selection.

You can access the contents of the closed selection set by invoking the **Reopen Selection** or **Reselect** commands. When you do, the contents of the closed selection set are added to the contents of the current selection set (this selection set could be empty).

Each sheet or symbol opened in a Schematic Editor or Symbol Editor window has its own open selection set and closed selection set.

Undo and Redo

- Undo reverses the previous “undoable” action

- Redo (from popup menu) reverses the previous undo
- DA supports more than one level of undo and redo. Default level is set to 5.
- Not all functions are undoable

Undo and Redo

Undo reverses the action of the previous function called in any window within a Design Architect session. You can click the **UNDO** button on the palette or draw the undo stroke (shown on the left page) to undo a previous action.

The default number of undo levels is 5. You can change the undo level by choosing the **Setup > Other Options > Undo Level** pulldown menu item. Remember, the more levels of undo you specify, the more memory is taken up holding this levels in reserve.

Not all functions are undoable. For example, the function executed when you choose the **Setup > Other Options > Undo Level** is not undoable. Design Architect will undo the next undoable function that was previously executed and ignores all non-undoable functions that followed it.

Redo lets you recover from unwanted undos and has the same number of levels as undo.

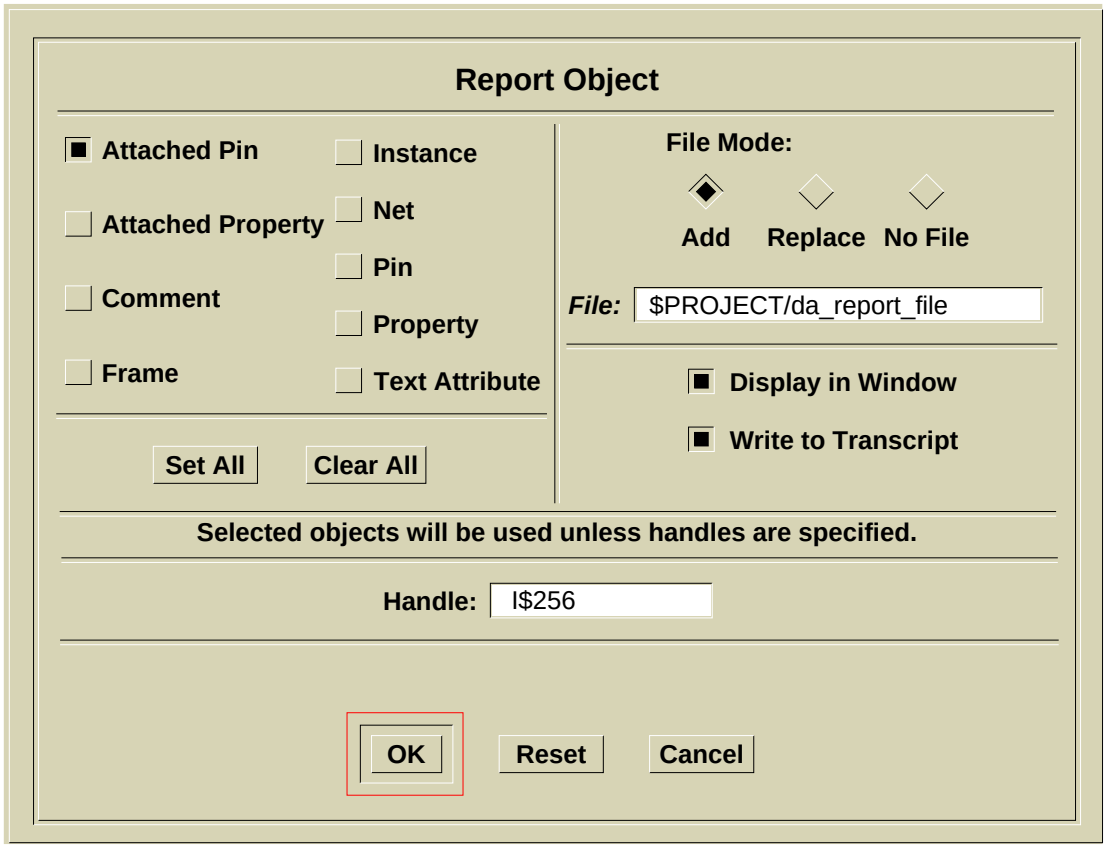
Reporting on Schematic Objects

1. **Select the Object(s)**

2. **Draw the report stroke** 

   or

- **From the pulldown menu bar:**
  Report > Object > As Specified...



Reporting on Objects

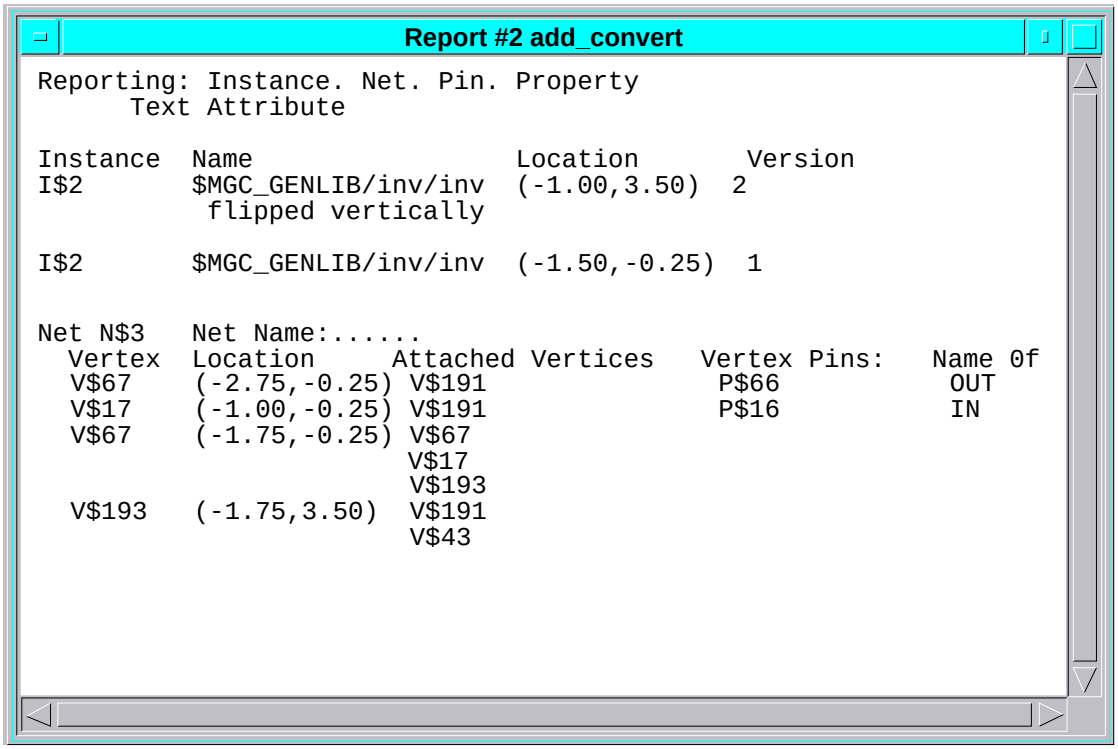
You can review the status of schematic and symbol objects in the Schematic and Symbol Editor windows by accessing the **Report > Object** menu item. If you select one of the **Report > Object > Selected** menu items, the resulting report provides information on the selected objects in the active window. The report is generally displayed in a popup message window and is also placed in the transcript by default.

If you select the **Report > Object > As Specified** menu item, a Report Object dialog box is displayed. The Report Object dialog box displayed on the facing page (in the Schematic Editor) lets you report on several types of objects: attached pins, attached properties, instances, nets, pins, vertices, comments, properties, and text attributes. Or, you can report on specific handles. If you type in a handle name in the Handle text entry box, another Handle text entry box appears. You can type in as many handle names as you want to specify. If you type at least one handle name, this takes precedence over the object types you selected at the top of the dialog box. You can also change the default report options (window, transcript, and file mode) that are used for this report.

Every graphical comment and electrical object has an associated handle. A *handle* is a unique, system-defined identifier. A handle consists of one of the following key letters, followed by the dollar sign character ($) and a system-assigned number: C (comment), F (frame), I (instance), N (net), P (pin), T (property text), and V (vertex).

The Symbol Editor dialog box is similar to this dialog box, except it has different types of objects that you can report on.

A Report Window Example



A Report Window Example

The example on the facing page is the result of a **Report > Object > As Specified** menu item on selected instances, nets, pins, properties, and text attributes. Note that the top of the report window indicates the type of objects that were specified in the Report Object dialog box.

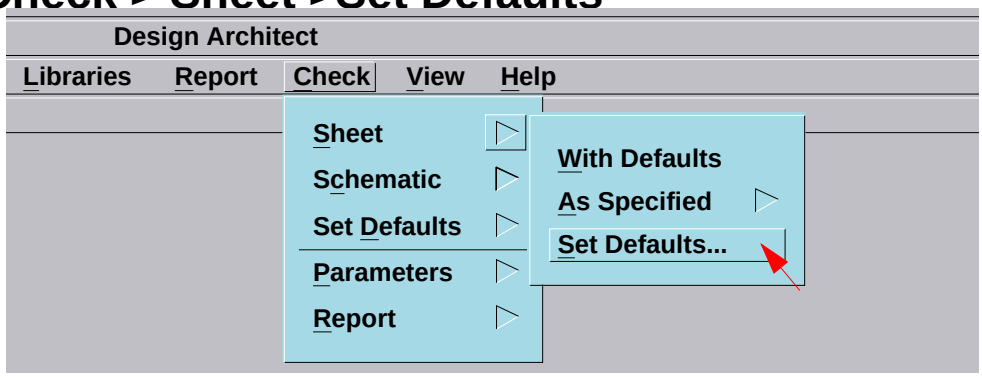
Information on instances includes: handle name, full pathname, location on sheet, and orientation.

Information on nets includes: handle name, net name, vertex handle names, locations of vertex handles, attached vertices handle names, vertex pin handle names, pin names, and location of pins.

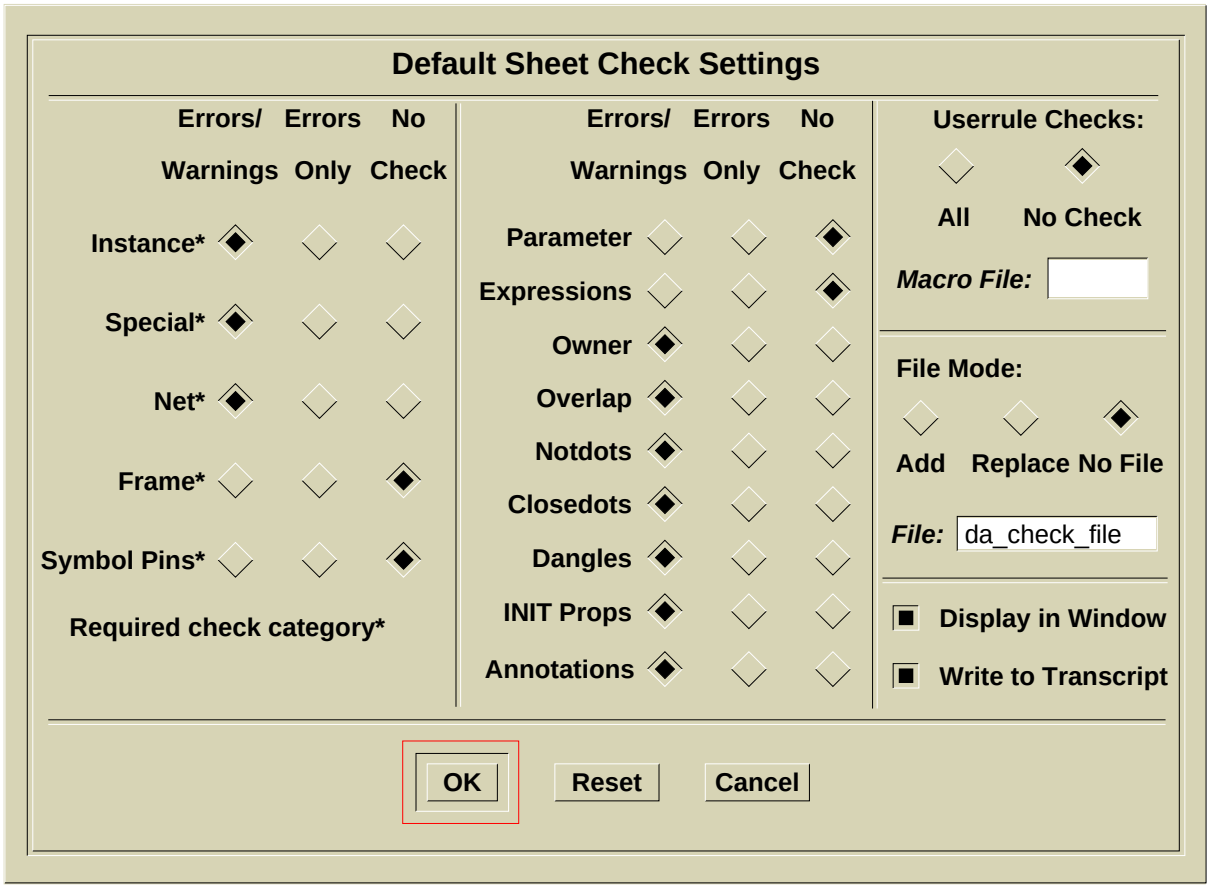
Selecting a handle in a report window causes the corresponding objected to be selected in the corresponding schematic or symbol window.

Setting Check Levels for Sheets

- **Check > Sheet >Set Defaults**



- **Displays:**



Setting Check Levels for Sheets

You can change the sheet check level defaults by selecting the **Check > Set Defaults > Sheet** menu item.

Required Sheet Checks

Instances. Checks for a valid Inst value, instance registered with an interface.
Special instances. Checks port, offpage, net, global, bus ripper, null.
Nets. Checks for valid net names, duplicate net names.
Frames. Checks frame overlap, frame expression, instance or pin overlap.
Symbol Pins. Checks for the existence of symbol pins on the sheet.

If you set the required checks to Nocheck, when the schematic sheet is evaluated in the downstream applications, the application will issue a warning that the sheet did not pass the required checks.

Optional Sheet Checks

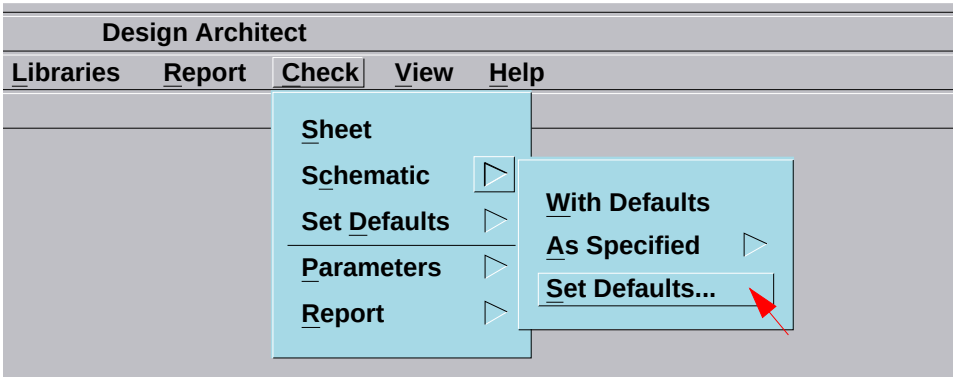
Parameters. Checks for parameter evaluation.
Expressions. Checks for expression evaluation.
Owner. Checks to make sure that all properties have the right owners.
Overlaps. Checks for bounding box instance overlaps.
Notdots. Checks for not-dot existence on sheet.
Closedots. Checks existence of visual dot vertices on net connections.
Dangles. Checks for existence of unconnected nets and unconnected pins.
INIT Props
Annotations Checks for annotations on fixed or protected properties.
Userrules. Checks user-defined checks.

User-Defined Sheet Checks

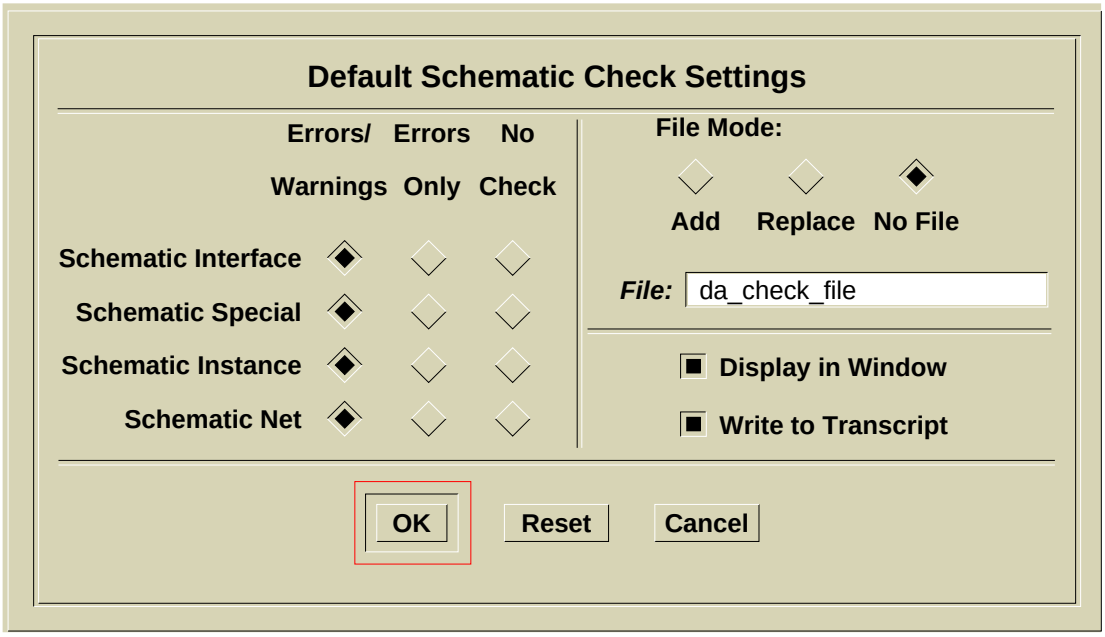
You can specify a user-defined macro file (written in AMPLE) that contains your own checks, and specify the pathname to the file that contains your user-defined checks. You can also change how the check results are displayed or stored. Check results are generally displayed in a check status window, placed in a transcript, but not stored in a file. You can change the values of these items by clicking the appropriate button.

Setting Check Levels for Schematics

- **Check > Schematic > Set Defaults...**



- **Displays**



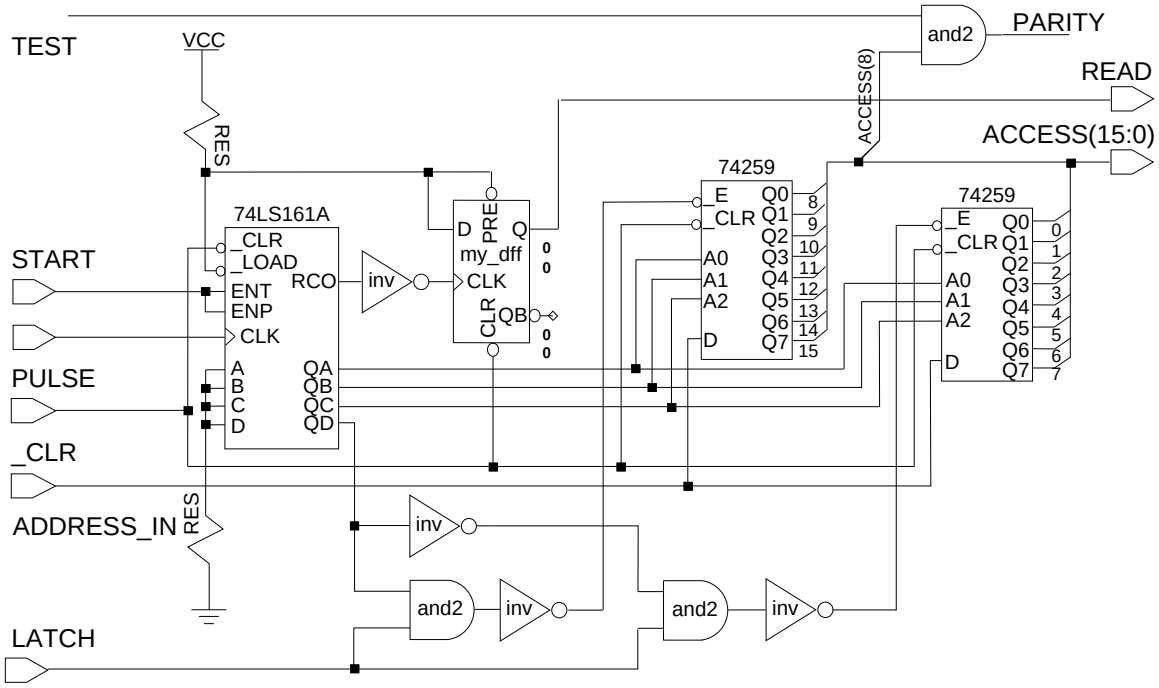
Setting Check Levels for Schematics

You can check all the sheets associated with a particular schematic using the default check levels, by selecting the **Check > Schematic > With Defaults** menu item. This level of check is useful for checking connectivity across sheets and doing other levels of user-defined checks.

Interface. Checks to verify a symbol pin matching a net on a schematic, a port on schematic matching a symbol pin, a symbol pin matching a port on a schematic.
Special instances. Checks on/offpage connectors, checks nets with same name on different sheets connected using on/offpage connectors.
Instances. Checks for valid Inst property values.
Nets. Checks to verify net and global have the same name, shorted global net.

You can specify a user-defined macro file that contains your own schematic checks, and specify the pathname to the file that contains your user-defined checks. You can also change how the check results are displayed or stored. Check results are displayed in a check status window, placed in a transcript, but not stored in a file. You can change these values by clicking the appropriate button.

Lab Overview



Lab Exercises

Print Out the Lab Exercises

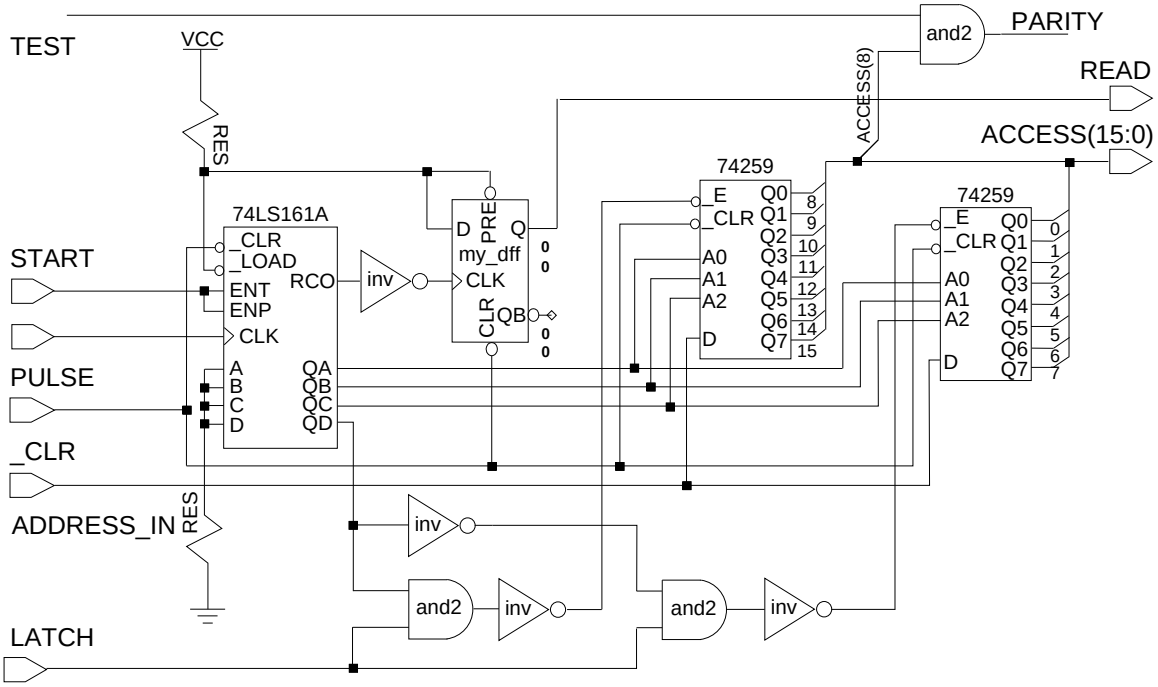
If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Creating a Hierarchical Design

Introduction

In this exercise you will create a schematic for a new component called **add_convert.** The main purpose of this circuit is to receive a 16-bit serial address and convert the address to 16 parallel bits. The circuit uses the **my_dff** component that you created in the last module and you will use components from $MGC_GENLIB and a special component_lib in your da_n directory.

The purpose of this exercise is to give you practice developing a new schematic from scratch with very little direction. This is a “free form” skill building exercise giving you a chance to become more proficient using strokes, palettes, and other DA user interface features. The directions in this exercise suggest a strategy for developing the schematic, but you may approach the task using a different methodology if you choose.



You will successfully complete this exercise when you have accomplished the following three objectives:

1. All symbols instantiated on the sheet as shown in the previous figure.
2. All instance pins connected as shown in the previous figure.
3. Schematic successfully checked with zero errors and warnings.

Component List

The **add_convert** schematic contains symbols from the following components

Components from Mentor Graphics gen_lib:

$MGC_GENLIB/vcc
$MGC_GENLIB/ground
$MGC_GENLIB/portin
$MGC_GENLIB/portout
$MGC_GENLIB/inv
$MGC_GENLIB/and2
$MGC_GENLIB/rip(use 8X1 symbol)
$MGC_GENLIB/rip(use 1X1 symbol)

Components from ...training/da_n/component_lib:

74ls161a (use MG_STD symbol)
74259 (use MG_STD symbol)
res.alt

Special Component:

Your **my_dff** component.

Open a New Schematic for add_convert

1. Activate a Design Architect session window.
2. Set the working directory to: **...training/da_n/card_reader**

3. Click on the OPEN SHEET icon.
4. Fill in the Open Sheet dialog box with the following information:

   Component Name: **add_convert**

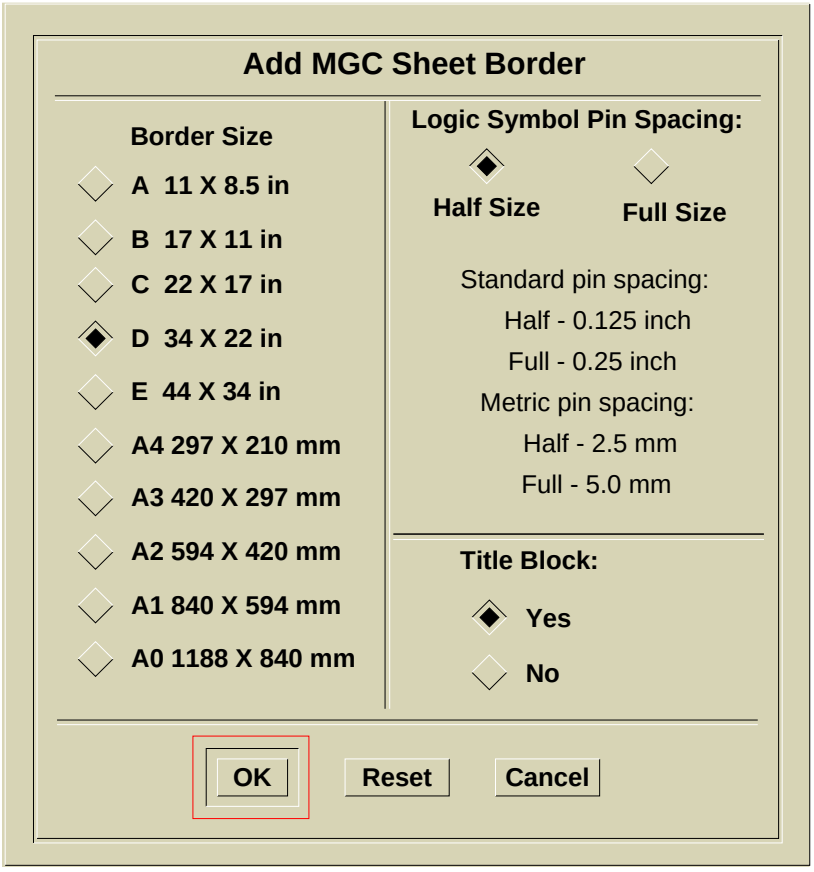
   a. Click **OK.** A new (blank) sheet should come up.

Add a Sheet Border and a Title Block.

1. Choose the following pulldown menu item:

   Edit > Add Sheet Border...

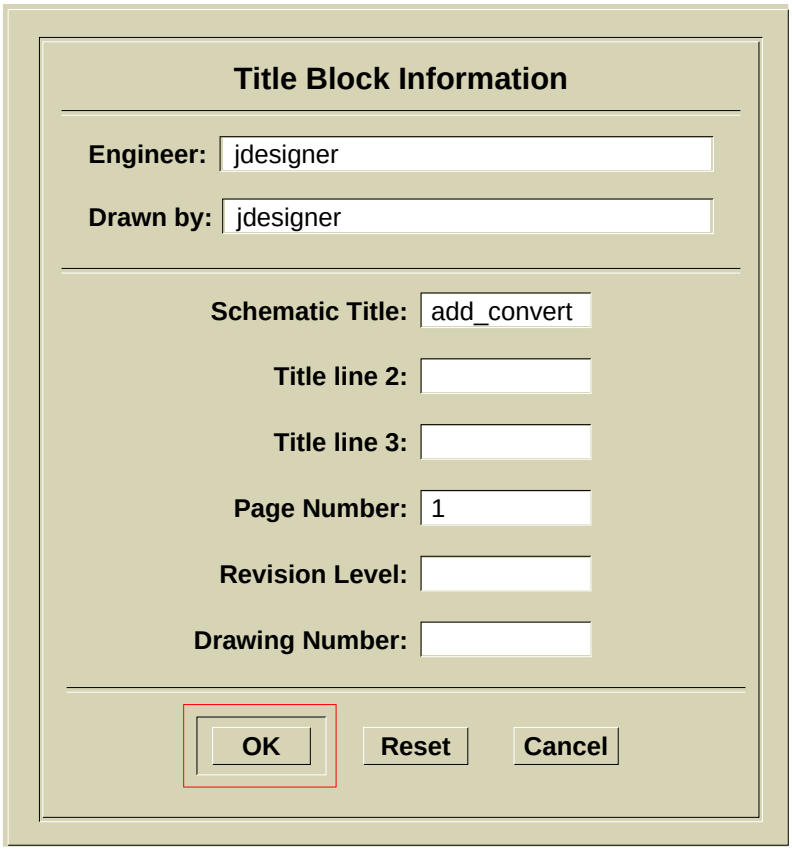
   The Add Sheet Border dialog box is displayed as follows:



   As you can see, there are 10 different sizes of sheet borders that are supported by Design Architect. The default size is size D.

The Logic Symbol Pin Spacing indicator is set to **Half Size**. The indicator specifies whether the symbols are specified as half size or full size. The default is Half Size. Also, notice that the Title Block indicator is set to **Yes**. This means that a title block will be added to the sheet border that you have specified.

2. Click **OK**. Notice that the sheet border is added to the **add_convert** sheet, but. before you can begin editing, the **Title Block Information** dialog box is displayed on the screen as shown below:



Notice that the **Engineer:** and **Drawn By:** entry boxes are filled in with your login name. The **Schematic Title:** entry box is filled in with the component name, which in this case is **add_convert**. The Page Number entry box is filled in with **1** because this is sheet1 of the schematic.

3. Type the following information into the form:

Revision Level: A

Drawing Number: 1

4. Click the **OK**. The title block is added to the sheet border.

Verify the Pin Spacing and Grid Settings

Choose the following pulldown menu item:

Setup > Net/Comment/Page > Page: The Setup Page prompt bar is displayed.

To what values have the pin spacing and user units been set to?

_____

1. Click **Cancel**.
2. Choose the following pulldown menu item:

   Setup > Grid/Report/Color > Grid... The Grid dialog box is displayed.

   To what values have the Grids Per Pin, Minor Multiple, and Major Multiple text entry boxes been set to?

   _____

3. Click **Cancel**.

   What is the pin spacing between each Minor Multiple? _____

   What is the pin spacing between each Major Multiple? _____

Add Instances to the Sheet

Place instances of each component on the sheet in the center area defined by the sheet border. Use the diagram at the beginning of this exercise as a guide.

Add Nets to the Sheet

Add nets to the schematic in any order. Try using the autoroute feature by choosing the pulldown menu Setup > AutoRoute On

Note

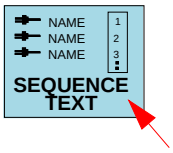
When you add the wire from the middle of the ACCESS bus to the input of the and2 instance, a single “implicit” bus ripper is automatically added. Specify bit “8” in the popup form.

Modify NET Property Values

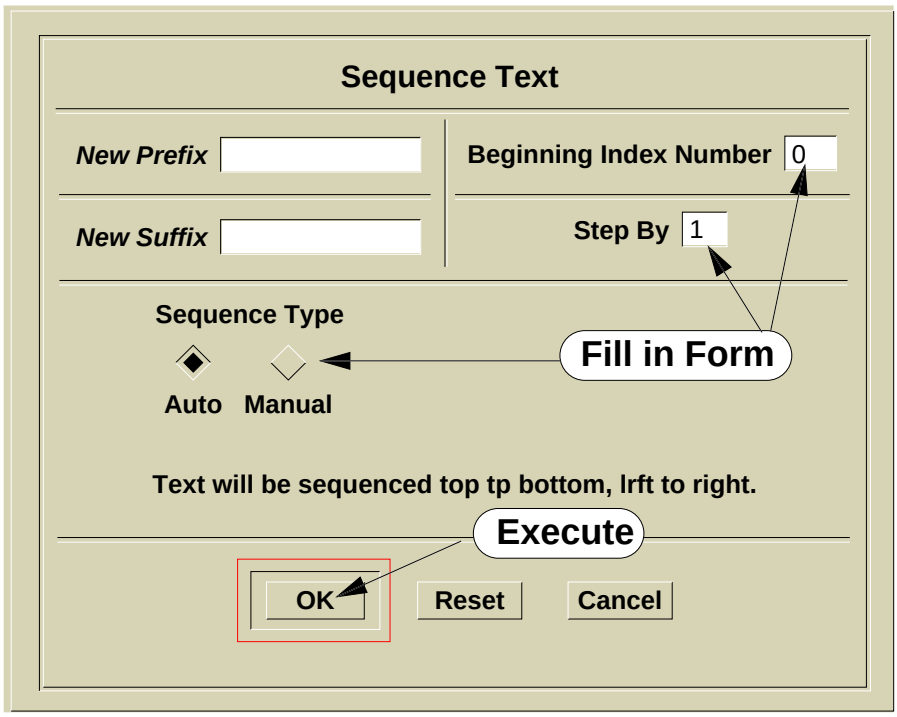
Select and change the NET property values to the appropriate names. If you changed the Modify Property stroke to ⌐► in the last customizing exercise, try using this stroke to change the values.

Use Sequence Text to Change the RULE Property Values

1. Zoom into the area that contains the two 8X1 bus rippers.
2. Make sure everything is unselected.
3. Choose the **SEQUENCE TEXT** icon on the **schematic_text** palette.



4. Fill in the form as follows:



5. Select the area around the right-most ripper symbol. Notice that the R values are automatically converted to numbers from 0 to 7.

6. Unselect everything on the sheet.

7. Convert the R property values on the left-most ripper symbol, choose the **SEQUENCE TEXT** icon again.

8. Change the **Beginning Index Number:** to **8**

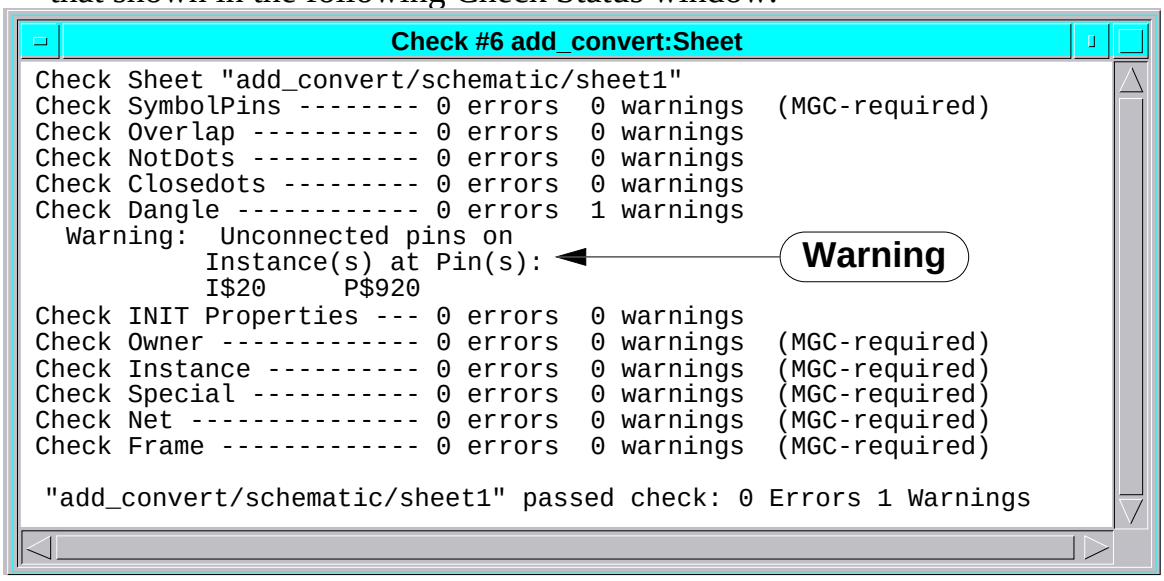
9. Click the **OK**.

10. Select the area around the left-most ripper symbol. Notice that the R values are automatically converted to numbers from 8 to 15.

11. Unselect everything on the sheet.

Check the Sheet

1. Check the sheet using default check values. You should see results similar to that shown in the following Check Status window.



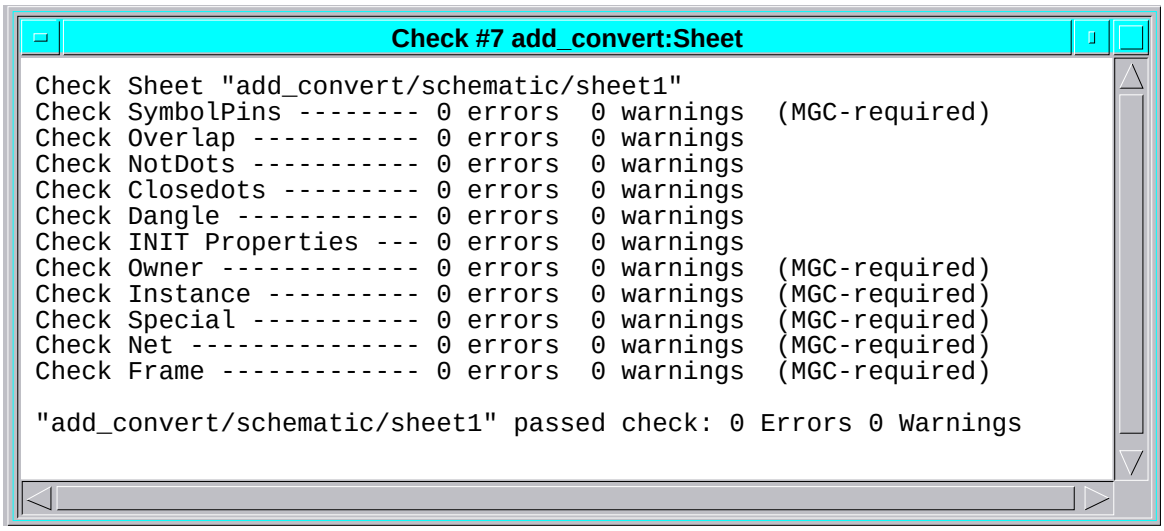
Tell the System that the Dangling Pin in OK

Remember that the goal is to produce a sheet that checks without errors or warnings. Now tell the system that the dangling pin on the **my_dff** instance is there on purpose.

1. Highlight the pin handle name in the Check Status window and look for the selected pin on the schematic sheet.
2. Close the Check Status window.
3. Zoom into the area around the selected pin.
4. Unselect the pin, then select the Net Vertex on the Pin.
5. Add a CLASS property to the vertex with a value of “dangle”.

Check the Sheet Again

1. Recheck the sheet. The dangle warning should go away as shown in the following figure:



2. Close the Check Status window:

Save the Sheet

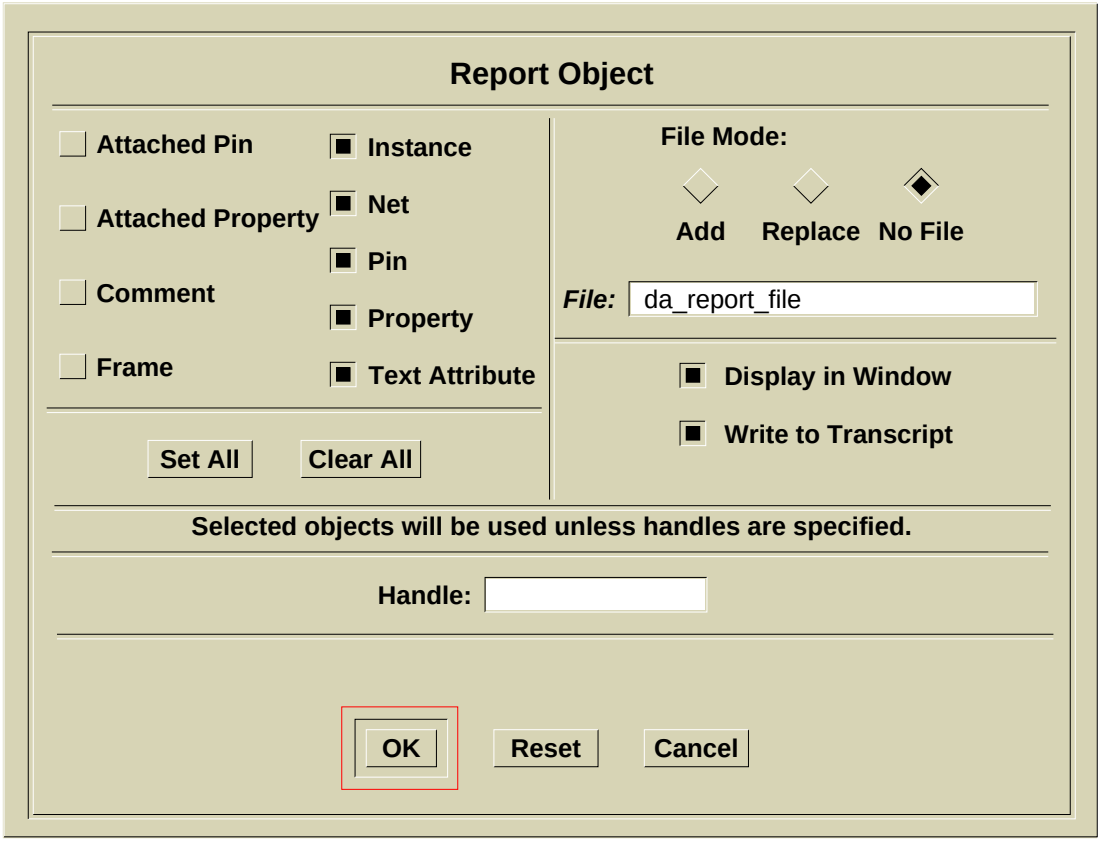
Save the sheet to disk as you have done in previous exercises.

Report on Sheet Status

1. Select an area that contains instances within the sheet.
2. Choose the following pulldown menu item:

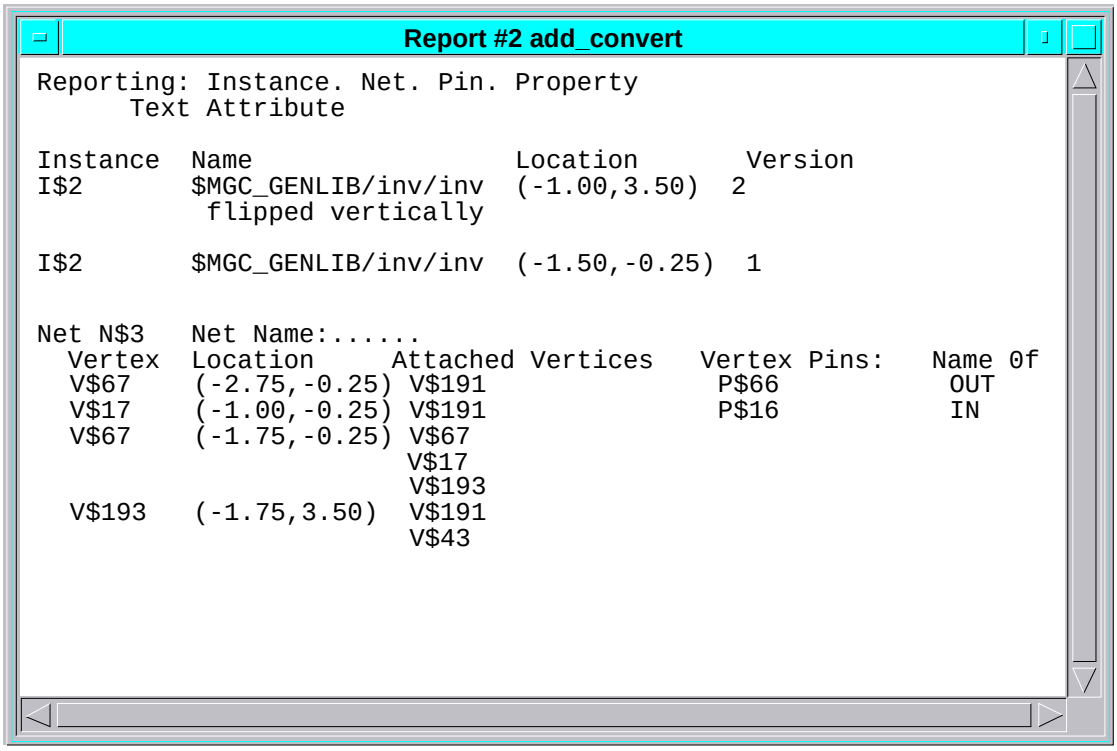
   Report > Object > As Specified...

The Report Object dialog box is displayed.



1. Click the **Instance**, **Net**, **Pin**, **Property**, and **Text Attribute** boxes as shown above:
2. Click **OK**.

A report window similar to the following is displayed specifying all instance, pin, net, property, and text attributes information associated with the selected objects.



3. Scroll to the right of the report window if you need to view the entire contents.
4. Close the report window.

Close the add_convert Schematic Window

Close the add_convert Schematic window as you have done in previous exercises.

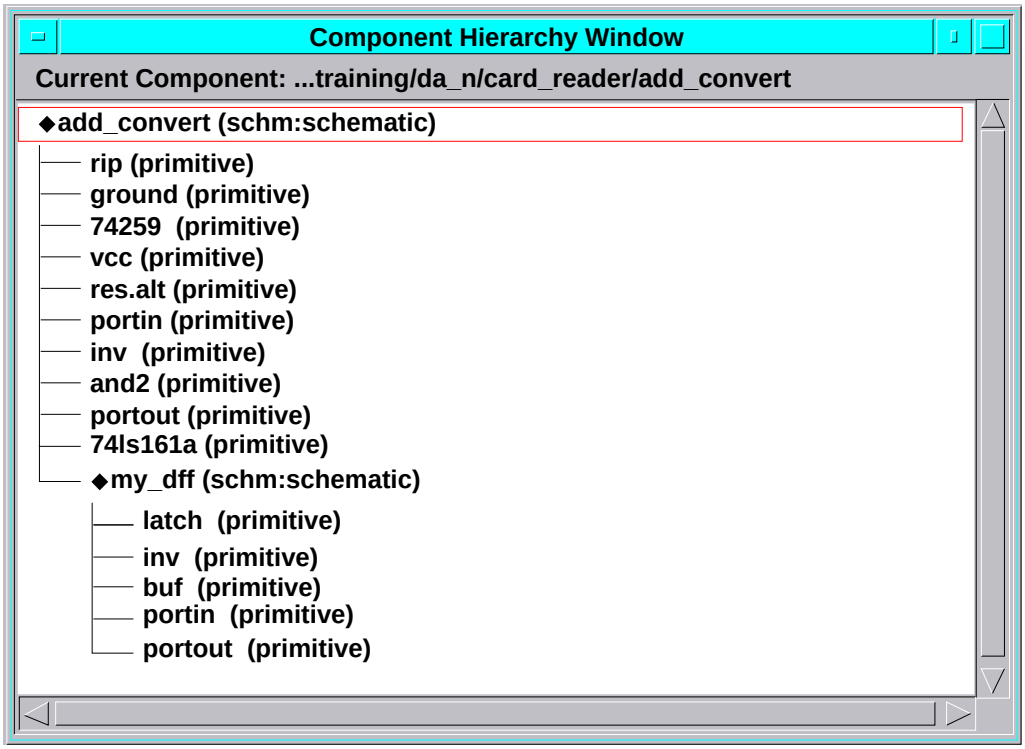
Exercise 2: Browsing the add_convert Component in the Component Hierarchy Window

It is helpful to keep track of the hierarchical structure of your design. The following exercise will instruct you on how to view the hierarchy of you newly created **add_convert** design in the Component Hierarchy Window.

1. Activate the DA Session window by clicking on it.

2. Click on the HIERARCHY WINDOW palette icon.

3. Select the **add_convert** component in the Navigator Window and click **OK**:



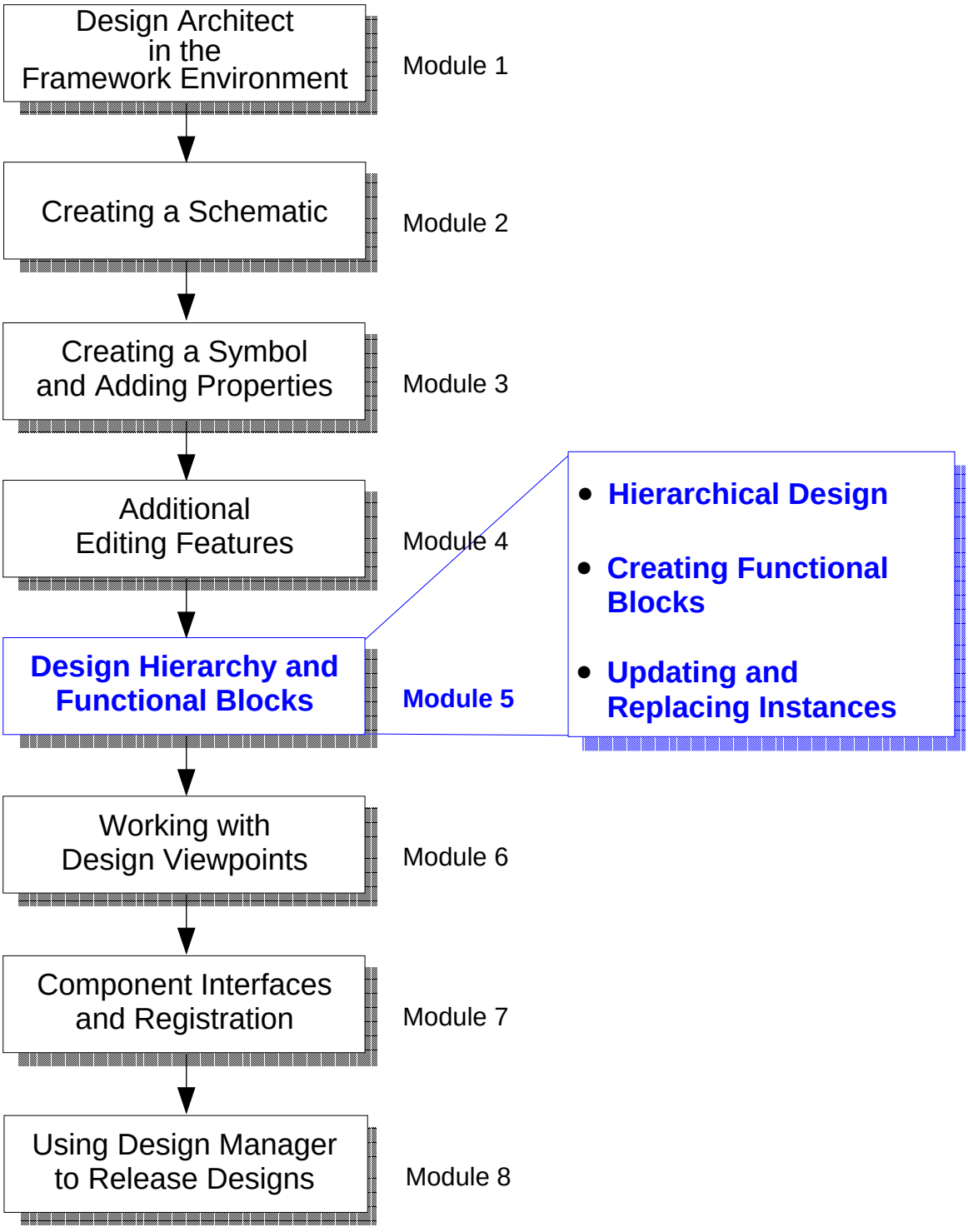
The Component Hierarchy window appears and shows you the structure of the **add_convert** schematic you just created. Click on the my_dff component to see the structure underneath.

End of Lab Exercises

This concludes the lab exercises for this module. If you have time, turn to Exercise 5 in **Appendix A - Customizing Exercises** and learn how to create a function that allows you to return to a previous zoom setting.

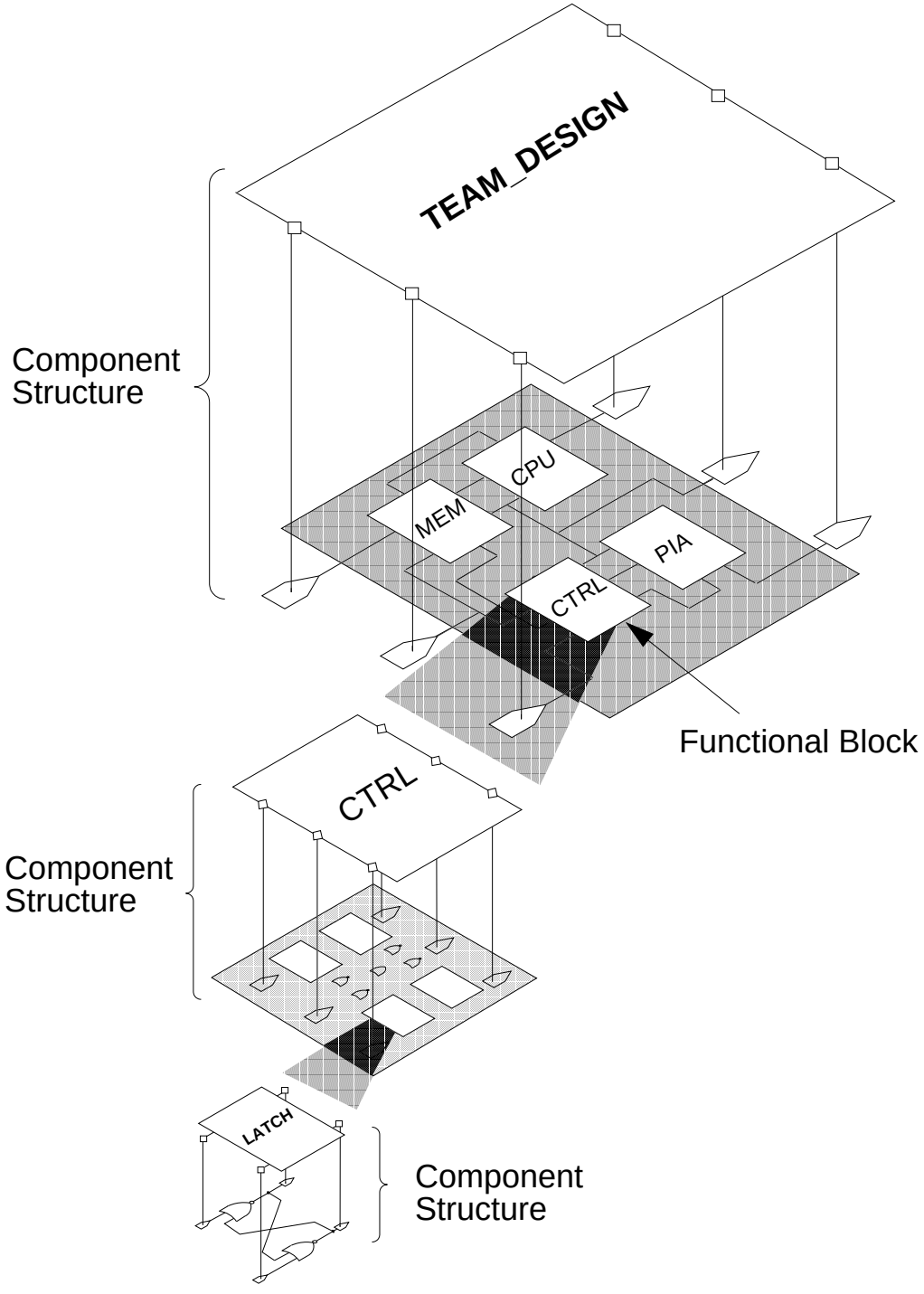
Module 5
Design Hierarchy and Functional Blocks

Module 5 Overview



Lesson 1
Design Hierarchy and Functional Blocks

Hierarchical Design



Hierarchical Design

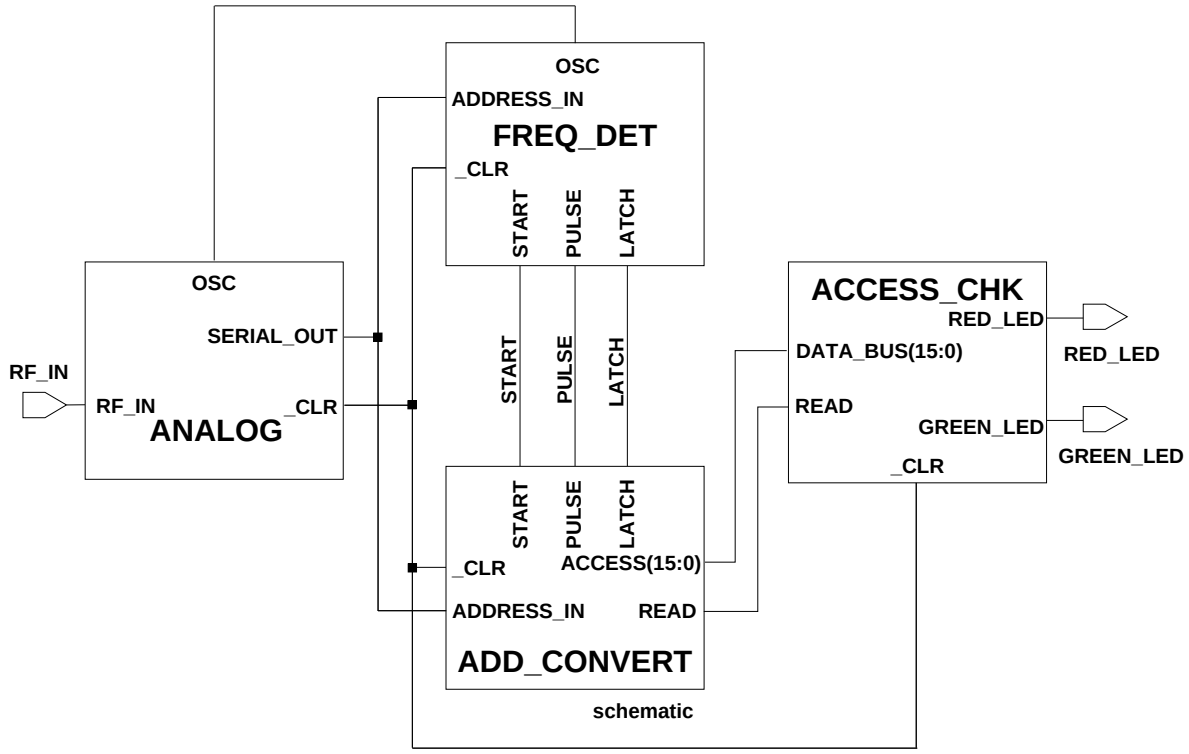
The illustration on the left shows a three-level hierarchical design that is represented by the symbol TEAM_DESIGN. Assume that this symbol represents an ASIC or other type of complex module that is ready to be instantiated on a sheet representing an even more complex system-level design. The TEAM_DESIGN schematic is broken into four functional blocks, each representing a more detailed structure. The CRTL block is represented by a schematic containing library parts, one of which is LATCH. The LATCH component is represented by a schematic with primitives (components that have no schematic).

Looking at the highest-level schematic, the state of development of the other three functional blocks is unknown. Each block could be empty (only containing a symbol), each could be supported by a high-level behavioral model, or each could be fully developed like the CTRL block.

Design Architect supports both top-down and bottom design methodologies, as well as anything in between. In the illustration on the left, any one of the component structures in the hierarchy could be developed first, followed by any of the others in random order.

Functional Blocks

- **Rectangular symbols used to represent major partitions at the higher levels of a design**
- **The blocks can be created right on the sheet using symbol editor functionality**



- **A behavioral model or a schematic model usually supports each block during simulation.**

Functional Blocks

When a design team creates a complex design like an ASIC, it is useful to create functional blocks at the higher levels, so the design can be divided into self-contained portions that each team member can develop and simulate separately.

Functional blocks are typically represented by rectangular symbols that represent a grouping of high-level functionality. Below a functional block may be a behavioral model, a schematic with more functional blocks, or a detailed lower-level schematic composed of library parts.

The whole design can be simulated and checked at various level of development, if the undeveloped functional blocks are supported by behavioral models that closely match the intended functionality of the circuit.

Creating Functional Blocks

- **You can create functional blocks by using:**
  - **The Symbol Editor**
  - **The Schematic Editor**
- **Creating a Block from the Schematic Editor:**
  - **Add Comment Graphics, Symbol Pins, and Properties**
  - **Select All Elements of the Block**
  - **Choose (pulldown) Edit > Make Symbol**
  - **Symbol is automatically:**
    - **Checked**
    - **Registered**
    - **Saved**
    - **Instantiated in Place**

Creating Functional Blocks

A functional block is basically a component structure just like any other library component. You can create a functional block from the Schematic Editor as well as the Symbol Editor. The advantage of using the Schematic Editor is that you can create a high level design “on the fly” without having to go to the Symbol Editor every time you want to create a new functional block.

The following list describes the steps required to create a functional block from the Schematic Editor:

1. Create comment graphics; select any of the icons in the **schematic_draw** palette.
2. Add symbol pins; choose the **ADD PIN(S)** icon.
3. Add properties to the comment graphics.
4. Select only the Comment graphics and symbol pins on the block.
5. Choose **Edit > Make Symbol** from the pulldown menu.

The results from this final step are:

- A new symbol is created. A new component structure is also created unless a component by the same name already exists at the specified pathname location.
- The symbol is automatically checked using default check values.
- If the symbol passes check, it is saved and automatically registered with the default component interface. (You can explicitly define an interface if you use the command line syntax.)
- The newly-created symbol is instantiated “in-place” on the sheet.

Lesson 2
Updating Instances on a Schematic

Updating and Replacing Instances

- **Updating**
  - **Reflects the Latest Version of the Symbol**
  - **May loose properties and property values, depending on how the update occurs**
  - **Two Ways to Update:**
    - **On OPEN SHEET; you can choose whether or not to update the instances**
    - **While the Sheet is Open:**
      (pulldown menu) Edit > Update
- **Replacing**
  - **Reflects the Latest Version of Another Symbol**
  - **Procedure**
    - **Select the Instance(s)**
    - **(pulldown menu) Edit > Replace**

Updating and Replacing Instances

Properties on an instance can be updated when a schematic sheet is opened and the instances on the sheet can reflect new (and updated) versions of the symbols, if those symbols were updated since the last time the sheet was opened. You can also manually update symbol instances one at a time by selecting the instance and choosing the **Edit > Update** menu item. This update process can delete some or all of the properties and property values you have placed and changed on a symbol instance, depending on how the update options are set.

You can choose whether or not you want to automatically update all instances on an existing sheet when that sheet is opened in a Design Architect session. If you do not update the sheet, and the symbols have changed, your sheet will fail check.

The **Edit >Replace** menu item lets you replace the symbol instance with an instance of another symbol.

Symbol and Instance Properties

- **Symbol-Specific Property**
  - **A Property Added to the Symbol**
  - **May or May not be Modifiable on an Instance**
- **Instance-Specific Property**
  - **A Property Added to a Particular Instance**
  - **Not Added if a Symbol Property by the Same Name Exists.**

Symbol and Instance Properties

There are two classes of properties that are electronically “visible” on an instance. These are:

- **Symbol-specific properties** Properties that are added to the symbol.
- **Instance-specific properties** Properties that are added to a specific instance on a sheet.

The following discussion concentrates on symbol-specific properties. These properties can be further subdivided into the following categories:

- **Fixed Properties** Symbol-specific properties that are never intended to be modified on the instance. These properties have their property stability switch value set to *fixed*. Examples are Pin and Class properties.
- **Variable and Protected Properties** Symbol-specific properties that are allowed to be modified on the instance. Property values with the *protected* switch set are only allowed to be changed at instantiation time. Property values with the *variable* switch set are allowed to be changed anytime. The value represents a nominal “default” value that is suitable for specifying the initial design but may not adequately specify the completed design. The nominal default value may be changed on the symbol as new libraries are released. Some examples are the Rise and Fall properties and the Model property.

Attribute-Modified and Value-Modified Properties

- **Sheet designer performs two types of edits:**
  - **Changes the property value**
  - **Changes the location or “look” of a property**
- **VALUE_MODIFIED flag set when value changes**
- **ATTRIBUTE_MODIFIED flag set when graphical attributes are changed and when the value is changed**
- **VALUE_MODIFIED flag can be manually set with the pulldown menu:**

Miscellaneous > Mark Property Value

Attribute-Modified and Value-Modified Properties

There are basically two types of “edits” that a sheet designer can perform on properties on the instance. If the designer moves a property value relative to the instance, or changes the text height or justification of the value, then an **attribute** of the property value has been modified. The property now has a flag attached to it, called the ATTRIBUTE_MODIFIED flag.

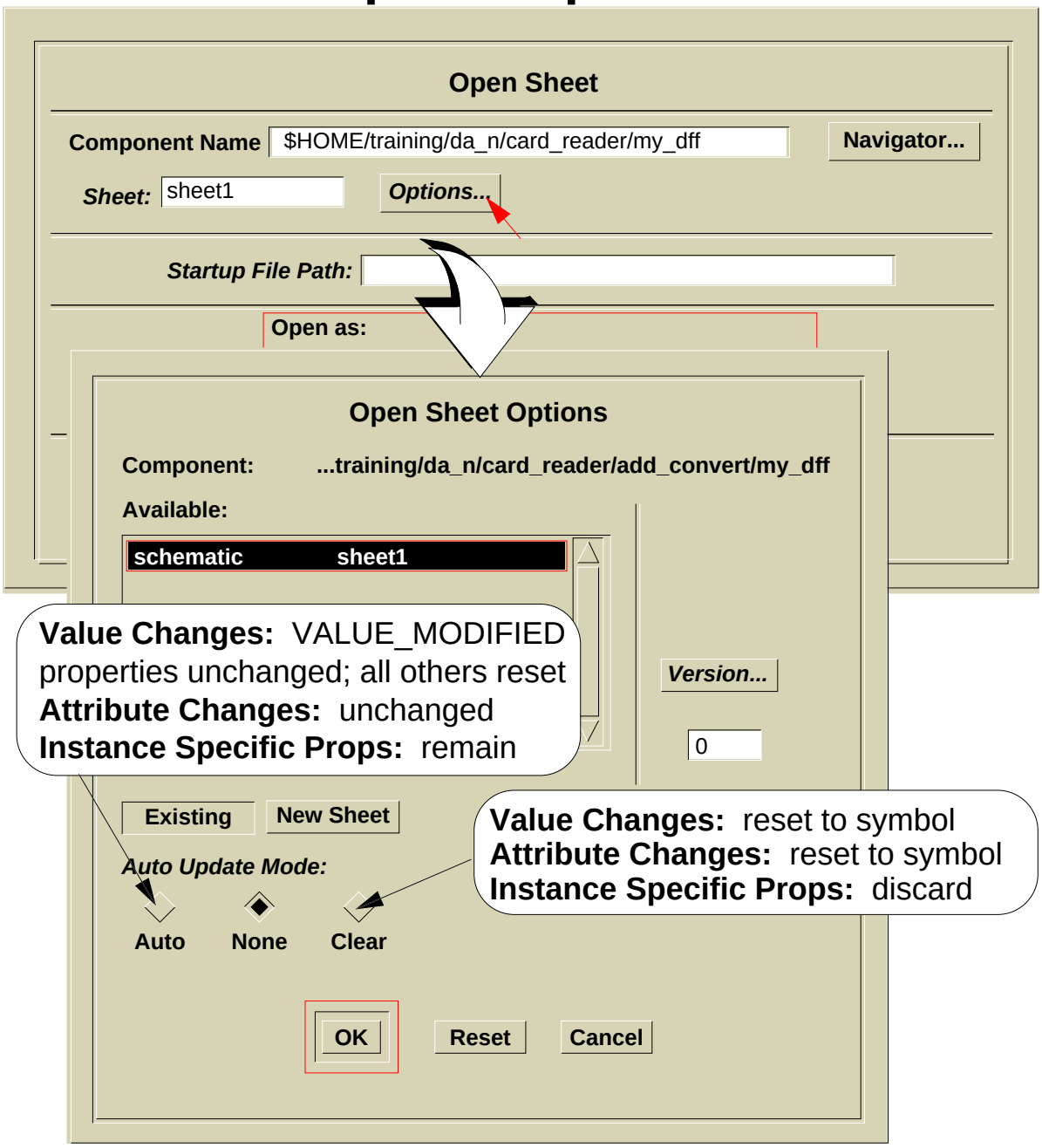
If a designer changes the value of the property, the property has the VALUE_MODIFIED flag and the ATTRIBUTE_MODIFIED flag (by default) attached to it. The status of these flags are displayed with the other property information in a report window.

A property value on an instance becomes VALUE_MODIFIED when one of the following actions occur:

- The designer changes a property value with the Add Instance, Add Property, Change Text Value, Change Property Value, or Delete command.
- The designer marks the property value as VALUE_MODIFIED using the pulldown menu **Miscellaneous > Mark Property Value**. You can unmark the property value as VALUE_MODIFIED using the same command.

Marking the value as VALUE_MODIFIED means that the property will be written out to the database as being “owned” by the instance, just as if you added an instance-specific property to the instance. This means that if you update the instance to use the most current version of the symbol, and the symbol property values have changed, the instance property values will **not** be affected by the symbol property changes.

Update Options



Update Options

You can explicitly specify how you want the instances on a sheet to be updated via the **Auto Update Mode** buttons as shown on the left. You can also specify how the instances should be updated individually within the Update and Replace commands by choosing one of the following switches:

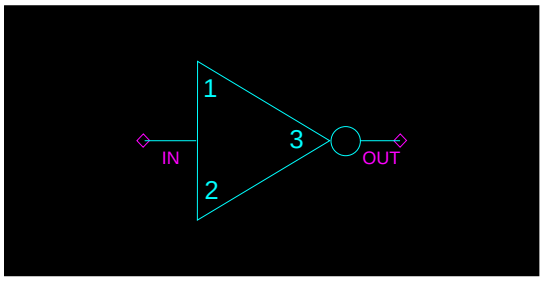
- **Auto**. **Property value changes:** VALUE_MODIFIED properties remain unchanged and all other properties are reset to the current symbol value. **Property attribute changes:** property attributes changed on the instance remain unchanged. **Instance-specific properties** are kept. This is the default when updating a symbol instance.

- **None**(no update). This option is available only when the sheet is opened. No instances are updated. This is the default mode when the sheet is opened.

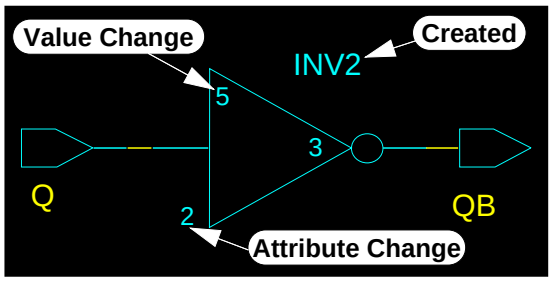
- **Clear**. **Property value changes:** resets all symbol-specific property values to the current symbol value. **Property attribute changes:** all attributes are reset to the symbol property attributes. **All instance-specific properties** are removed. This is the default when replacing a symbol instance.

Update Example

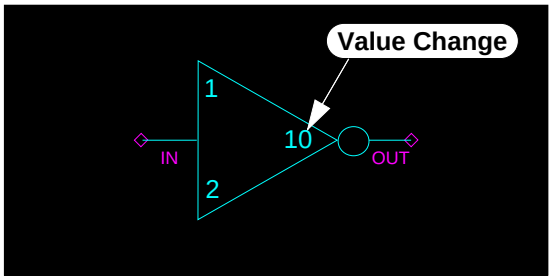
Time 1: Symbol is Created



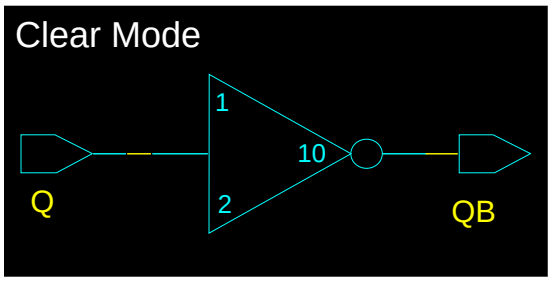
Time 2: Instance Created on Sheet

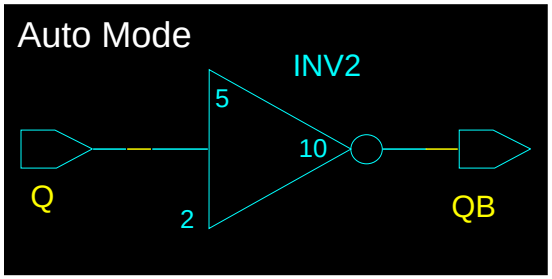


Time 3: Symbol is Modified



Update Mode on Next OPEN SHEET





Update Example

The left side of the example on the facing page sets the stage for describing the results of updating a symbol instance when the sheet is re-opened. The scenario is as follows:

Time 1 A symbol is created with the properties, “top”, “bottom”, and “right”.

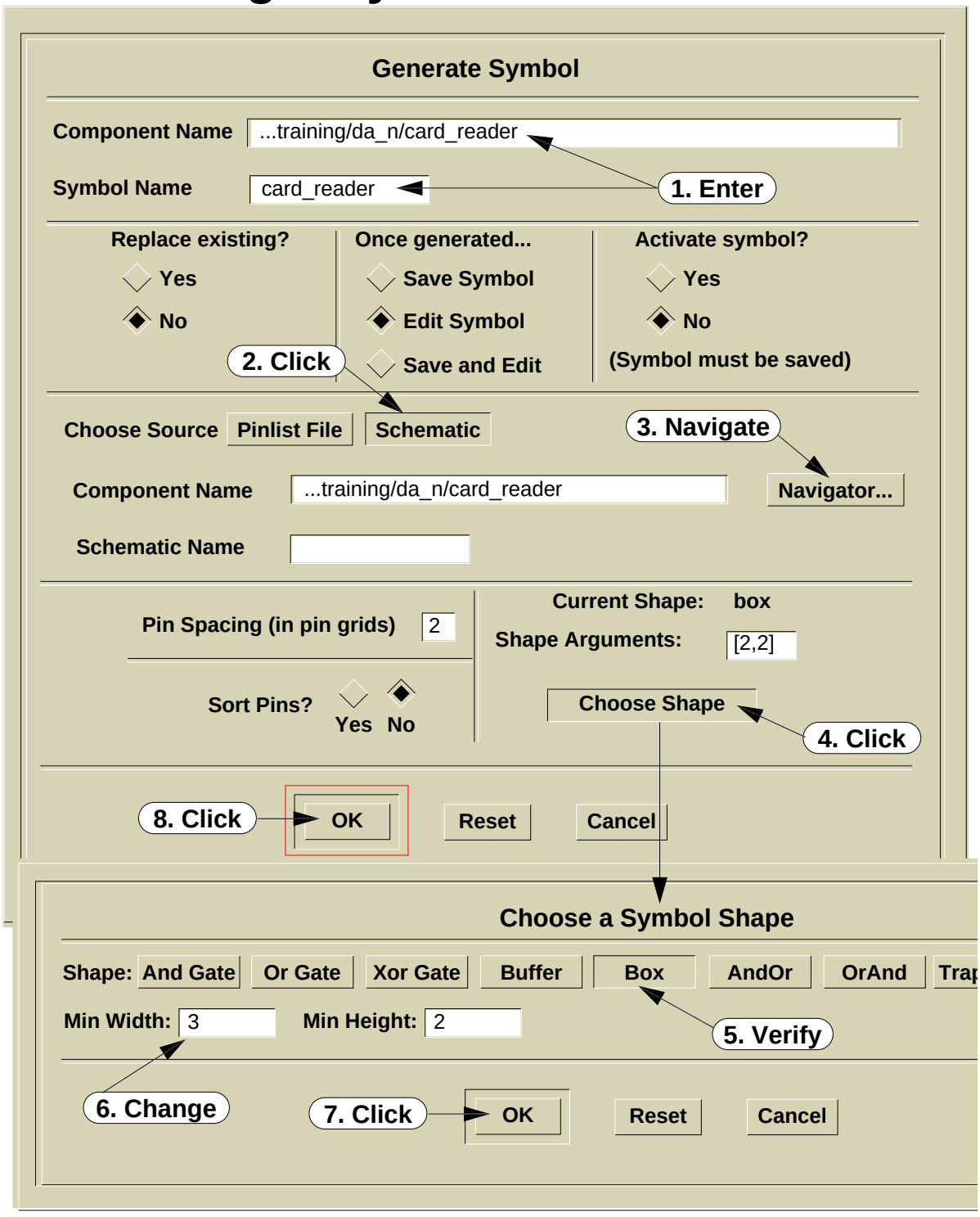
Time 2 An instance of the inverter is placed on a sheet. The value of “top” is changed to 5 which sets the **Value Modified** flag and the **Attribute Modified** flag for this property. The value of “bottom” is moved to the left; this sets the **Attribute Modified** flag for “bottom”. A new instance specific property with a value of INV2 is also added. The property value of “right” is selected and “marked” as **Value Modified**.

Time 3 The inverter symbol is re-opened and the value of “right” is changed to 10. The symbol is then checked and re-saved to disk.

If the sheet is re-opened in the **Clear Mode**, the instance is updated to match the revised symbol. The instance-specific property is discarded.

If the sheet is re-opened in the **Auto Mode**, the “top” property has its **Value Modified** flag set; its value remains unchanged. The “bottom” property has its **Attribute Modified** flag set, but its value was not modified; the value remains unchanged and the location remains unchanged. The “right” property was modified at the symbol level; its value changes to 10. What would happen to the value of the “right” property if the value on the instance was “marked” as **Value Modified** with the **Miscellaneous > Mark Property Value:** pulldown menu item? _____

Generating a Symbol from a Schematic



Generating a Symbol from a Schematic

A symbol can be generated from a schematic by executing the Design Architect session pulldown menu **File > Generate > Symbol** or the Schematic window pulldown menu **Miscellaneous > Generate Symbol...** Fill out the form as shown on the left:

(1) Make sure the component name of the component containing the schematic is entered correctly.

(2) Click the **Schematic** button.

(3) Enter the pathname of a component structure. If the component does not exist at that location, a new component structure will be created. If a component structure by the specified name does exist at the specified location, the new symbol is registered with that component structure.

(4) Choose the graphic characteristics of the new symbol by clicking **Choose Shape**

(8) Verify the shape (in this example the shape is **box**.)

(9) Edit the shape. In this case, make the width greater than the height by entering [3,2]

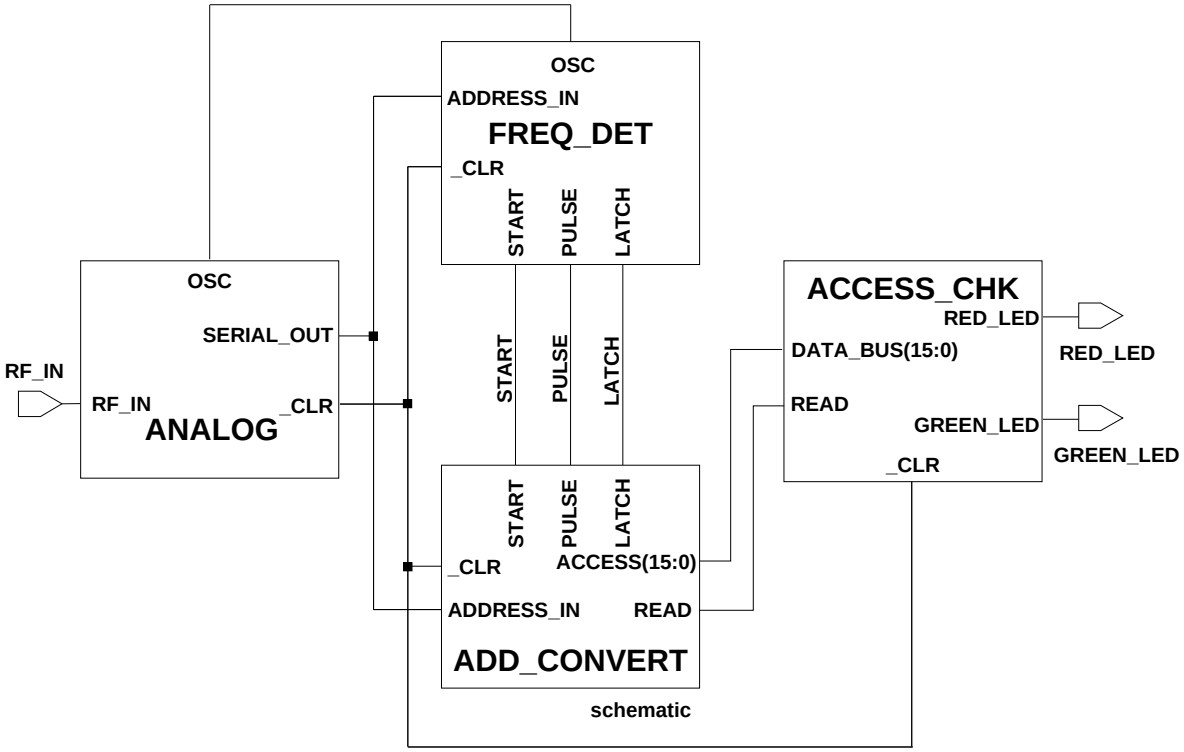
(10) Execute the shape form.

(11) Execute the Generate Symbol form.

The new symbol is created and the symbol editor is opened so you can further edit the symbol. When you are finished editing, you must check and save the symbol. This action may cause an existing schematic model to be marked “invalid”, so you should re-validate the existing models.

The Generate Symbol function can also create a symbol from a *pinlist* file that was created from the **Miscellaneous > Create Pin List...** pulldown menu. Refer to Appendix E in the Design Architect Reference Manual for a description of the *pinlist* file format.

Lab Overview



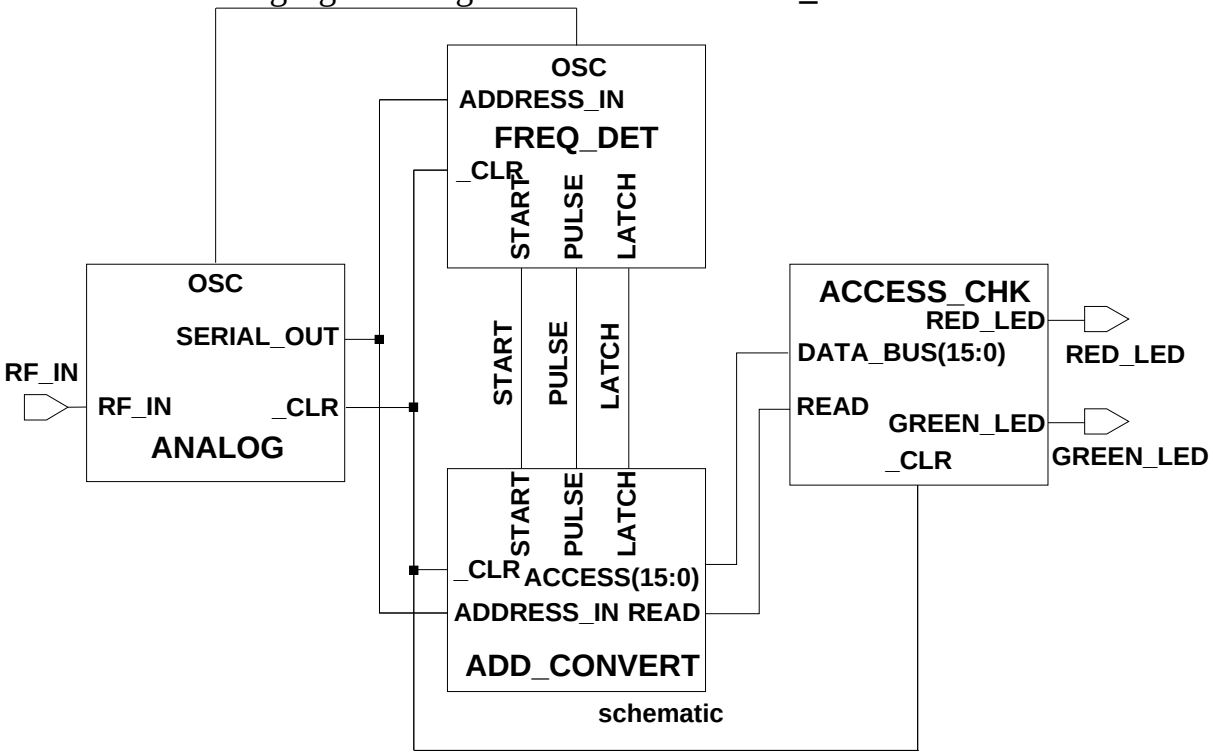
Lab Exercises

Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

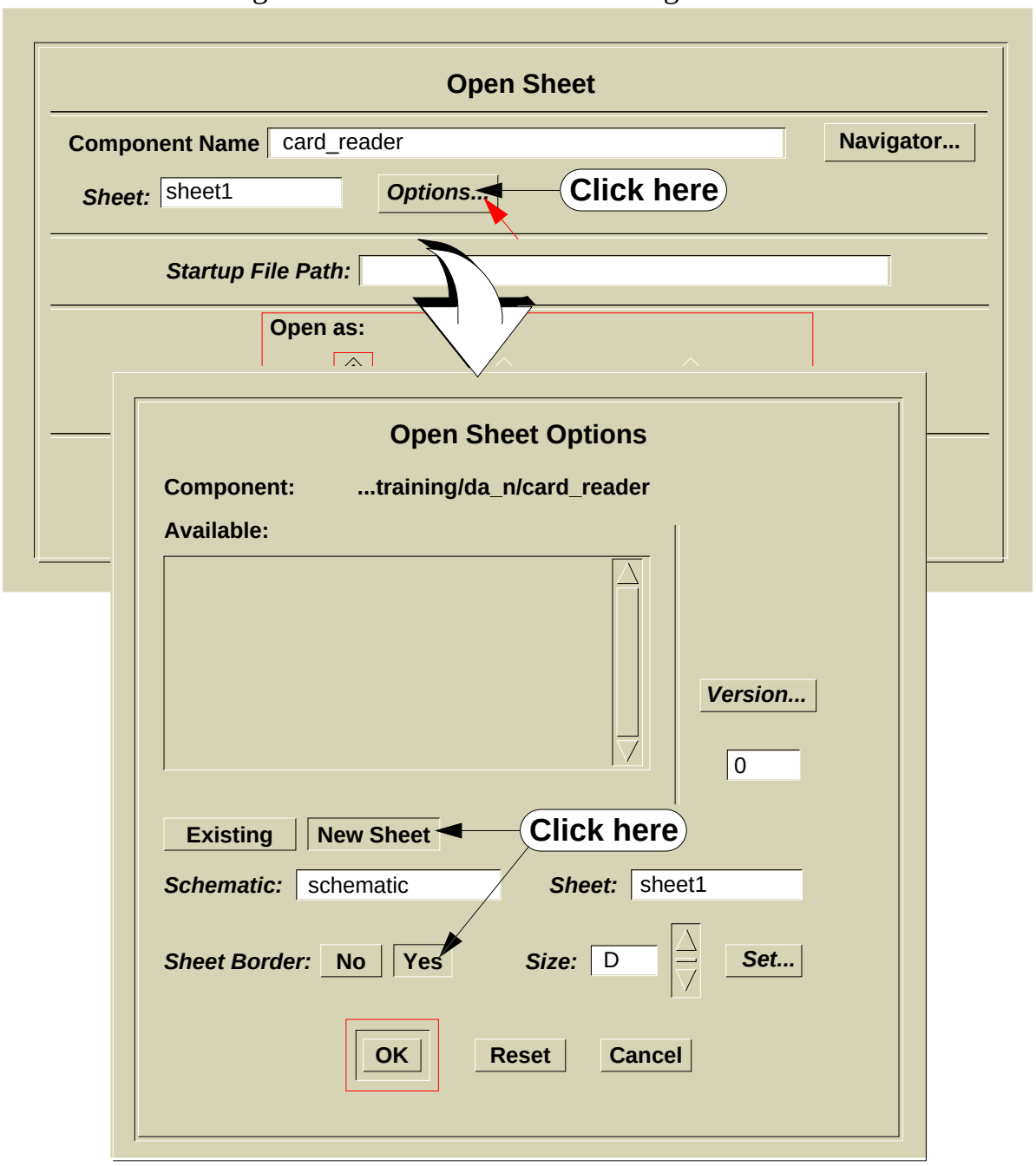
Exercise 1: Creating the card_reader Functional Blocks

In this exercise, you will create a schematic sheet that contains only functional blocks, nets, and, **portin** and **portout** connectors. Notice that you are creating a functional block for the **add_convert** design that you created in the last module. Use the following figure as a guide to create the **card_reader** schematic:

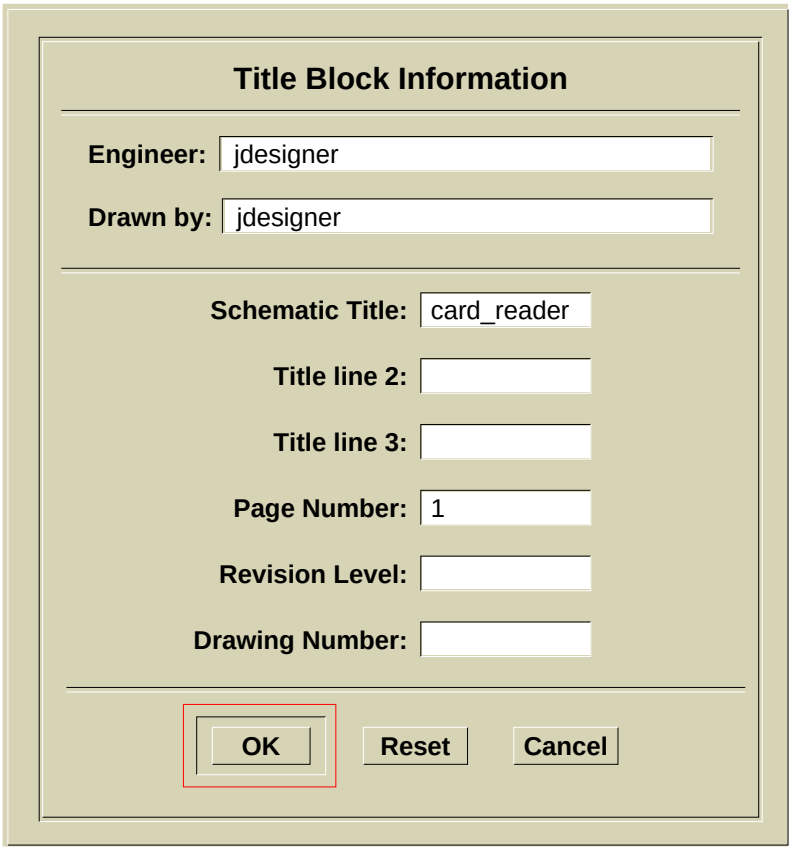


1. Set the working directory to <*your_home_directory*>/**training/da_n**
2. From the Design Architect Session window, click on the OPEN SHEET icon:

3. Fill in the dialog boxes as shown in the following illustration.



4. Click on the **Yes** button for Sheet Border.
5. Click **OK** on both dialog boxes.
6. Notice that the Title Block Information is filled in for you:



7. Click **OK**

Create the Rectangles for the Functional Blocks

1. Zoom into the center of the sheet until you see the pin grid.
2. Click on the **DRAW** palette button.
3. Click on the **ADD RECTANGLE** icon and create a rectangle that is 8 pin grid spaces wide and 6 pin grid spaces tall. Fit the rectangle exactly on the grid points. This is the ACCESS_CHK functional block. (Use the STRETCH icon to resize the rectangle if you need to.)

4. Copy the rectangle with a stroke and position the copy so it is 6 grid spaces to the left and 1 grid space above the ACCESS_CHK rectangle. This is the FREQ_DET functional block. (See the diagram.)

5. Copy the rectangle again and position the copy so it is 6 grid spaces to the left of and 1 grid space below the FREQ_DET rectangle. This is the ANALOG functional block. (See the diagram.)

6. Copy the rectangle one more time and position the copy so it is 6 grid spaces to the right of and 1 grid space below) the ANALOG rectangle. This is the ADD_CONVERT functional block. (See the diagram.)

7. Unselect All, View All, then View Area around the blocks.

Add Symbol Pins to the Rectangles

1. Using the schematic diagram in page 5-26 as a guide, you are going to click on the ADD PIN(S) icon four times, once for each side of the diagram. Make sure that the following information is set in the Add Pin(s) dialog box:

   Name Height: **50%**
   Name Placement: **Name**
   PinType: <*see table below*>

   Use the following table as a guide to add the pins:

Pin Placement	Pins	Pintype
Left	RF_IN	IN
	ADDRESS_IN	IN
	_CLR	IN
	_CLR	IN
	ADDRESS_IN	IN
	DATA_BUS(15:0)	IN
	READ	IN

Pin Placement	Pins	Pintype
Top	OSC(ANALOG) OSC(FREQ_DET) START PULSE LATCH	OUT IN IN IN IN
Bottom	START PULSE LATCH _CLR	OUT OUT OUT IN
Right	SERIAL_OUT _CLR ACCESS(15:0) READ RED_LED GREEN_LED	OUT OUT OUT OUT OUT OUT

Add a BLOCK_NAME Property and Value to Each Functional Block

The purpose of this property is provide symbol text for the functional blocks you are creating.

1. Click the **TEXT** palette button. The **schematic_text** palette appears.
2. Select the ACCESS_CHK rectangle. Make sure that this is the only object selected. The select count should be 1.
3. Click the **ADD PROPERTY** icon. Fill in the following information:

   Property Name: **BLOCK_NAME**
   Property Value: **ACCESS_CHK**
   Property Type: **String**
4. Click **OK**.
5. Position the “ACCESS_CHK” text inside the rectangle and click the Select mouse button, then Unselect All .

6. Select the FREQ_DET rectangle and click the **ADD PROPERTY** icon.

7. Perform the following when the Add Property dialog box is displayed:

   Select **BLOCK_NAME** from the Existing Property Name scrolling window

   Property Value: **FREQ_DET**

8. Click **OK**, position the "FREQ_DET" text inside the rectangle and click the Select mouse button, then Unselect All .

9. Use the previous steps to add the BLOCK_NAME property to ANALOG and ADD_CONVERT in their respective rectangles, then Unselect All .

Add a MODEL Property to Each Rectangle

Using what you have learned from earlier lab exercises and the previous step, add a MODEL property to each rectangle. Specify a value of "schematic" for the ADD_CONVERT block and leave the MODEL property values undefined on the other blocks.

Create Functional Blocks

In this step you will select each rectangle and its contents, convert the elements into a symbol, and instantiate that symbol in place.

1. Reset the working directory to
   <*your_home_directory*>/training/da_n/card_reader

2. Unselect everything on the sheet .

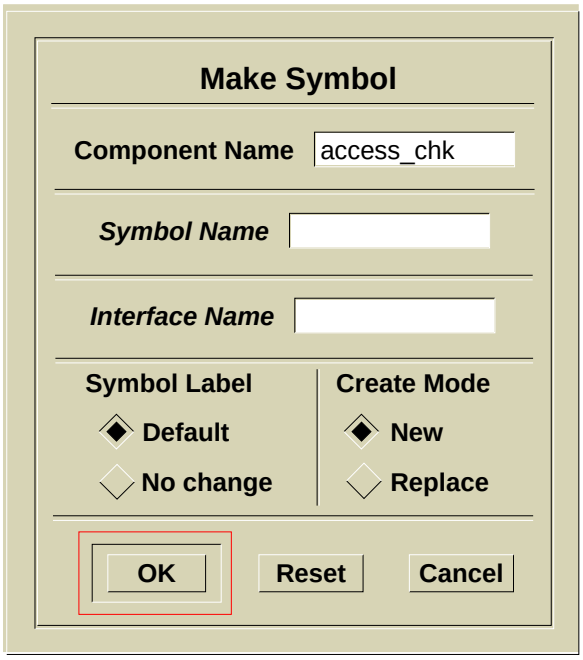
3. Set the Select Filter to select only **Comments** and **Symbol Pins**.

4. Select the comment graphics and symbol pins of the ACCESS_CHK rectangle by pressing the select mouse button and drag the mouse cursor across an area that encloses the ACCESS_CHK rectangle. Make sure that nothing else outside of the rectangle is selected.

5. Choose the following pulldown menu item:

   Edit > Make Symbol...

The following dialog box appears:.



6. Fill in the **Component Name** entry box with the following: **access_chk**
7. Click **OK**. The comment rectangle becomes a symbol instance, the symbol pins become instance pins, and the BLOCK_NAME becomes a symbol property that is attached to the symbol body. A new component by the name of **access_chk** is also created in the current working directory.
8. Unselect everything on the sheet
9. Repeat the above steps to create the FREQ_DET, ANALOG, and ADD_CONVERT functional blocks.

Finish the card_reader Schematic

1. Add the **portin** and **portout** instances. You can find these symbols in the Symbol History List in the Active Symbol Window.
2. Add the wires and buses.
3. Rename the NET property values.

Check the Sheet

1. Check the sheet. You should get no errors or warnings.
2. Close the Check Status window.

Save the Sheet

Open Down into the add_convert Sheet

1. Double-click on the border of the **ADD_CONVERT** functional block. The Open Down dialog box is displayed, showing all the models that are associated with the **add_convert** component.
2. Select the schematic model in the Available scrolling window, then click **OK**. A schematic window is displayed in the Session window, showing the **add_convert** schematic.

Exercise 2: Updating an Instance

This exercise will show you how to edit the **my_dff** symbol from the Schematic Editor Window.

Open the my_dff Symbol from the add_convert Schematic

1. Double-click on the border of the **my_dff** instance. The Open Down dialog box is displayed, showing all the models that are associated with **my_dff**.
2. Select the symbol model in the Available scrolling window and click **OK**.

   A **my_dff** Symbol window is opened in the DA Session area.

Change Property Values and Attributes

1. Use the Modify Property stroke to change the **QRISE** and **QFALL** property values to 5 and 10, respectively.
2. Move the locations of the **QBRISE** and **QBFALL** property values.

Check and Save the Symbol

1. Check the symbol, then close the Check Status window.
2. Save the **my_dff** symbol to disk.
3. Close the **my_dff** symbol window.

Update the my_dff Instance

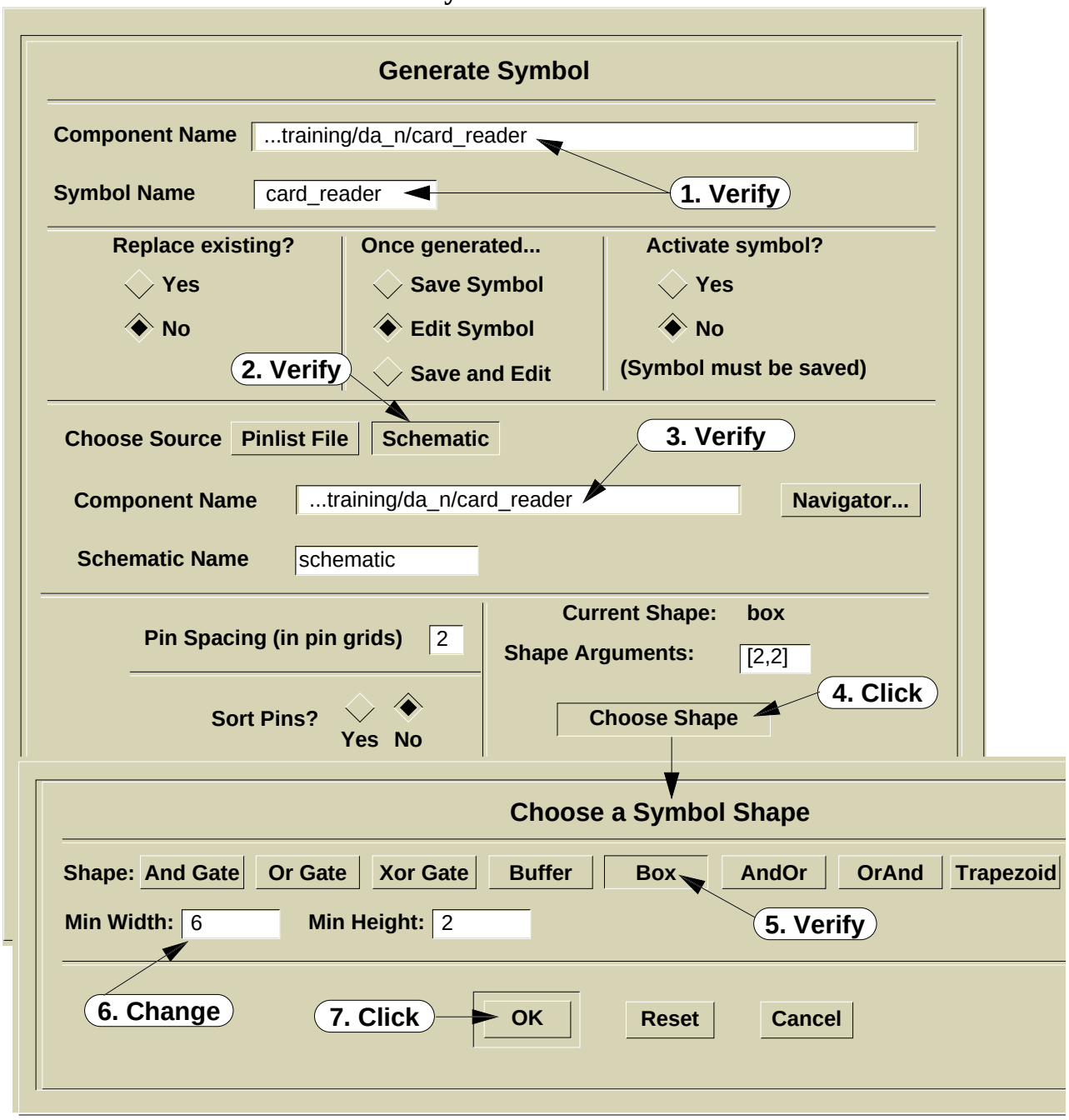
1. Make the **add_convert** schematic window active.
2. Make sure the **my_dff** instance is selected, then choose the following popup menu item: **Update > Auto**

   Notice that the new values and locations of QRISE, QFALL, QBRISE, and QBFALL are reflected in the new instance.

Check, Save and Close the add_convert Schematic

Exercise 3: Generating a card_reader Symbol

Next, you will automatically generate a card_reader symbol from the card_reader schematic. From the active card_reader Schematic window, execute the pulldown menu **Miscellaneous > Generate Symbol...** Fill out the form as shown below:



1. Verify that card_reader is specified as the component pathname.
2. Verify that the **Schematic** button is selected.
3. Verify that the existing card_reader pathname is specified to receive the new symbol.
4. (4) Choose the graphic characteristics of the new symbol by clicking **Choose Shape.**
5. Verify that the **box** shape is selected.
6. (9) Edit the shape to make the width greater than the height by entering [6,2]. This will expand the width to accommodate the longer pin names.
7. Execute the shape form.
8. Execute the Generate Symbol form.

   The new symbol window should popup with the new card_reader symbol contained therein.
9. Add CARD_READER symbol text to the symbol body.
10. Check and save the symbol.
11. Close the Symbol Editor window.

Check, Save and Close the card_reader Schematic

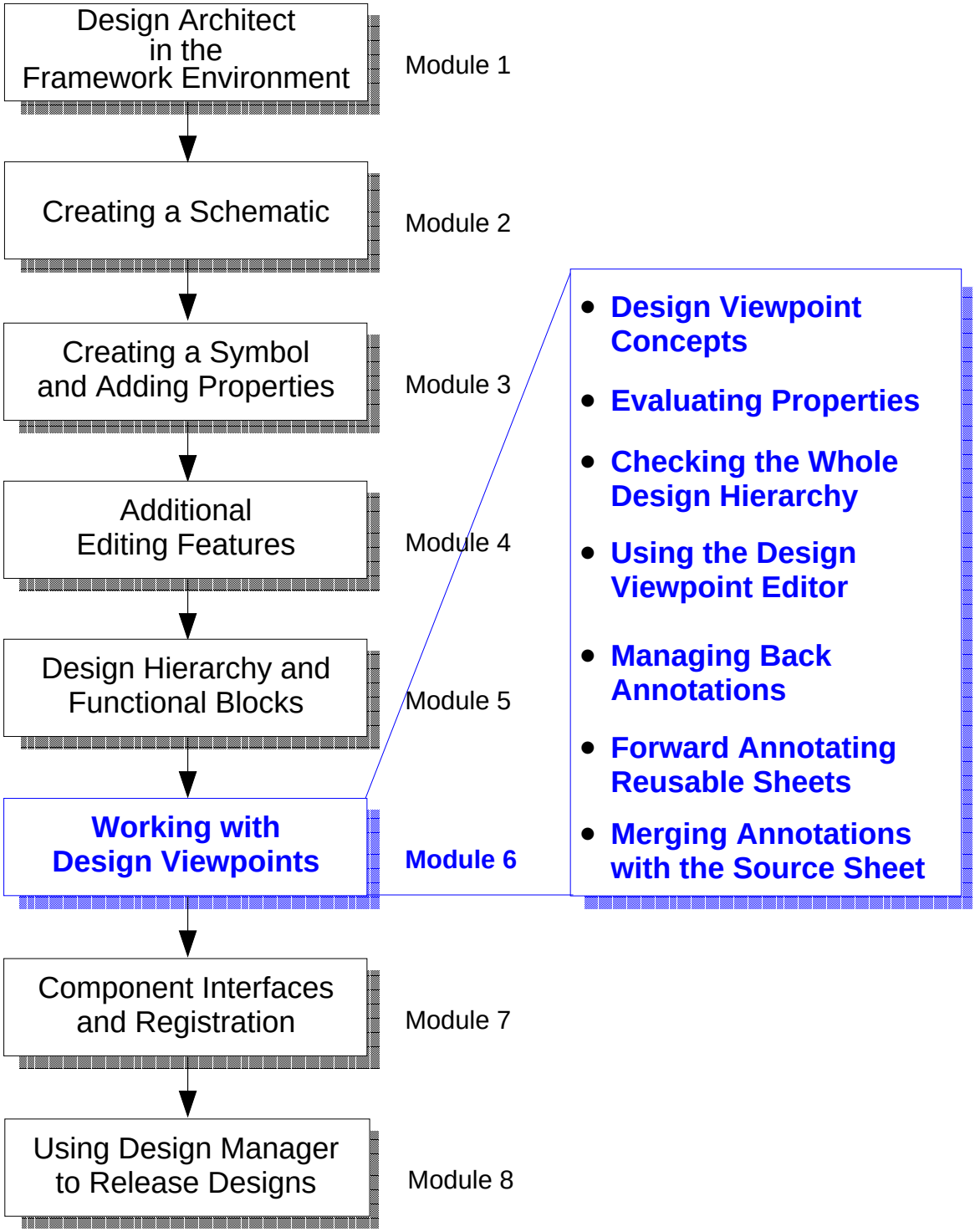
This action will re-validate the schematic against the new card_reader symbol pins.

End of Lab Exercises

This concludes the lab exercises for this module. If you have time, turn to Exercise 6 in **Appendix A - Customizing Exercises** and learn how to repair a broken design database.

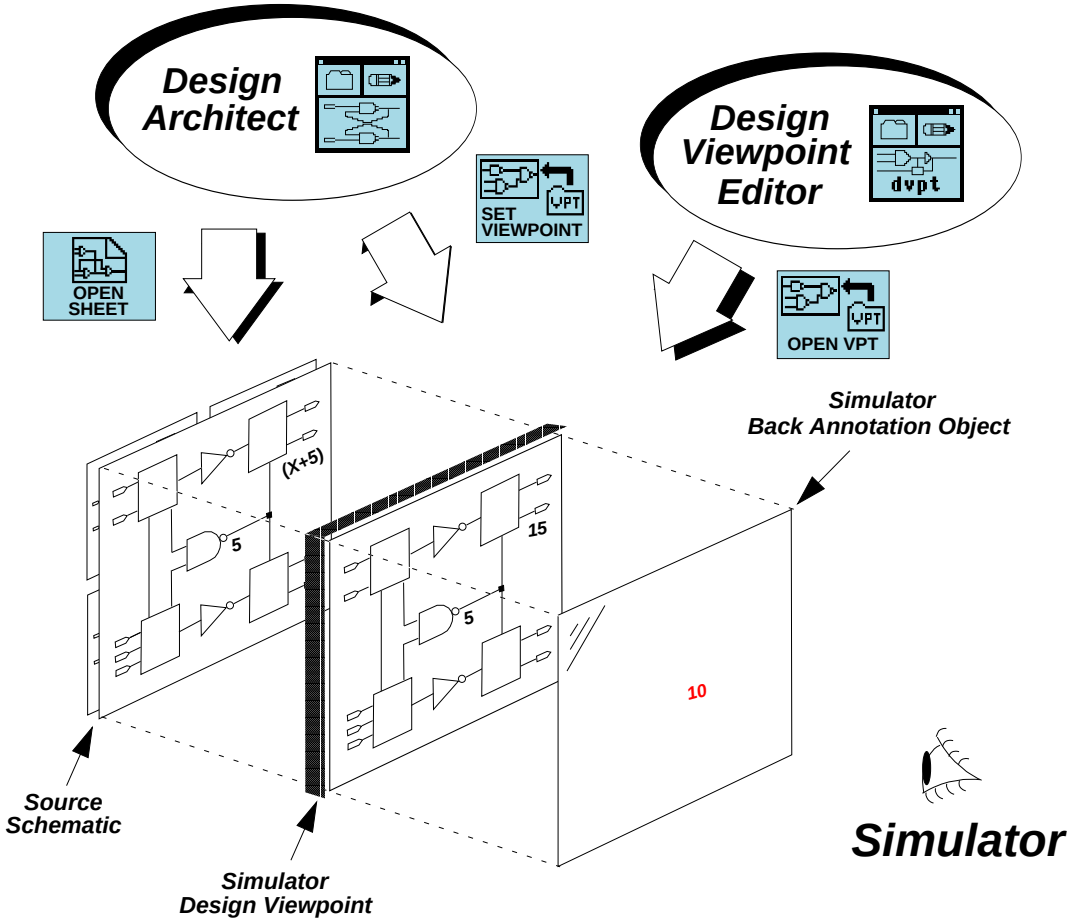
Module 6
Working with Design Viewpoints and Back Annotation

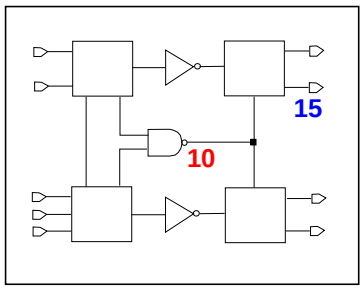
Module 6 Overview



Lesson 1
Design Viewpoint Concepts

Design Viewpoint (Conceptual View)





What the Simulator Sees

Design Viewpoint(Conceptual View)

Schematics are represented by files and directories in a software environment, so they can take on some of the characteristics of a software program. A timing value, for example, can be represented by a numeric expression such as (X + 5) as shown in the figure on the left. This expression must be evaluated to a constant before a downstream tool like a simulator can operate on it. The object in the data model that allows a downstrean tool to view the source schematic as fully evaluated data is called a *design viewpoint*.

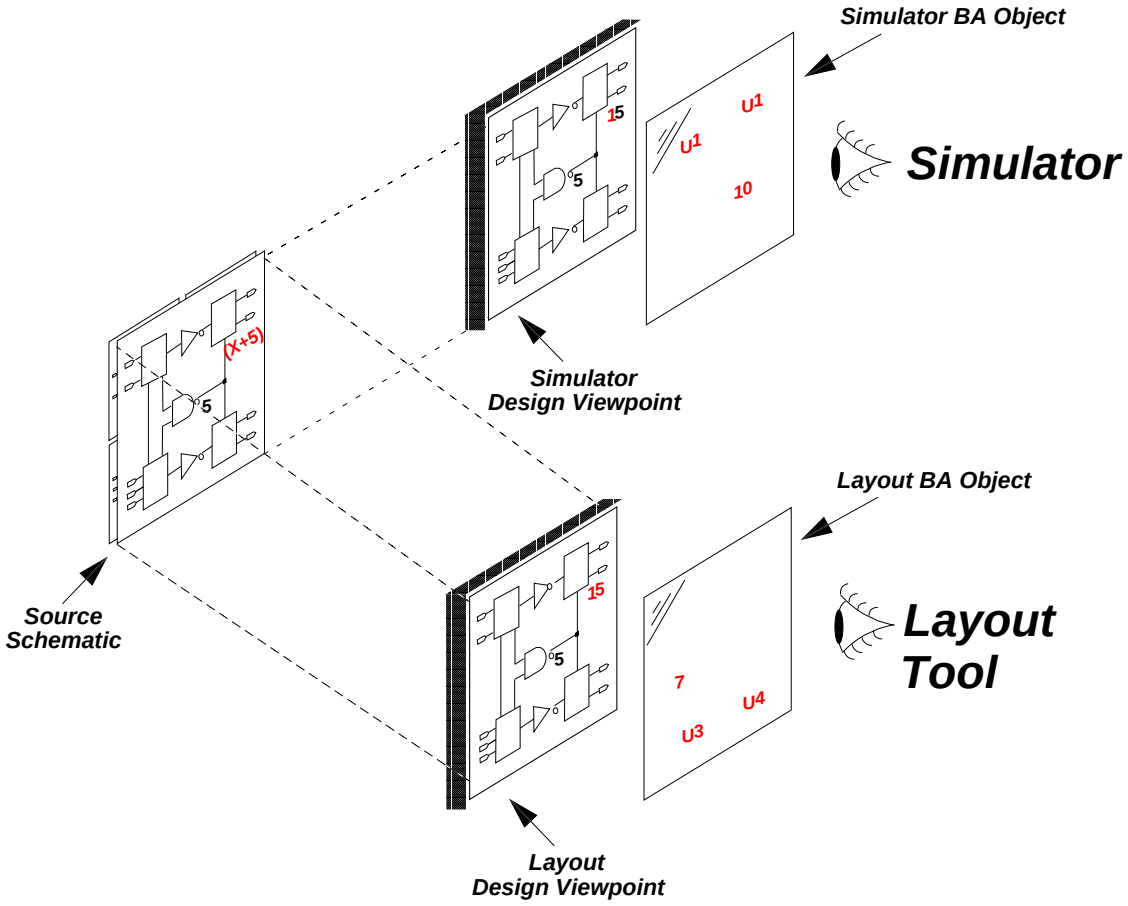
You may conceptually think of a design viewpoint object as a picture frame through which the downstream tool views the schematic. In your mind's eye, think of the image of the source schematic as being reflected onto the back of the glass in the picture frame. Notice in the diagram that the simulator sees the fully evaluated data through the viewpoint (15 in this case) even though the expression on the source schematic (X + 5) doesn't change. The value of X can be defined elsewhere on the schematic or defined in the viewpoint itself.

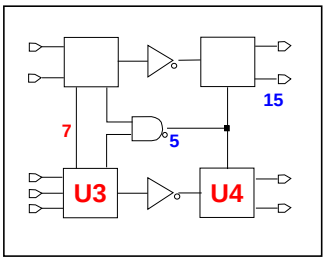
Because the glass in the viewpoint protects the source schematic, you can't change the source schematic from the downstream tool. You can appear to change the schematic, however, by selecting a property in the simulator Schematic View Window and making a change. The change is recorded in a Back Annotation object, which is conceptually represented as a transparent sheet laid over the top of the glass in the viewpoint. In the figure, the timing value in front of the center **and** gate is changed from 5 to 10 nanoseconds. The simulator sees 10 ns, as shown in the lower figure, even though the source schematic is unchanged.

All downstream tools must view the source schematic through a viewpoint. Typically, if a schematic doesn't have a viewpoint, the downstream tool creates one automatically when the tool is invoked on the design.

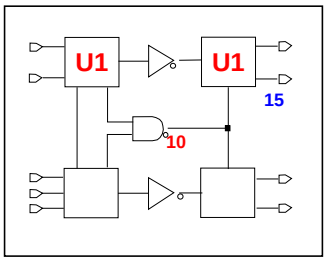
Viewpoints can be created and modified with a tool called the Design Viewpoint Editor. Design Architect can also invoke on a design viewpoint (using the SET VIEWPOINT icon) as well as a source schematic (using the OPEN SHEET icon). When you invoke Design Architect on a design viewpoint, you may selectively merge back annotation information from the Back Annotation object onto the source schematic.

Multiple Views of a Source Design





What the Layout Tool Sees



What the Simulator Sees

Multiple Views of a Source Design

Concurrent Engineering is a design method that allows the members of a design team to work more in a parallel on the same design. Although perfect concurrency is not possible, it is possible to start downstream processes much sooner than ever before. Tasks like simulation and physical layout can get started early even while significant modifications are still being made to the original source design. The illustration on the left shows how the concept of the viewpoint makes this possible.

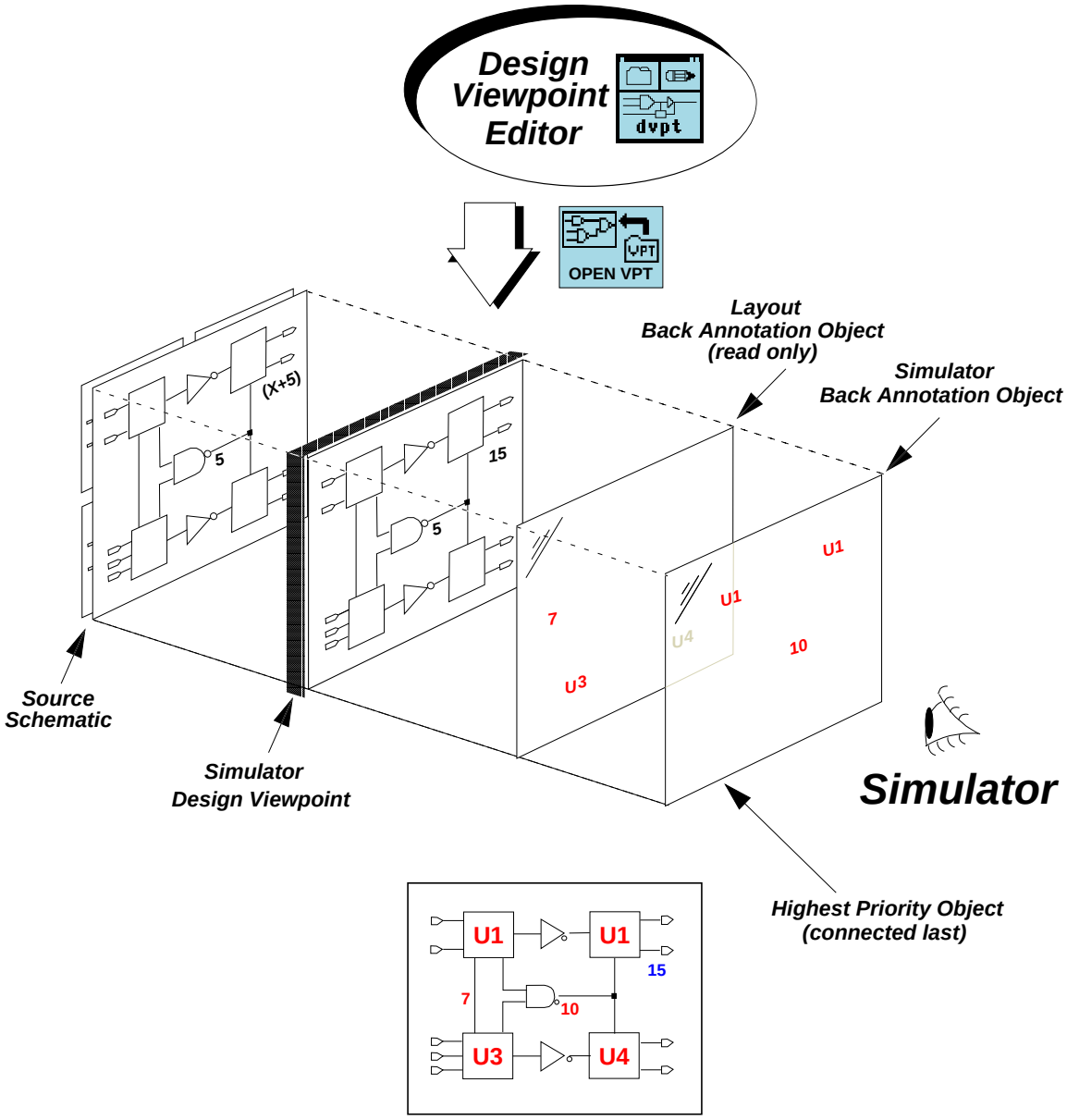
As shown on the left page, the Simulator and the Layout tool both see the reflected image of the source design in their respective viewpoints. Changes made to the design by these downstream tools are captured in their respective Back Annotation objects.

The person working with the simulator has changed the timing value on the center **and** gate to **10 ns** in order to see the effect on circuit performance. Also, in order to ensure a minimum wire length between the two upper blocks, the simulation person has pre-assigned the reference designator U1 that tells the PCB PACKAGE tool to include these blocks in the same physical package.

The person using the Layout Tool has also made some changes from a layout perspective. The bottom two blocks are assigned reference designators and a timing value (7) has been added to the wire on the left side, possibly due to a long physical wire length. Notice that this person does not see the change to the center timing value that was made by the person using the simulator. (see the bottom figures).

An important concept in keeping this design scenario stable is a concept called *latching*. The creator of each viewpoint typically “latches” the viewpoint to a particular version of the source schematic. This keeps the schematic view stable in each viewpoint, even though the design version may be slightly different. At the same time, the person developing the source schematic can keep working on and refining the design on the original schematics. At any point in time, a person working with a particular viewpoint can “unlatch” the viewpoint, update the schematic to the most current version, then re-latch the viewpoint.

Viewing Layout Changes in the Simulator



What the Simulator Sees

Viewing Layout Changes in the Simulator

The ability to *connect* any Back Annotation object to any viewpoint makes it possible for design changes to be shared between tools. In the illustration on the left, the Layout Tool Back Annotation object (created on the previous page) is now connected to the Simulation viewpoint. It is also still connected to the Layout Tool viewpoint and can continue to receive changes made by the person doing the physical layout. Notice that the Layout Tool Back Annotation object is connected in *read only* mode. The person using the simulator now sees the changes being proposed by the Layout Tool and can test the affects on circuit performance, but cannot make changes to the Layout Tool Back Annotation object. The figure at the bottom of the page shows what the simulator see.

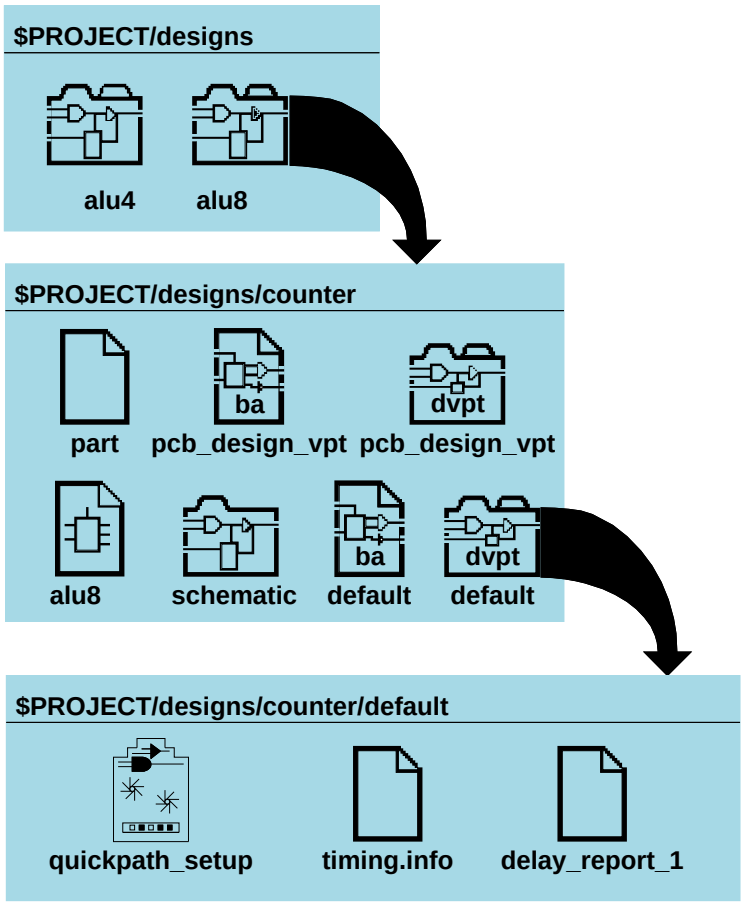
Dealing with conflicting change. It is possible that in a situation like the one on the left that a change is made to the same property on two different back annotation objects. In these situations, the object connected last has the highest priority. In the illustration, the simulation BA object has the highest priority and takes precedence over any conflicting changes that may occur between the connected BA objects.

Dealing with a Diverging Design. With many people making changes to a design in parallel, the design tends to diverge rather than converge. It is up to the team members to meet at regular intervals and "*synchronize*" the viewpoints. This is a process where the team members decide which changes are valid. The valid Layout changes like the reference designators on the Simulation BA object are selectively "exported", then "imported" to the Layout Tool BA object. Likewise, the timing change on the Layout Tool BA Object can be exported, then imported to the Simulator BA Object.

Merging Final Changes onto the Source Schematic. When the design is finished, the changes in the Back Annotation objects can be merged onto the source schematic before archiving. This is done by invoking the DESIGN SHEET editor in Design Architect on each viewpoint and merging the annotations (selectively or all together) onto the source schematic. If you are working with reusable sheets, this practice of merging annotations may not be desirable.

Design Viewpoints (Iconic View)

- **Default location for design viewpoints and back annotation objects**



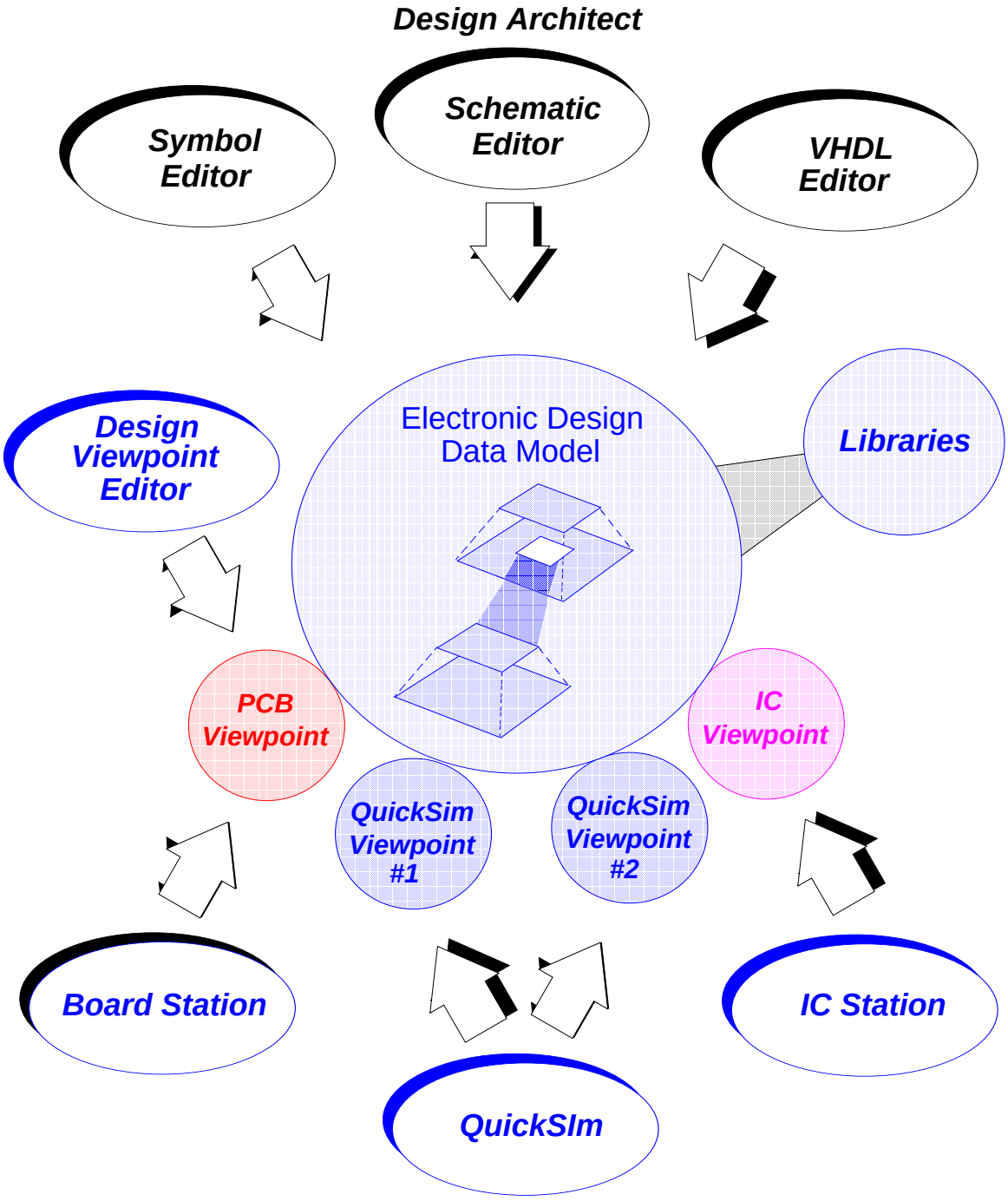
Design Viewpoints(Iconic View)

Even though you can think of a viewpoint as a “wrapper” around the source design, the viewpoint object and the associated back annotation objects are saved to a position inside the root component container. This is done so that when you copy the design from one location to another, all you need to do is specify the root compound container and you get all the associated viewpoints and back annotation objects with it.

The figure on the facing page shows the default location for the design viewpoints and back annotation objects. In this directory structure, the directory with the path **$PROJECT/designs** contains two designs, **alu** and **counter**. The counter design has a symbol, a schematic, two viewpoints, and two back annotation objects. The viewpoint called **default** is assumed to be setup for QuickSim, because this is the default name given for a QuickSim compatible viewpoint. The back annotation object called “default” is assumed to go with the “default” viewpoint. The name **pcb_design_vpt** is the default name given to a PCB viewpoint.

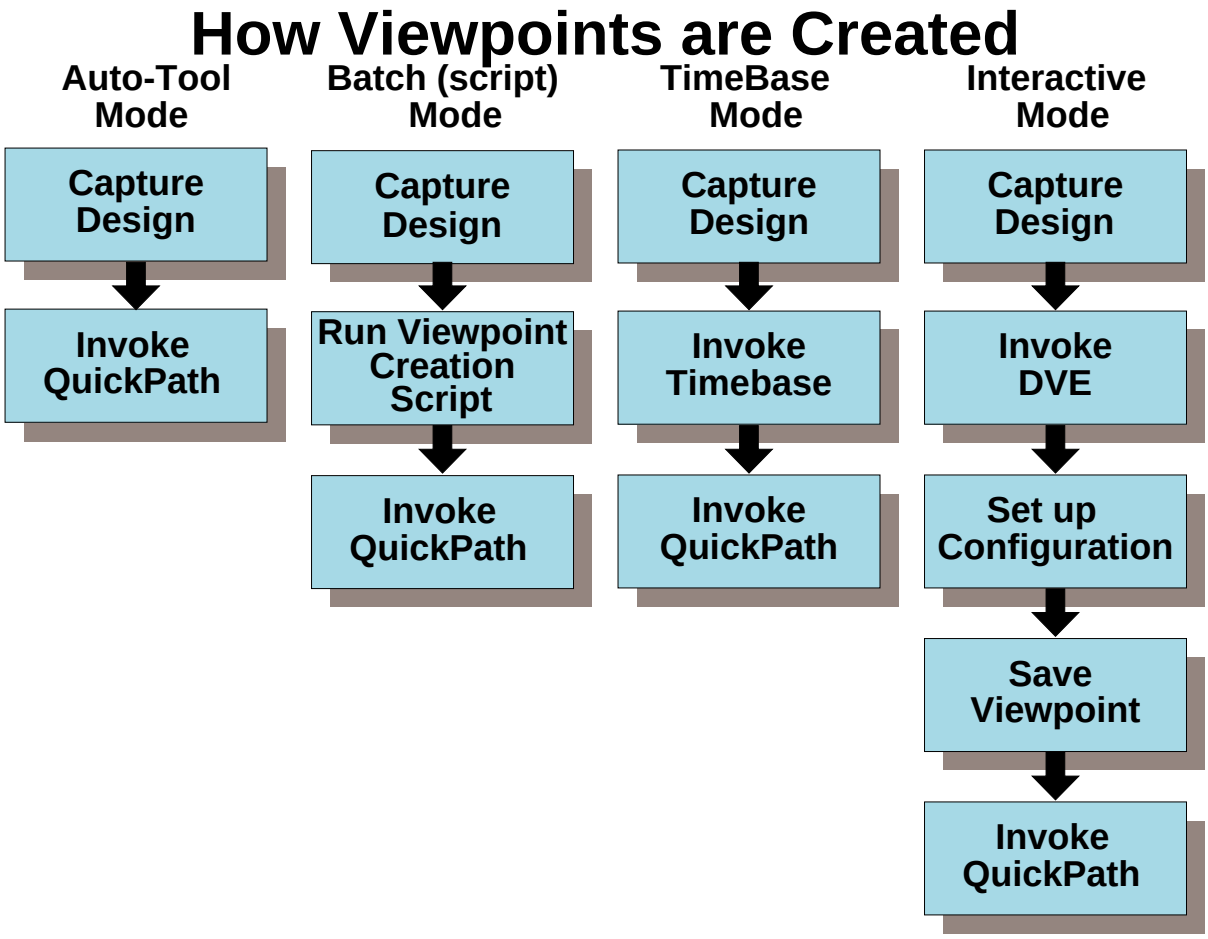
Notice that the viewpoint is a container itself that can hold objects and files which are specific to it. In this case, the **default** viewpoint holds a **quicksim_setup** object, a **quicksim_state** object, and a **simview_setup** object. It could also hold a forces waveform database object that could be used as input stimulus for the design during a simulation.

Downstream Tools and Viewpoints



Downstream Tools and Viewpoints

The figure on the left shows how any number of downstream tools can create a viewpoint on a single design. Because the viewpoints capture changes in Back Annotation Objects, and the source design is protected from change, people using the downstream tools can work in parallel and experiment with different design modifications and scenarios. Notice that this design has two QuickSim viewpoints. Each viewpoint can be configured differently with different models and different timing value combinations. And because a viewpoint is a container, input stimulus and the simulation results from each configuration can be keep inside their respective viewpoints.



- **Auto-tool mode -- QuickSim II creates a default viewpoint, if none exists, or uses existing one**
- **Batch mode -- Shell script (DVE) creates viewpoint tailored to company or design process**
- **TimeBase mode --Timebase calculates timing and saves timing cache to default viewpoint**
- **Interactive mode -- You invoke DVE and create or modify a viewpoint interactively**

How Viewpoints are Created

A design viewpoint can be created in several ways as illustrated on the left page.

- **Auto-Tool Mode**

  In most cases, simply invoking a downstream tool like QuickSim II, PCB PACKAGE, or IC Station on the source design causes the tool to create a default design viewpoint for you, if the design has no viewpoint. If a viewpoint already exits for the tool and it has the default name for that tool, then the tool automatically invokes on that viewpoint.

- **Batch (script) Mode**

  Some companies and ASIC vendors provide shell scripts that you invoke to generate a custom viewpoint that fits the design process and libraries being used. The script usually contains AMPLE code that invokes the Design Viewpoint Editor in **-nodisplay** mode and executes the necessary DVE functions to set the design configuration, global parameters and visible properties list.

- **TimeBase Mode**

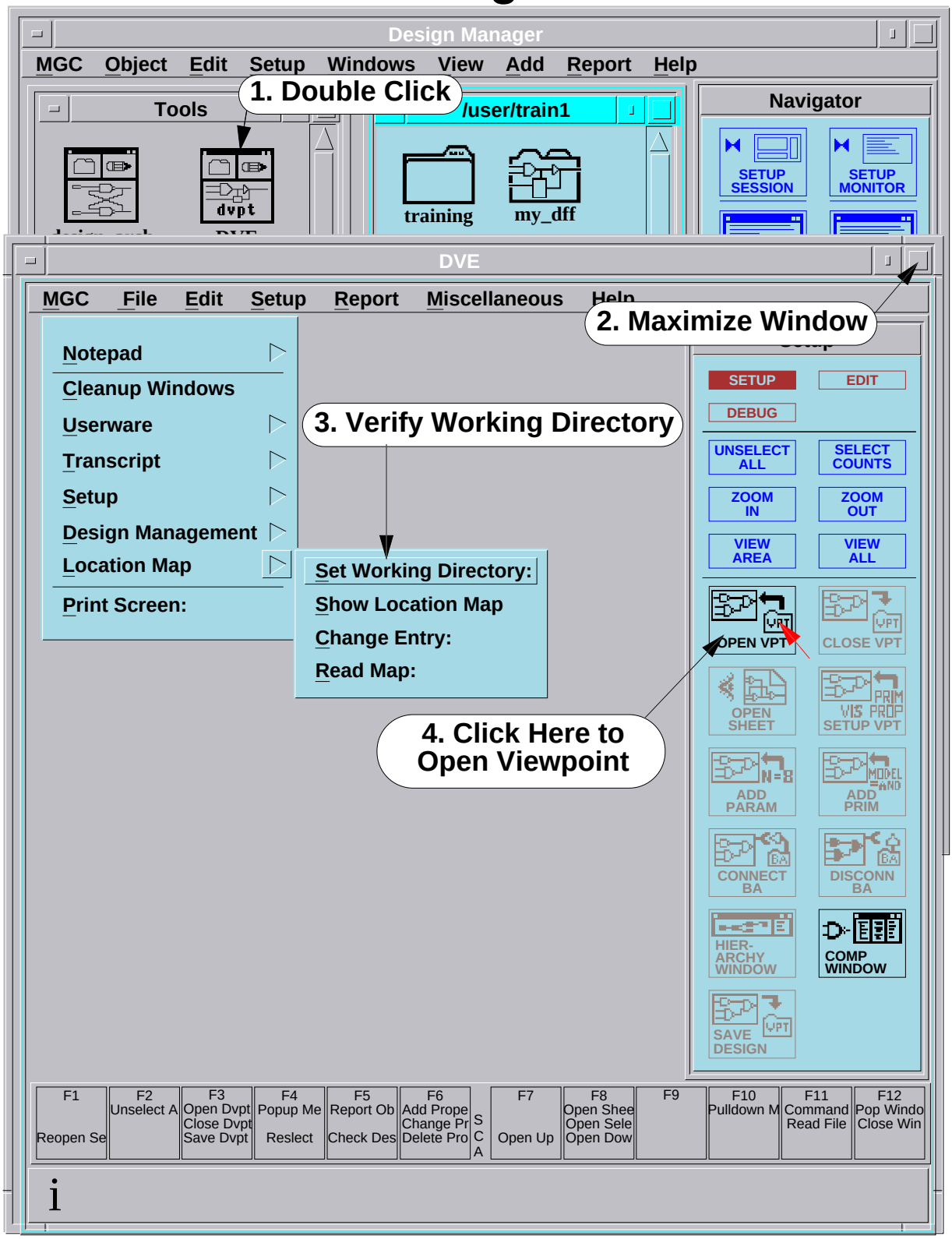
  TimeBase is a Mentor Graphics subprogram that is used to calculate timing. When you invoke TimeBase directly on a design, TimeBase creates a persistent(saved to disk) default viewpoint and back annotation object, calculates the timing, then saves the Timing Cache file in the design viewpoint container. This is a fast way to create a persistent viewpoint and at the same time speed application invoke time all in one step. The persistent viewpoint can then be used as a place to save the QuickPath setup object and analysis reports.

- **Interactive Mode**

  This mode allows you to custom create your own design viewpoint using the Design Viewpoint Editor. You can also invoke DVE on an existing design viewpoint and add further customizations of your own.

Lesson 2
Using the Design Viewpoint Editor

Invoking DVE



Invoking DVE

The Design Viewpoint Editor is a standalone application just like Design Architect. You invoke DVE from the Design Manager in one of two ways:

- Double Click on the **DVE** icon in the Tools Window as shown on the left, or
- Select a component icon in the Navigator window, press the right mouse button, and choose **Open > DVE**.

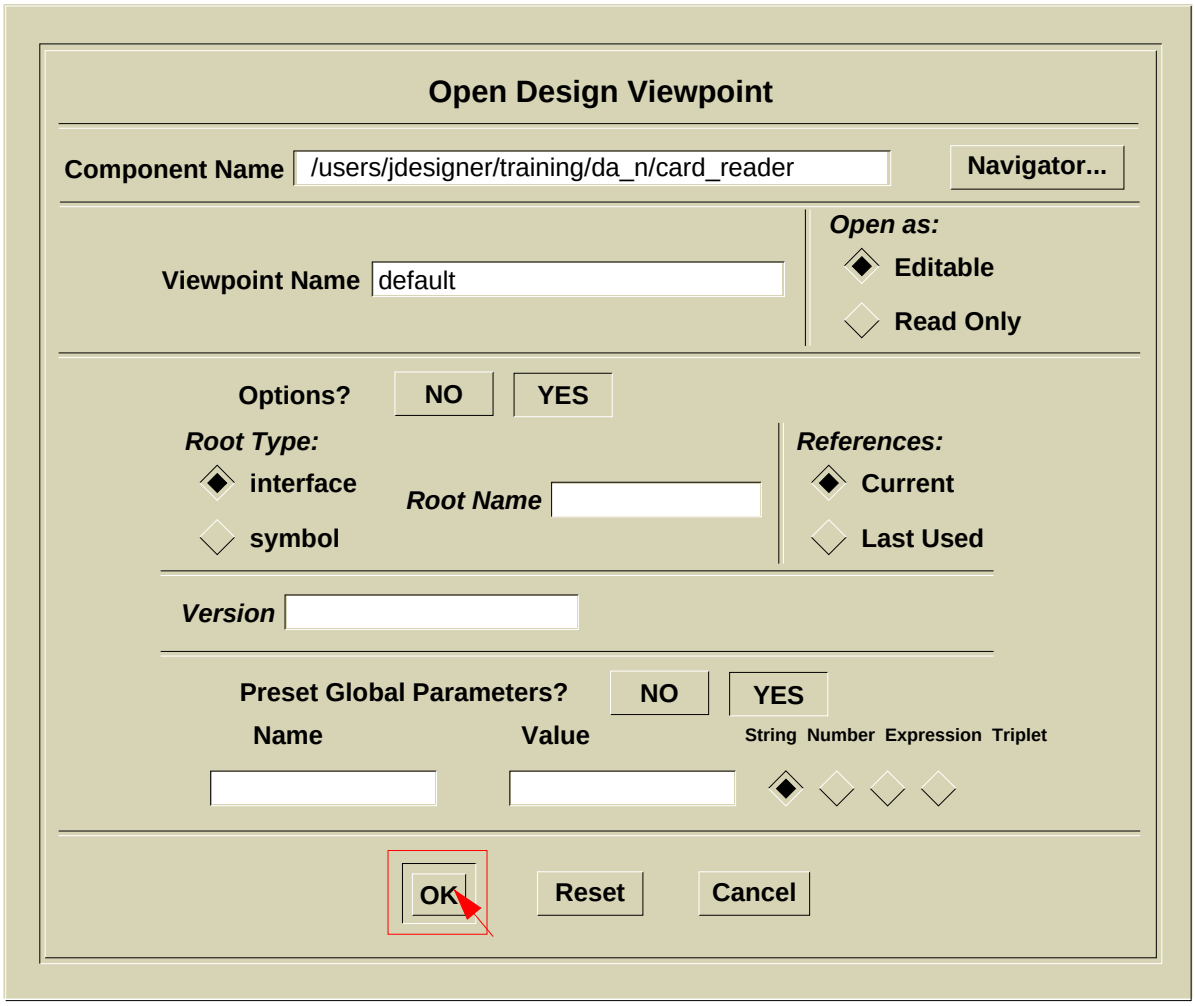
(DVE can also be invoked from a shell by typing ***$MGC_HOME/bin/dve***.)

After DVE comes up, it is a good practice to Maximize the window, then verify the setting of the working directory. Normally, the working directory will be set to the pathname specified by the shell environmental variable $MGC_WD, if this variable is defined; otherwise the working directory is set to the same location as the shell from which DVE is invoked.

It is always best to verify that the working directory is set to the location where you want it, because all relative pathnames that you enter will be considered relative to the setting of the current working directory.

You open an existing Design Viewpoint or create a new one by clicking the **OPEN VPT** icon, as shown on the left.

Opening a Design Viewpoint



Opening a Design Viewpoint

The Open Design Viewpoint form is shown on the left. You must specify the following entries:

Component Name The pathname for the component representing you design.

Viewpoint Name The name “default” is entered by default. If you are creating a new viewpoint, the new viewpoint name will be *default* unless you backspace over this name and enter a different name.

Open as: You can open an existing viewpoint as **Editable** or **Read Only**.

You may optionally specify the following:

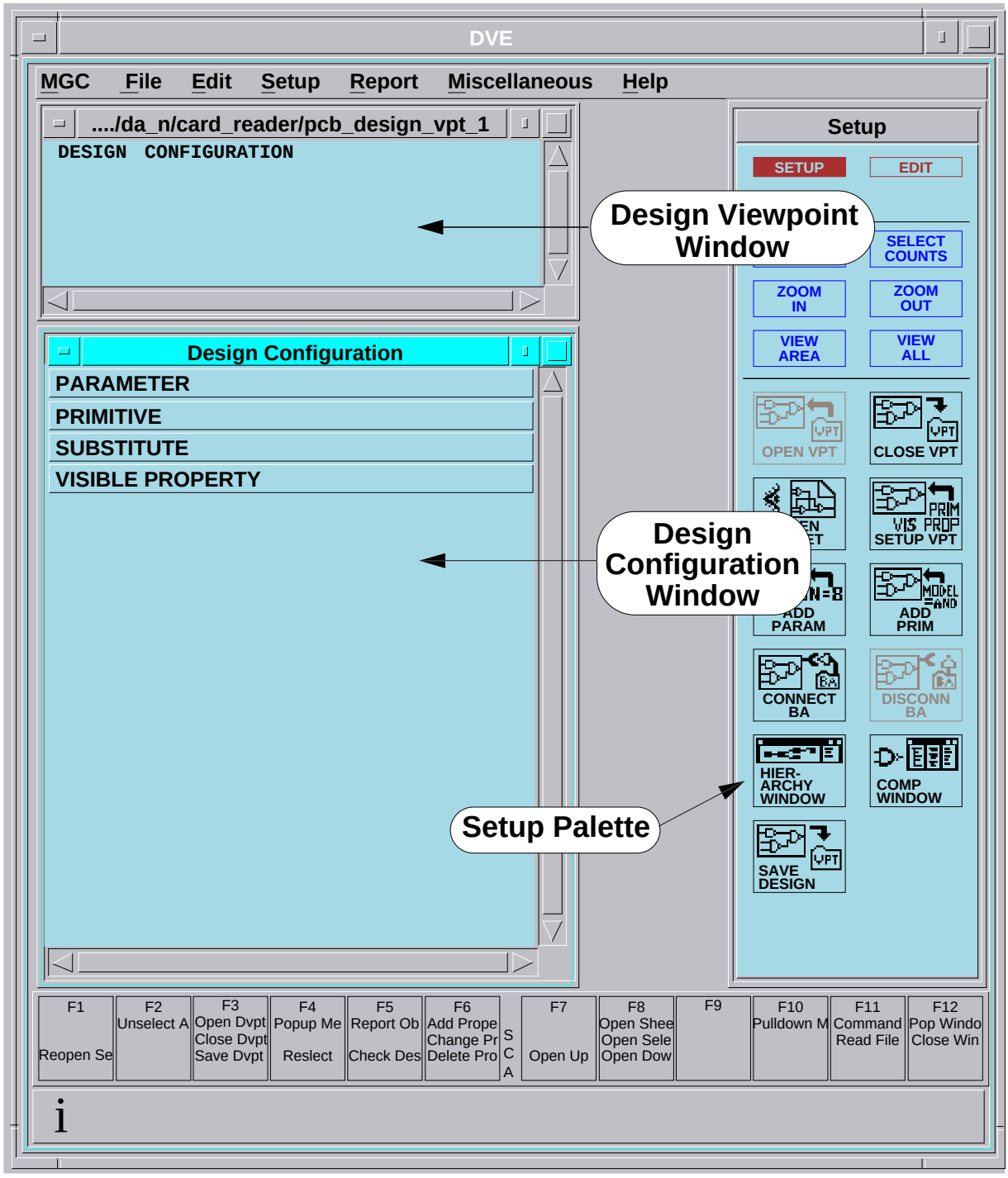
Root Type: Information about the design root (top level) can come from the default component interface table or the default symbol, which ever you specify. If the root component has more than one component interface table or symbol, you can specify the source by entering the name of the object in the **Root Name** entry box.

References: You may specify that the viewpoint is to use the most **Curren**t version of every referenced design object or use the versions that were used the last time the viewpoint was saved to disk (**Last Used**).

Version: You may open a viewpoint on any existing version of the specified root component.

Preset Global Parameters? You may specify global parameters when you invoke on the viewpoint. Otherwise, you may specify global parameters with the Add Parameters command after the editor comes up.

Default Window Arrangement

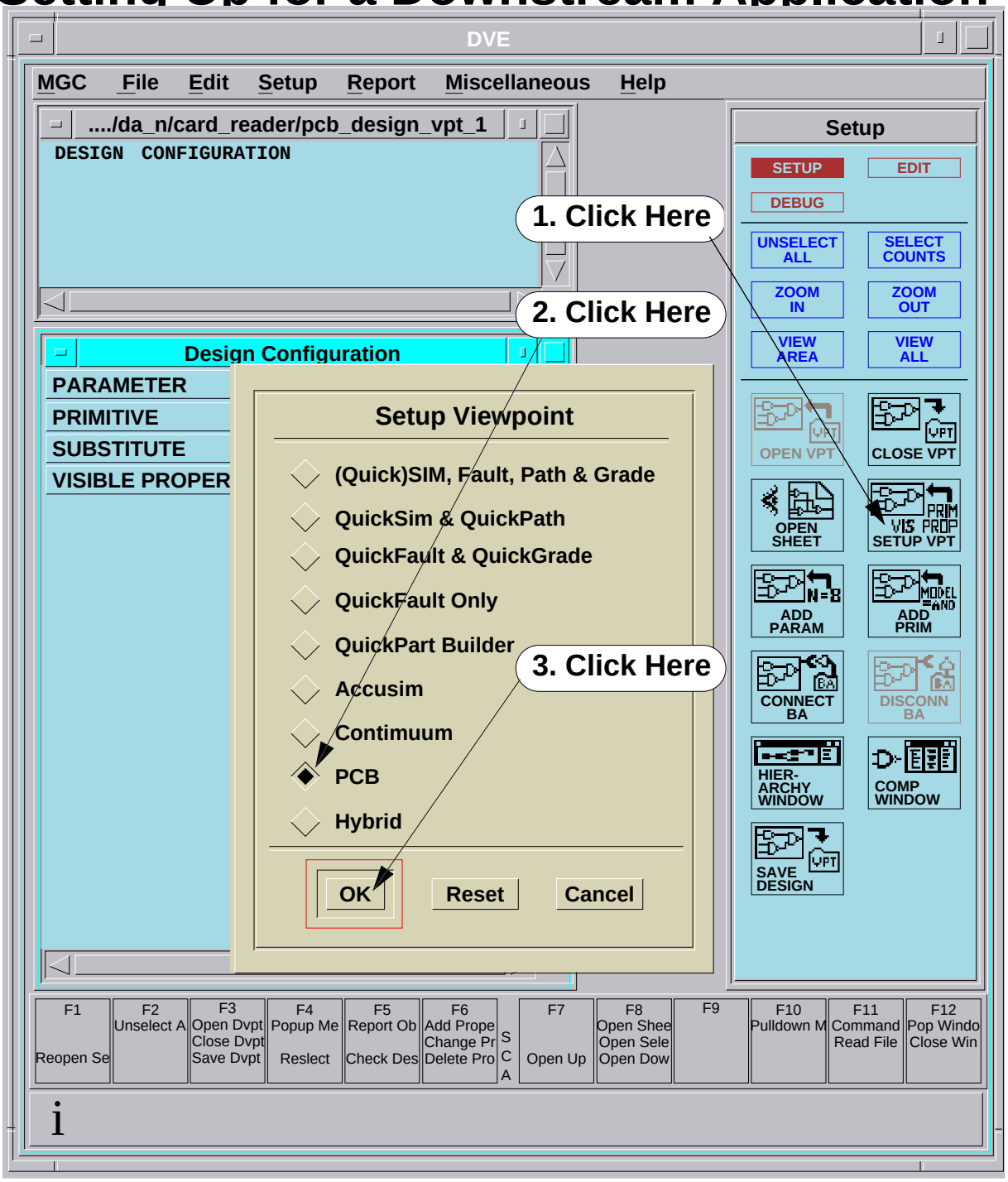


Default Window Arrangement

The default windows for DVE are shown on the left are described as follows:

- **Design Viewpoint Window** This is the main control window for the viewpoint which is named in the title area. When back annotation objects are opened and/or connected to the viewpoint, they are listed in this window.
- **Design Configuration Window** This window shows the configuration rules that are defined for the viewpoint. In the illustration on the left, the viewpoint is new and the rules are undefined, so there is no information displayed other than the title blocks for the rules.
- **Setup Palette** This palette contains icons that you will use to define the configuration rules for the opened viewpoint.

Setting Up for a Downstream Application



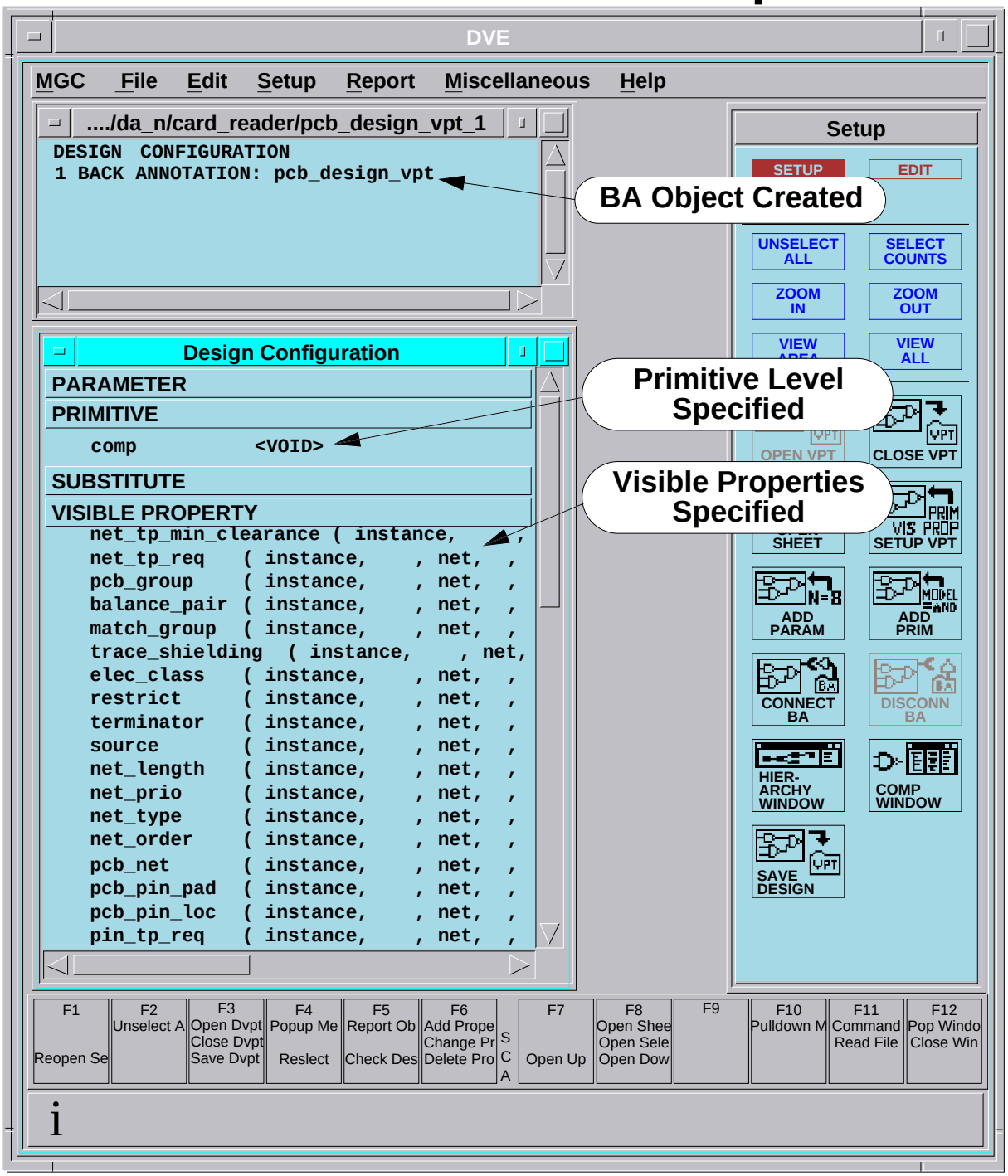
Setting Up for a Downstream Application

The process to set up the design configuration for a downstream application is outlined as follows:

1. Click the SETUP VPT icon
2. Click the button for the downstream tool you will be using.
3. Click OK

You can then watch the rules in the Design Configuration window being automatically defined.

The Default PCB Setup



The Default PCB Setup

The default PCB setup is shown on the left. Notice in the Design Viewpoint window that a new back annotation object called *pcb_design_vpt* is created and opened.

In the Design Configuration window, many visible properties are declared. These properties will be visible to the PCB tools that use the Design File Interface to transmit and receive information. The *comp* property is specified in the primitive list. Because specific values of the comp property are not specified, the value reads (VOID). This means that every instance in the design that has a comp property, regardless of value, is considered primitive (no schematic underneath).

You may add additional parameters, primitive definitions, substitutions, or visible properties by using the palette icons and the Design Configuration window popup menu **Add >**. The next several pages outline this process.

Tasks that can only be done with DVE

- **Browse the design configuration rules of a design viewpoint**
- **Changing the design configuration rules for a design viewpoint**
  - **Define additional parameters at the viewpoint level**
  - **Define addition properties that set the level of “primitiveness” for the design**
  - **Define what additional properties are to be visible to the Design File Interface**
  - **Specifying property value substitutes**
- **Connect and disconnect back annotation objects**
- **Change the priority of back annotation objects**

Tasks that can only be done with DVE

There are certain tasks that can only be done with the Design Viewpoint Editor. These tasks are listed as follows:

- Browsing the design configuration rules specified for a viewpoint.
- Changing the design configuration rules of a viewpoint.
  - Defining additional properties that set the primitive level of the design.
  - Defining global parameters in the viewpoint.
  - Defining property value substitutes.
  - Defining what additional properties are visible to the Design File Interface.
- Connecting and disconnecting back annotation objects.

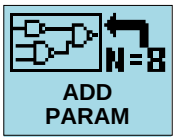
  Connecting a back annotation object created in one tool to a viewpoint created in another tool is how information is transferred between tools.
- Changing the priority of a back annotation object.

  Any change to a property value that is recorded in the highest priority back annotation object overrides all other changes made to the same property in other connected back annotation objects. The highest priority back annotation object is that one that is connect last and is listed as number 1 in the Design Viewpoint window. This object is also called the *active* back annotation object because all new changes are recorded in this object.

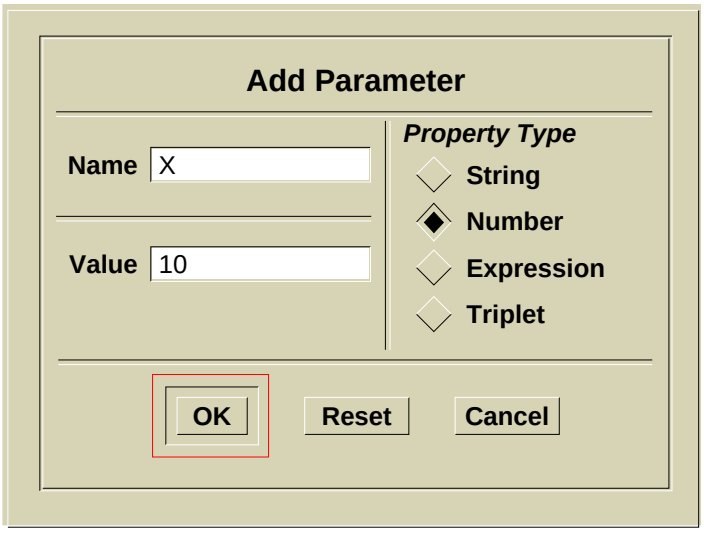
  A lower priority back annotation object is made the highest priority by first disconnecting the object, then re-connecting it back again.

Adding Parameters to the Viewpoint

- **Click Icon:**



- **Fill out Form:**



Adding Parameters to the Viewpoint

A *parameter* is a named value for a variable that is passed to an expression from the outside. A parameter may be defined as another property attached to an object higher in the design tree, it may be a property defined in the design viewpoint parameter rule, or it may be defined through an associated technology file.

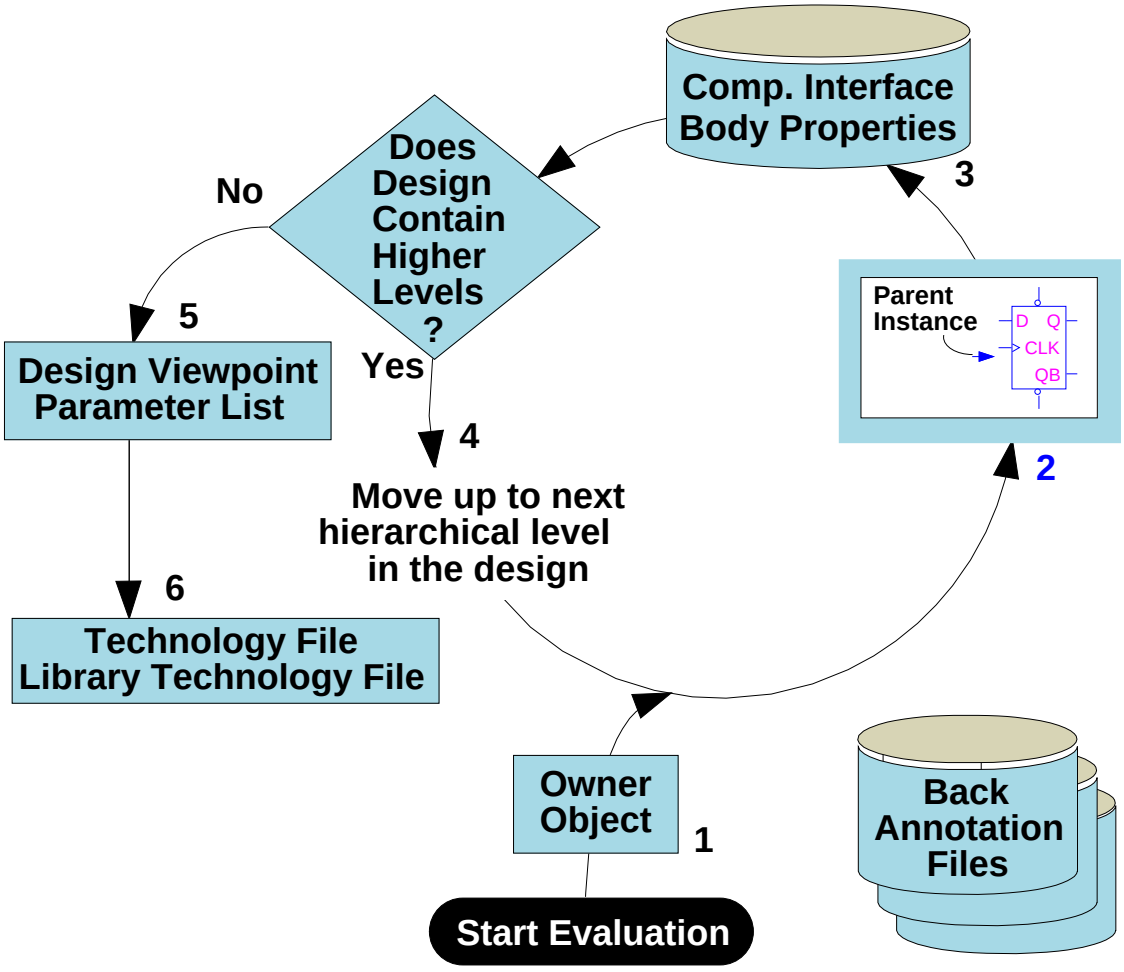
You must define parameters for all variables in the design prior to the time the design is evaluated. As each design object is evaluated, unresolved variables cause the system to search up through the design tree. If a match is found, the value is substituted and the expression is resolved to a constant. If no match found, the parameter rule in the design viewpoint is checked, then the associated technology file is checked, if one exists. If the value for a variable is not found, an error occurs and an error message is issued.

Parameters defined in the viewpoint configuration rule are called *global* parameters, because they can be seen by the entire hierarchical design.

The figure on the left shows how the global parameter X is defined in the viewpoint configuration rule. If a value X is specified in a design expression and the property X is not defined elsewhere higher in the design hierarchy, then the number 10, which is defined for X in the viewpoint, is substituted for X when the expression is evaluated.

The exact search rule for parameters is defined on the next page.

Search Path for Parameters



Search Path for Parameters

When the design is evaluated in the context of a design viewpoint and the system finds an undefined variable in an expression, it starts a search up through the design tree to find a value for that variable. The figure on the facing page illustrates the search path the system uses to find the value. As soon as a valid value is found, the search stops. The search is described as follows:

1. The property owner object (net, instance pin, or instance body) is search first.

2. If the owner in the above step is an instance pin, the body properties of the attached instance are searched next. (If the owner is a net, this step is skipped.)

3. The body property list of the instance's component interface table is searched next. (If the owner is a net, this step is skipped.)

4. Does the design have more levels of hierarchy? If yes, the search moves up one level to the parent instance on the upper sheet. The properties on the instance body are checked first, then the body property list of the instance's component interface table is searched next.

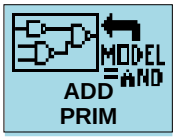
   During each step in the search up the design tree, the value of a parameter may be overridden by a back annotation specified in a connected back annotation object. If more than one back annotation object is connected, the BA objects are search in prioritized order.

5. After the parent instance on the top sheet is searched, the design viewpoint Parameters list is searched.

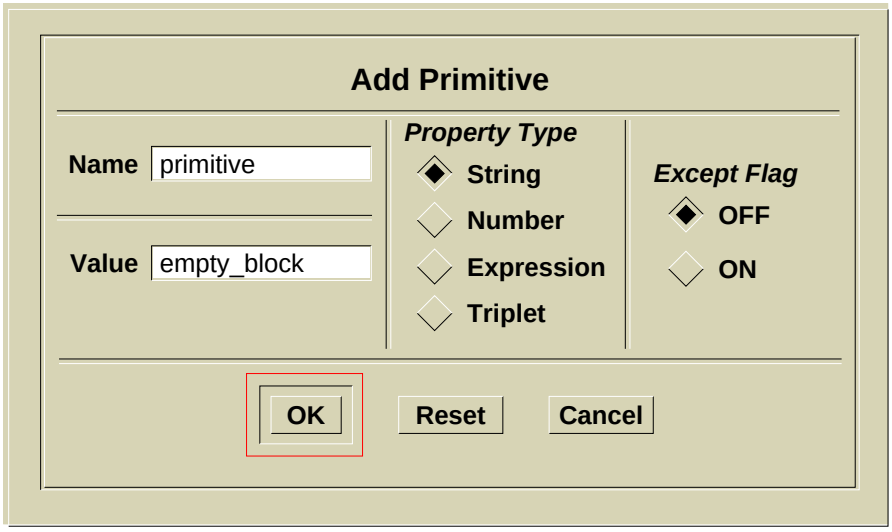
6. If a value is still not found, a corresponding technology file (if registered to the top-level component) and then the library data technology file (if registered with the top-level component) is searched for the parameter. If the value is still not found or if the technology files do not exist, an error is issued.

Defining Primitive Instances

- **To add a primitive level, click icon:**



- **Fill out Form:**



- **If no primitive rules exist, the evaluation stops at instances that have no models**

Defining Primitive Instances

The design evaluation progresses from the highest hierarchical level to a stopping point recognized by finding certain property names and values on instances. Any instance which is a termination point in the descent is called a *primitive*. To set which instances are to be considered primitive during evaluation, property names and, optionally, values are listed in the primitive rule.

If no primitive rules are specified, the evaluation stops at instances that have no models. Such instances are marked as primitive, and appropriate warning or error messages are issued.

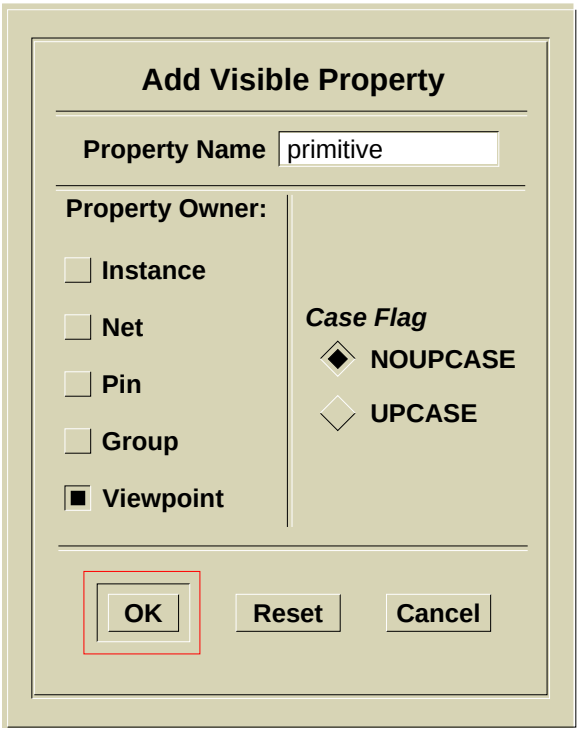
The depth of design evaluation depends on which downstream tool you plan to use. For example, the PCB viewpoint specifies that any instance with a **comp** property, regardless of value, is to be considered primitive. The presence of a **comp** property implies that a physical part exists for that instance. A simulation viewpoint, on the other hand, may need to descend further in order to read a possible schematic-based functional model.

In the primitive definition shown on the left, any instance that owns the property named **primitive** with a value **empty_block** will be considered primitive by the system. You can attach a property like this to the ANALOG, FREQ_DET, and ACCESS blocks in the card reader design that you created in the last module and the system will know that the blocks are primitive on purpose. This eliminates the warning messages and search for non-existent models during the design evaluation process. If you attach a primitive property to the add_convert block, the system won’t descend into that block. Why might you want to do this?

To edit an existing primitive rule in the list of primitive rules, select the primitive rule you want to change, then execute the Design Configuration window popup menu item **Edit**. A dialog box appears for you to make changes. To delete a primitive rule, select the desired rule, then execute the **Delete** popup menu item. The primitive rule is removed from the list.

Defining Visible Properties

- Defines properties to be made visible to the Design File Interface
- Use the Design Configuration window popup menu: Add > Visible Property...
- Fill out form:.



Defining Visible Properties

The *visible property* rule informs DVE which properties are to be made visible to the Design File Interface(DFI) and netlisters that are built on DFI. Typically, the visible property rule is issued three times, once for each owner type (Instance, Pin, Net), followed by a list of properties (model, modelfile, modelcode) for that owner. For example:

```
ADD VIsible Property  -Instance  model modelfile modelcode
ADD VIsible Property  -Pin rise fall drive pintype
ADD VIsible Property  -Net init dtime decay
```

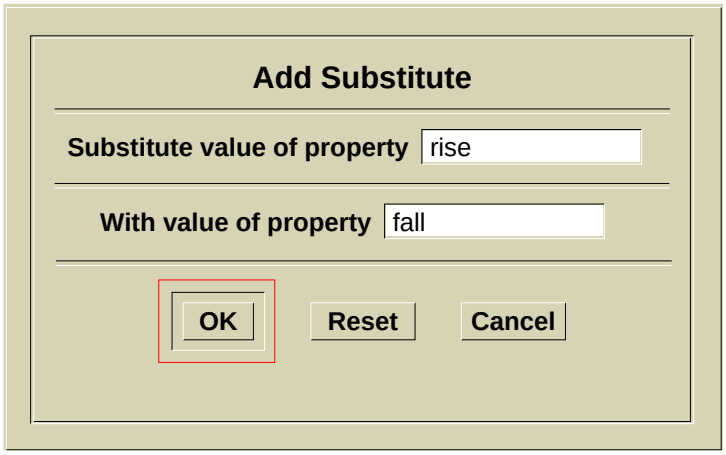
It is important to note that only the properties you specify with the visible property rule are accessible to DFI and netlisters that use DFI calls, and are only available as long as the design viewpoint exists.

You use the **Add > Visible Property** popup menu item in the Design Configuration window as shown on the left. If you want to edit an existing visible property rule, select the visible property rule you want to change, then execute the Design Configuration window popup menu item **Edit**.

A visible property rule can be removed from the list by using the **Delete** popup menu.

Specifying Substitute Property Values

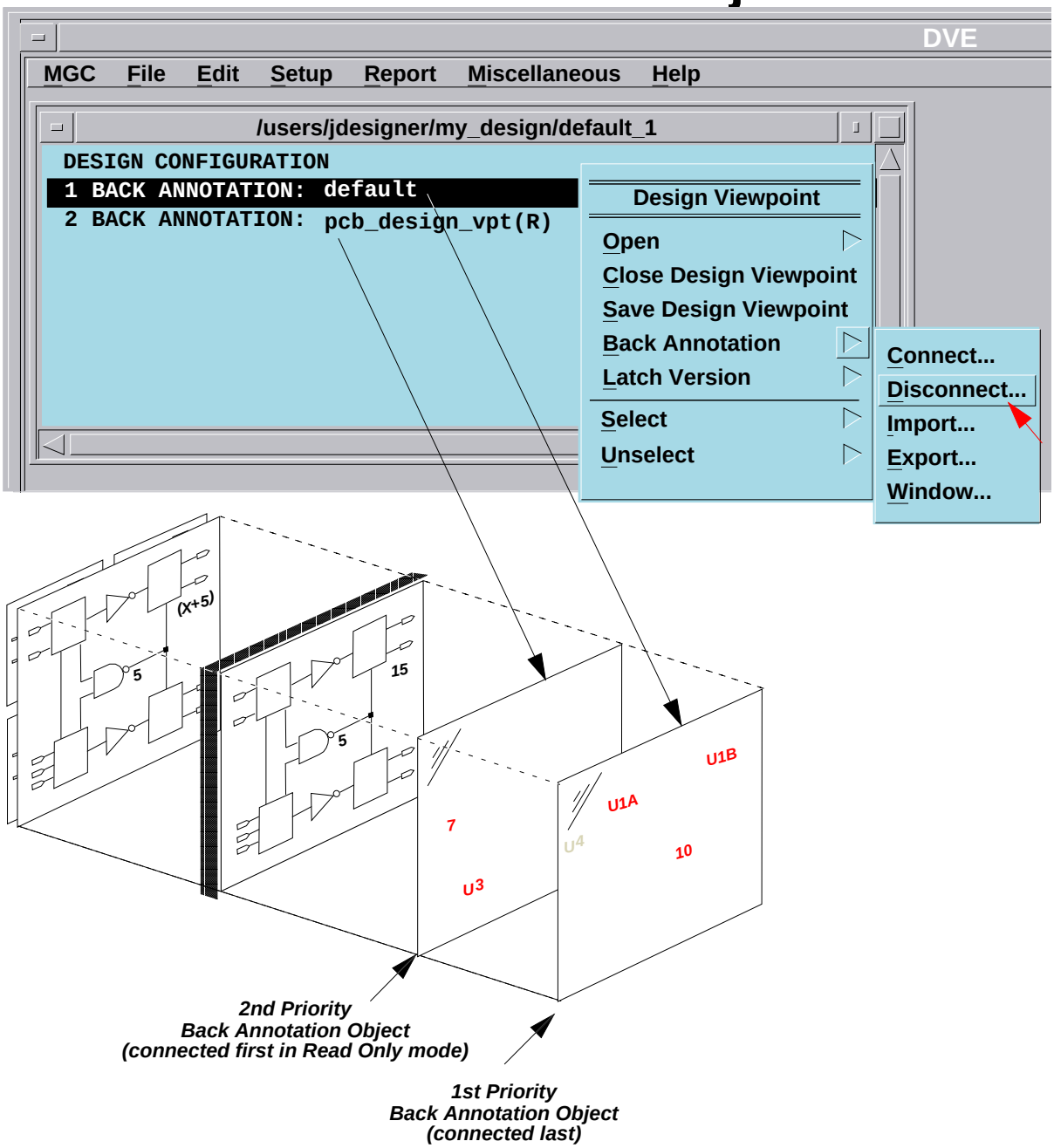
- Allows one property's value to be substituted for another
- Provides a property value where none exists
- Use popup menu:
  (Design Configuration) Add Substitute
- Fill out Form:



Specifying Substitute Property Values

The substitution rule allows one property's *value* to be substituted for another property's value. It can also provide a property value where none exists. For example, suppose you have a design with Rise and Fall properties assigned with various values. For a particular simulation you want the Rise property delay to be the same as the Fall property delay. The figure on the left shows how to fill out the Add Substitute form. This example means “substitute the value of the Rise property with the value of the Fall property” for each instance in the design. The value of the Fall property is unaffected.

Connecting and Disconnecting Back Annotation Objects



Connecting and Disconnecting Back Annotation Objects

The back annotation objects that are connected to the design viewpoint are listed in the Design Viewpoint window as shown on the left. In the illustration, the back annotation list in the window indicates that the **pcb_design_vpt** back annotation object was connect first (in read only mode), then the back annotation object named **default** was connected last. The back annotation object named **default** has the highest priority and is the “active” back annotation object, meaning that it will receive any new changes made to the design.

In the illustration, the default back annotation object has been selected in the window and the popup menu **Back Annotation > Disconnect** has been chosen. A form will appear to verify the pathname of the selected back annotation object. In this case, when the form is executed, the **default** back annotation object will be disconnected and the **pcb_design_vpt** back annotation will become the highest priority back annotation object. Since this object was originally connected in read only mode, no changes will be written to it.

In a similar manner, if you choose the popup menu item **Back Annotation > Connect,** a form comes up where you can specify the pathname of a back annotation object you which to connect to the viewpoint.

Other Tasks that may be done with DVE

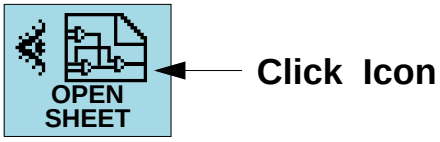
- Automatically setup for a downstream application
- View schematic sheets and VHDL models
- Add, modify, and delete back annotated property values
- Import and Export ASCII back annotation files
- Perform a design-wide check
- Latch a viewpoint
- Report on design objects

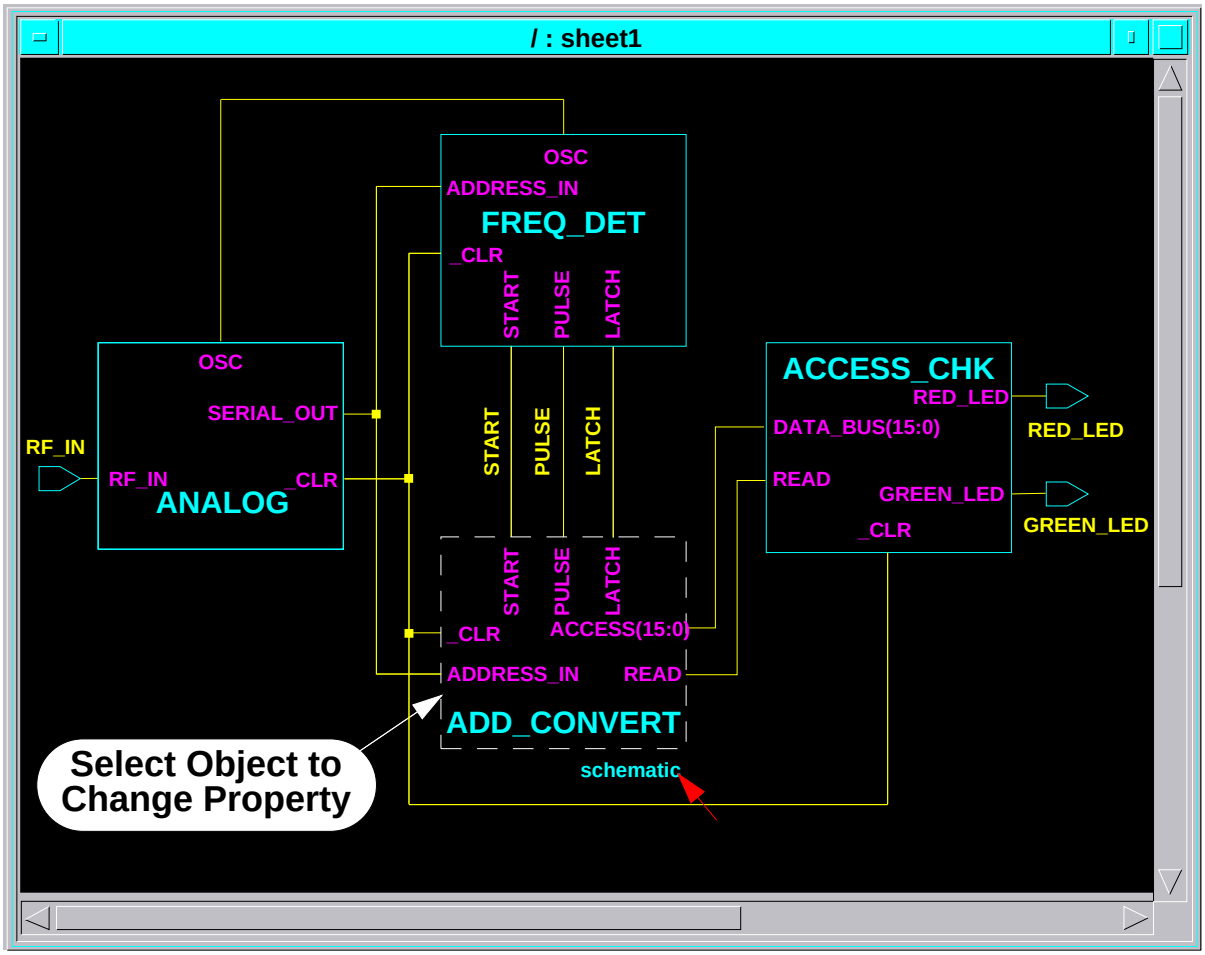
Other Tasks that may be done with DVE

You can perform the following tasks in DVE as well as in other applications:

- Automatically setup for a Downstream Application. (This has already been discussed.)
- View schematic sheets or VHDL models in your design. You can use the Schematic View Window to manipulate the back annotation properties on a schematic sheet displayed in that window. However, you can not manipulate the nets, instances, and SLD properties on the schematic like you can in the Design Architect Schematic Editor window.
- Add, modify and delete back-annotated property values. This includes changing the value of the Model property which changes the selection of the functional model underneath the instance.
- Importing an ASCII back annotation file into a back annotation object is an alternate method of back annotating a design. This can be used, for example, when you receive a set of timing values from an ASIC vendor. In like manner, data in a back annotation object can be exported to an ASCII back annotation file to provide a simple medium for editing and transporting the data.
- Check the syntax of your entire design. This check is design-wide in the context of the design viewpoint configuration. This check is different from the checking in DA, in that DA only checks a single schematic sheet or multiple sheets at the same level. DVE performs extensive checks of the entire design hierarchy with respect to the rules in the design configuration.
- Latching a viewpoint. This action freezes the design object versions that the viewpoint is invoked on and prevents these version from being deleted by the version manager. The purpose is to provide a stable environment for design team members that are working with downstrean analysis tools.
- Reports can be generated on any or all the objects being viewed through the viewpoint.

Schematic View Window



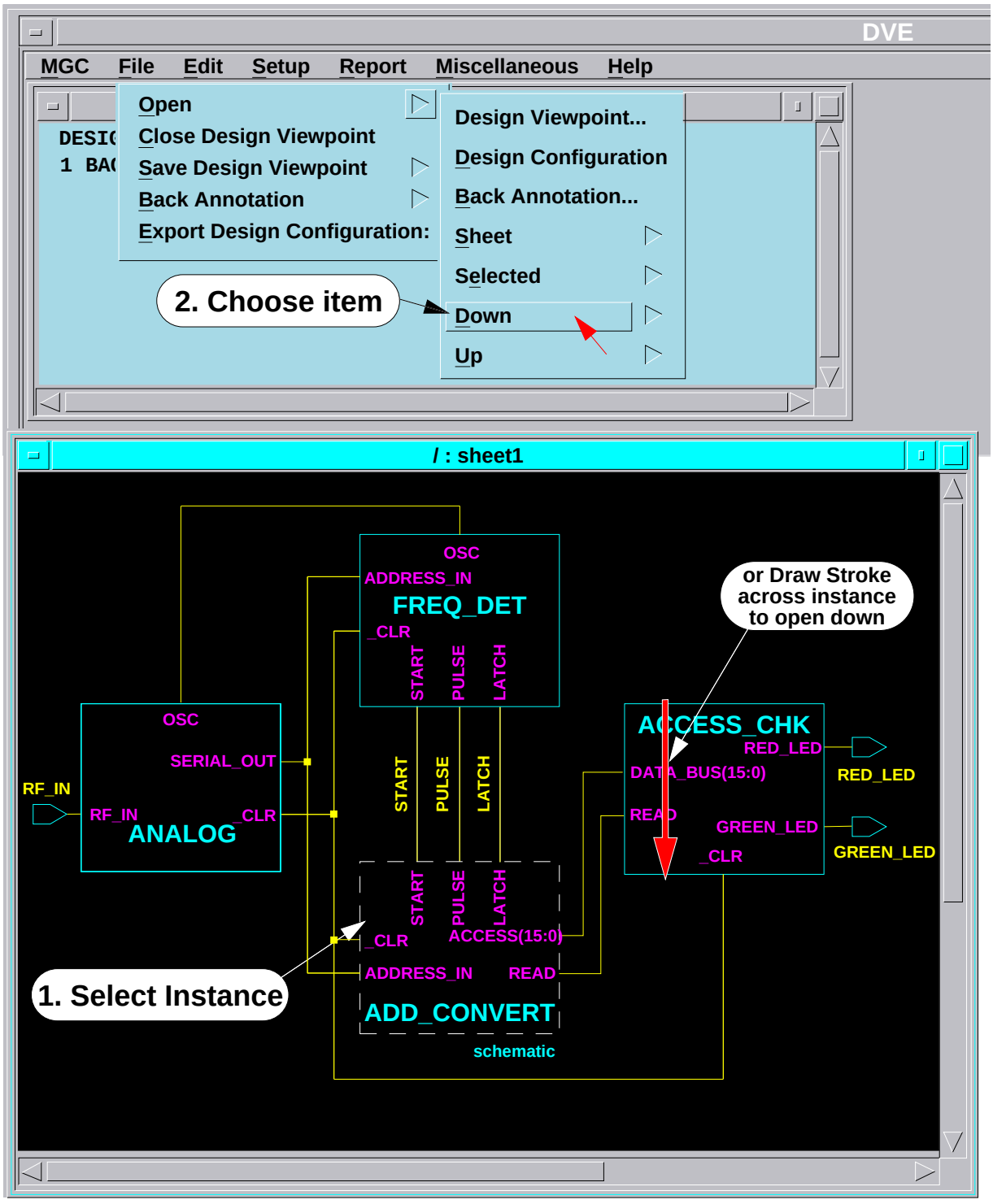


Schematic View Window

You can view the design source for schematics and VHDL models by clicking on the OPEN SHEET icon as shown on the left. This window appears like a Schematic View window in Design Architect, but it is slightly different. In this window you can only add, change, or delete non-SLD properties by selecting the property owner object and executing the appropriate command from the EDIT palette or the popup menu.

An alternate (and sometimes quicker) method of changing a property value is to place the cursor on a property value, as shown on the left, and press SHIFT F7.

Opening Down into the Hierarchy

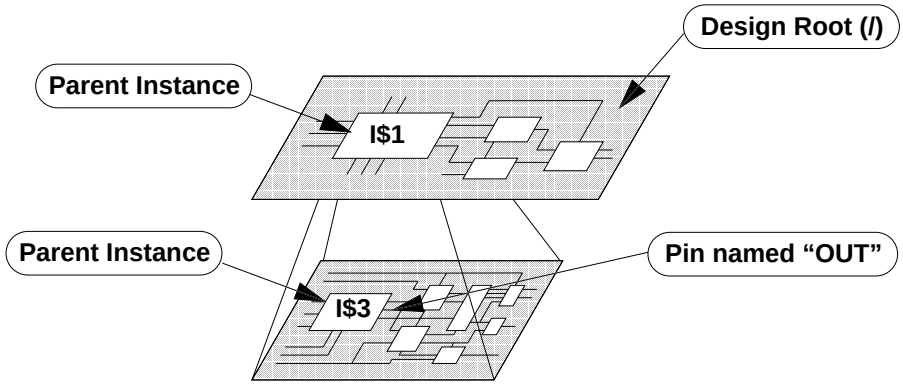


Opening Down into the Hierarchy

The Schematic View window can only display one sheet of a schematic at a time, however, you may open as many Schematic View windows as you desire. And like the Schematic Editor window in Design Architect, you may open down into the design hierarchy. The quick way to open down is to draw a vertical stroke (top-to-bottom) across an instance. You may also use the **File > Open > Down** pulldown menu to open down into the selected instance.

Referencing Objects in a Hierarchy

- A hierarchical design is similar to a hierarchical file structure
- The origin of the design tree (the top sheet) called the “root” of the design (the tree is upside down)
- Instances are like “directories,” nets and instance pins are like “files”
- Example: /I$1/I$3/OUT



Referencing Objects in a Hierarchy

Every instance, net, and instance pin within a design is part of a hierarchical tree of information that describes the relationship of every object to its surroundings. This hierarchical arrangement is called the *design tree*, with its origin beginning at the root of the design (the top sheet).

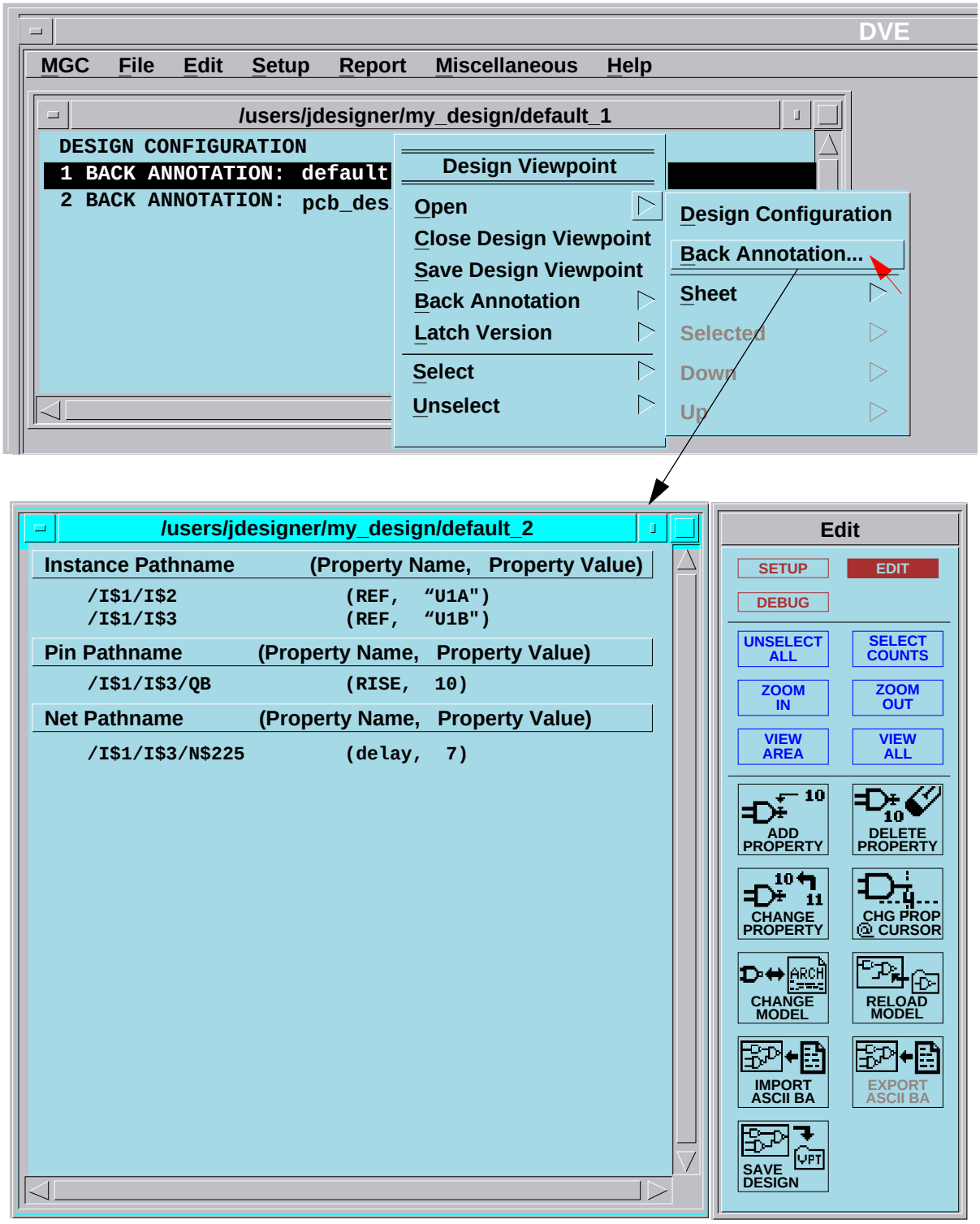
When you are in an application that uses a design viewpoint, you have access to the design tree, thus providing you with a method to identify objects within the design hierarchy.

You can identify every instance, net, and instance pin by a pathname. These pathnames are defined in relation to a hierarchy of instances that comprise the design. A hierarchical design is conceptually similar to the hierarchical file structure of your workstation's operating system; you can think of instances as the “directories”, and nets and instance pins as the “files.” The root level of the design is referenced by a slash (/).

By following a path that starts at the root level of the design(/), you can find any instance, net, or instance pin. For example, in the figure on the facing page the pathname /I$1/I$3/OUT is the pathname to an instance pin named OUT on an instance I$3. I$3 is an instance on a schematic whose parent instance I$1 lives on the sheet at the root level.

In the figure on the left, all the nets on the lower schematic have I$1 on the root sheet as a parent instance. So, for example, the pathname /I$1/N$245 refers to a net with the handle N$245 on the lower sheet.

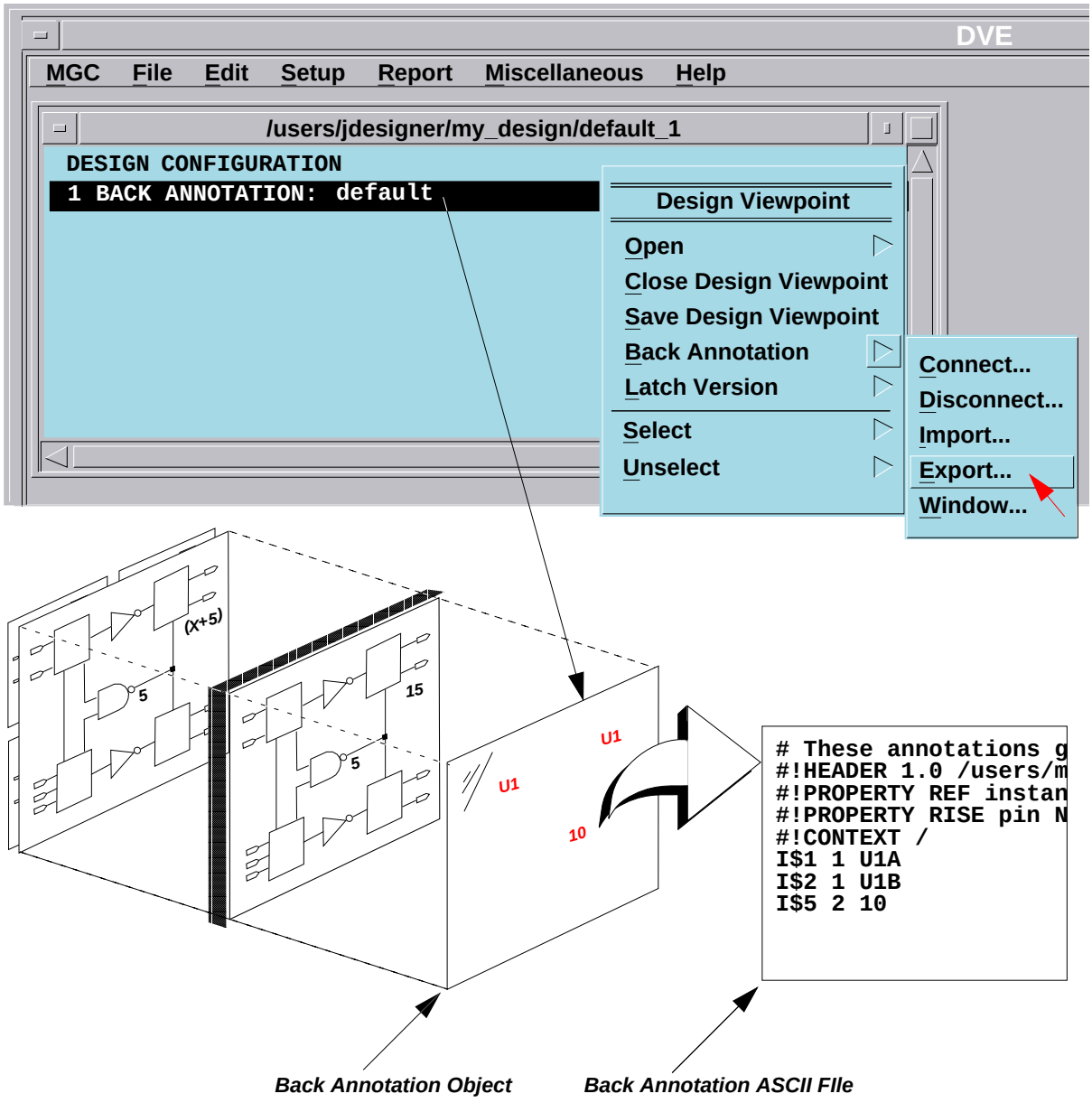
Back Annotation Window



Back Annotation Window

A Back Annotation window may be opened on any connected back annotation object by selecting the object name in the Design Viewpoint window and choosing the popup menu item **Open > Back Annotation**, as shown on the left. Annotations may be added. changed or deleted by clicking on the appropriate icon in the EDIT palette as shown in the diagram.

Importing and Exporting Back Annotation ASCII Files



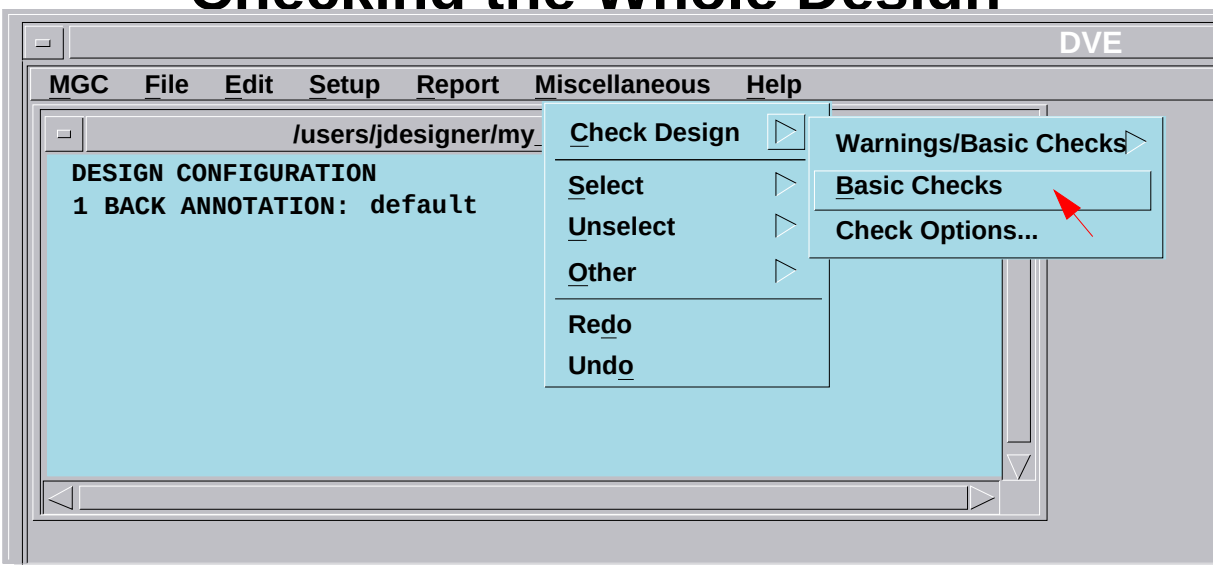
Importing and Exporting Back Annotation ASCII Files

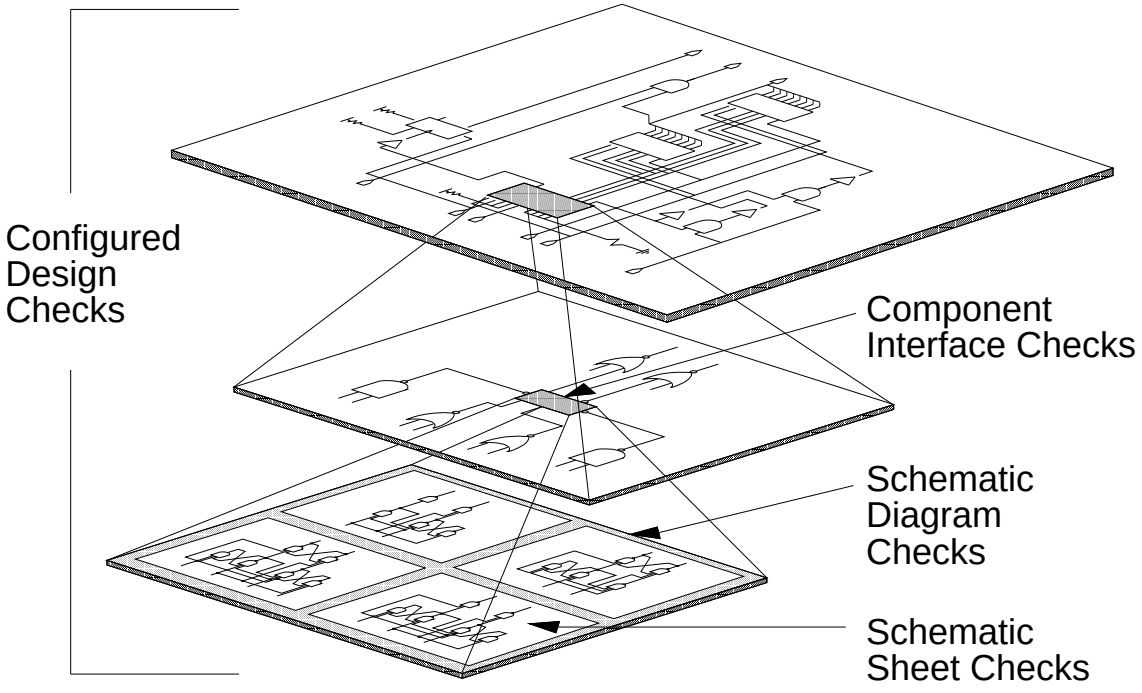
Exporting and importing back annotation data in ASCII form is a way to transfer data between back annotation objects. ASIC vendors may use this simple medium to transfer physical layout back annotation information to customers at remote sites.

The figure on the left illustrates how the information in a back annotation object may be exported as an ASCII text file. The ASCII file is formatted in a way that uses certain key words that are meaningful to the transfer of data in this format. The keywords are fully explained in the *DVE User's and Reference Manual.*

In a similar manner, the information in an ASCII back annotation file may be imported to another specified back annotation object.

Checking the Whole Design





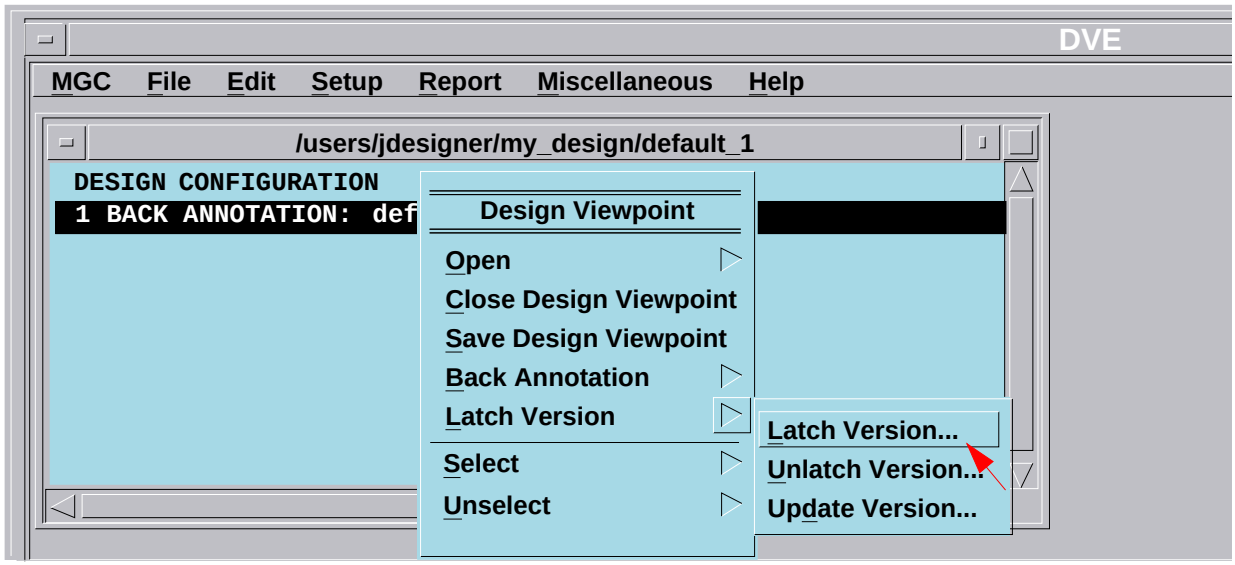
Checking the Whole Design

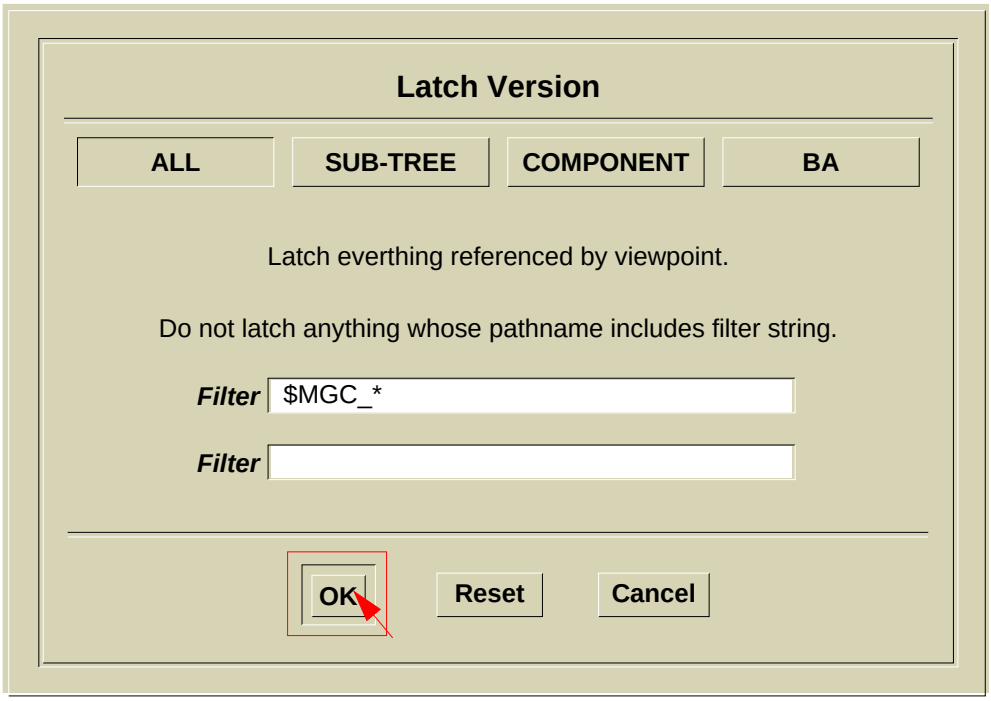
DVE can perform extensive checks of the entire design hierarchy, using rules in the design configuration and your target tool. These checks also examine the design for mismatched connections, unique names, and parameter values. DVE uses the **$check_design()** function. The checks are also performed during the invocation of QuickSim II on your design.

You can examine the sheet that caused an error or warning by selecting the instance pathname in the Check Design window, then use the Open Selected command. Once you know which sheet caused the error, you can open Design Architect in another shell, make the necessary changes to the sheets that contain errors and warnings, then check and save the component. You may also have errors and warnings that can be fixed by adjusting the design configuration rules or back annotations in DVE.

To re-check the design in DVE, use the **Edit > Reload Model** pulldown menu item, specifying that all or specific models should be reloaded. This causes the specified models to be reloaded into memory from disk.

Latching a Viewpoint





Latching a Viewpoint

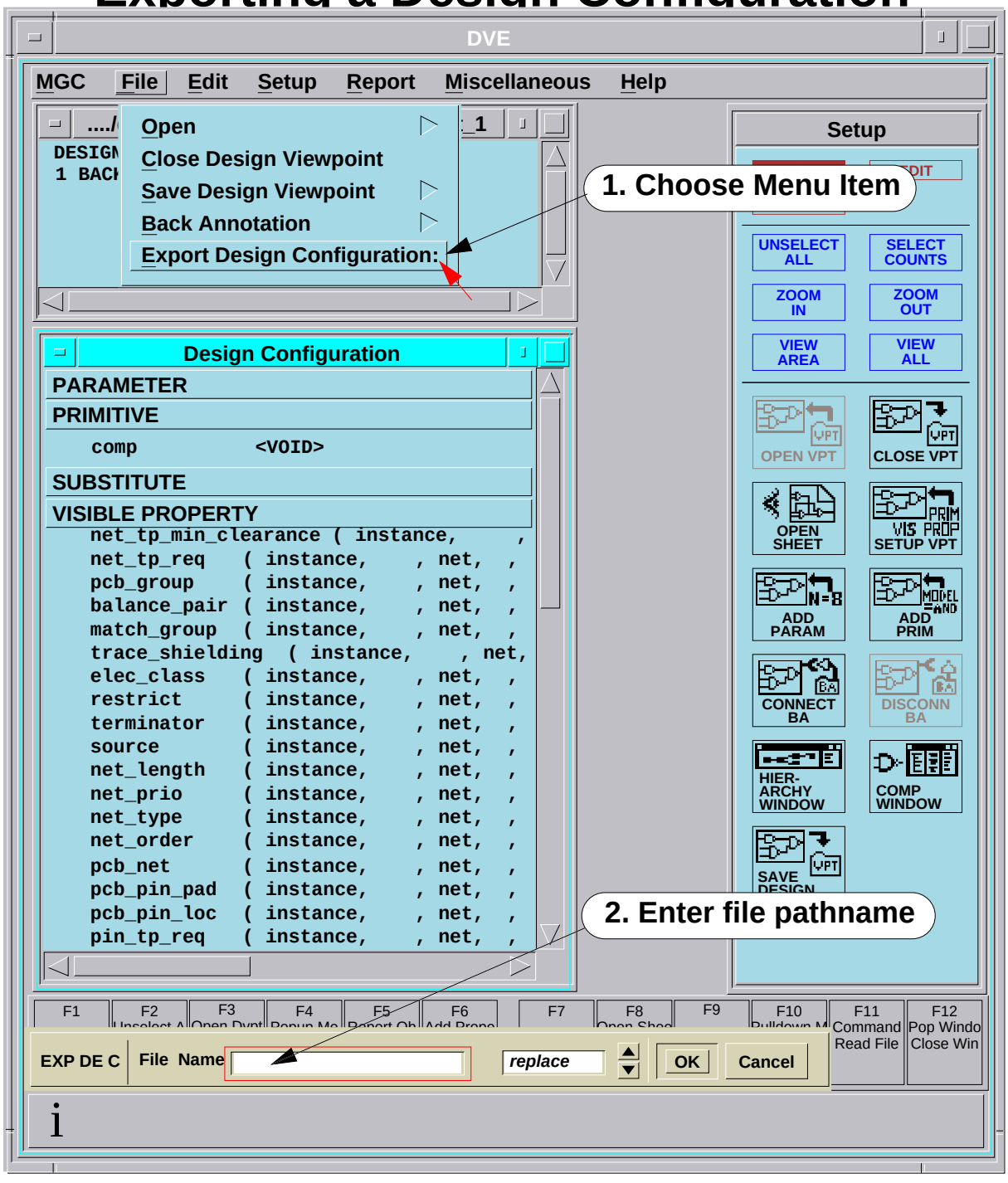
When a team is working on a design, some team members may need to “freeze” or “latch” a design version in its current state so they can perform simulation or physical layout without seeing the daily changes made by others on the design source.

The latching mechanism prevents the currently referenced versions of objects from being deleted, and specifies that only these versions should be used with the design viewpoint. It also lets others continue with development on the original source while a “frozen” version is being used for simulation or layout. Once a design viewpoint is latched, the design will not use an updated version of the source design until you specifically update it. You can latch a design viewpoint using DVE or QuickSim II. The latching capabilities let you do the following:

- Latch (or freeze) a version of every object referenced by the design viewpoint. These objects include components, models, component interfaces, VHDL source, and back annotation objects.
- Control the latching or unlatching of a specific sub-trees or back annotation object. This lets you specify when you want the design viewpoint to use the updated versions of the design or back annotation objects.
- Update the entire design to use the latest component and back annotation objects. This operation unlatches the design and re-latches with the newest versions.
- Filter out certain objects from being latched. The filter string **$MGC_*** in the form on the left prevents components in Mentor Graphics libraries from being latched.
- View references and version numbers of some or all of the objects used by the design viewpoint.

Reporting on Latching Status. You can generate a report that shows the latched versions and the most current version of every object in the design. The report is generated by choosing the pulldown menu item **Report > References...**

Exporting a Design Configuration



Exporting a Design Configuration

Viewpoints can not be included within viewpoints. If each member of a design team creates a viewpoint for testing a sub-module in a complex design, the viewpoints for the sub-modules and their associated configuration rules and back annotation objects can not be directly included in a higher-level viewpoint just by creating the higher-level viewpoint.

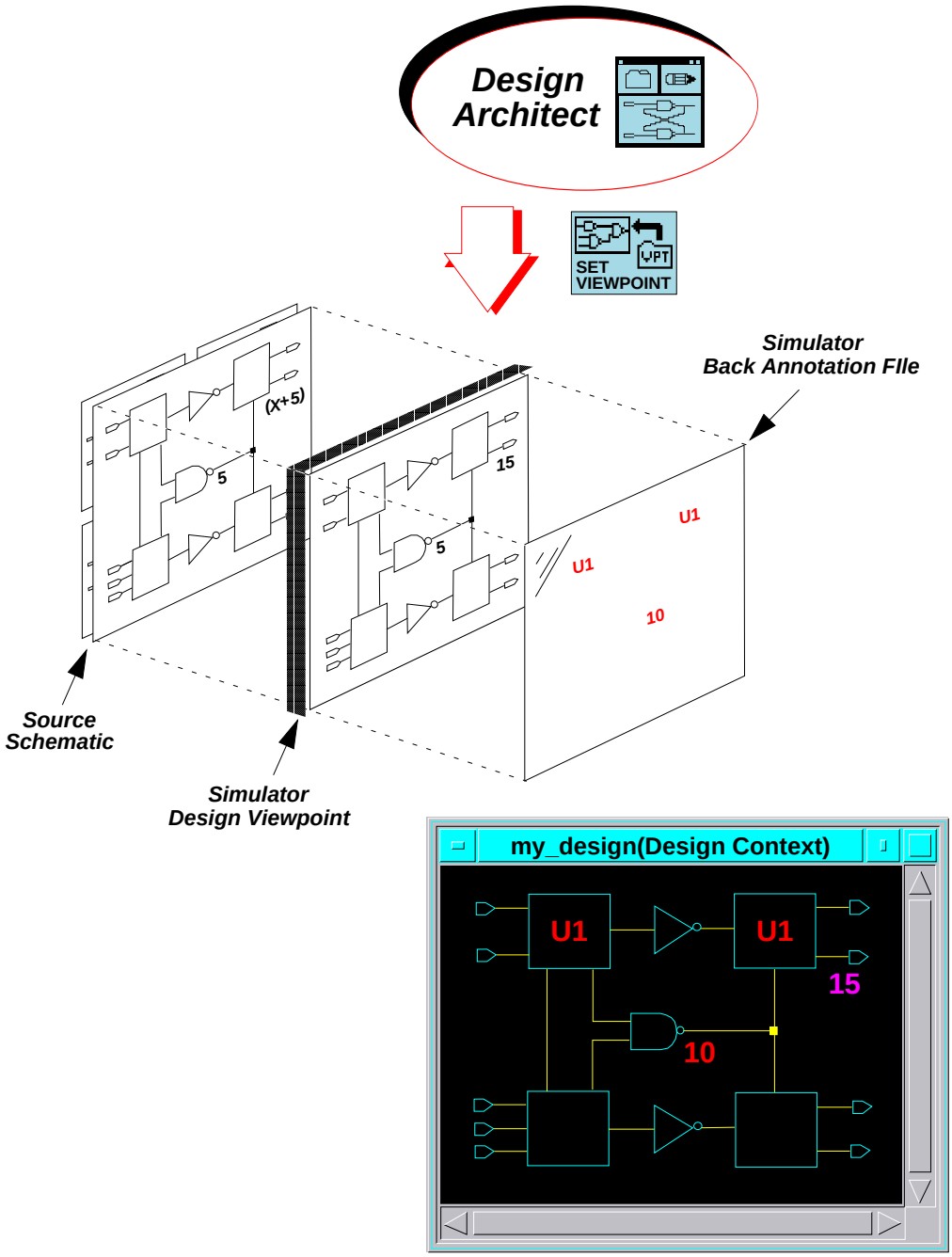
The ability to export a design configuration from one viewpoint to another solves the problem described above. Assume that the viewpoint opened in the figure on the left is a viewpoint for a sub-module of a more complex design. When it comes time to create a viewpoint for the entire design, a new viewpoint by a different name can be opened in a different DVE session. The design configuration rules for this sub-module can then be exported to an ASCII file. The content of the file takes the form of an AMPLE script. And, as previously described, any back annotation information from the lower-level viewpoint can be exported to a back annotation object in the higher-level viewpoint.

In the viewpoint DVE session for the whole design, the design configuration information from a pre-tested sub-module can be imported and added to the existing configuration rules by executing the newly created ASCII file as a dofile in a command line. For example, if the exported configuration for a sub-module is placed in a file named */user/jdesigner/card_reader_config*, then from a command line in the DVE session for the whole design, you type:

The information in the ASCII file is then imported to the new higher-level viewpoint and added to the existing design configuration rules.

Lesson 3
Using Design Architect to Edit and Merge Back Annotations

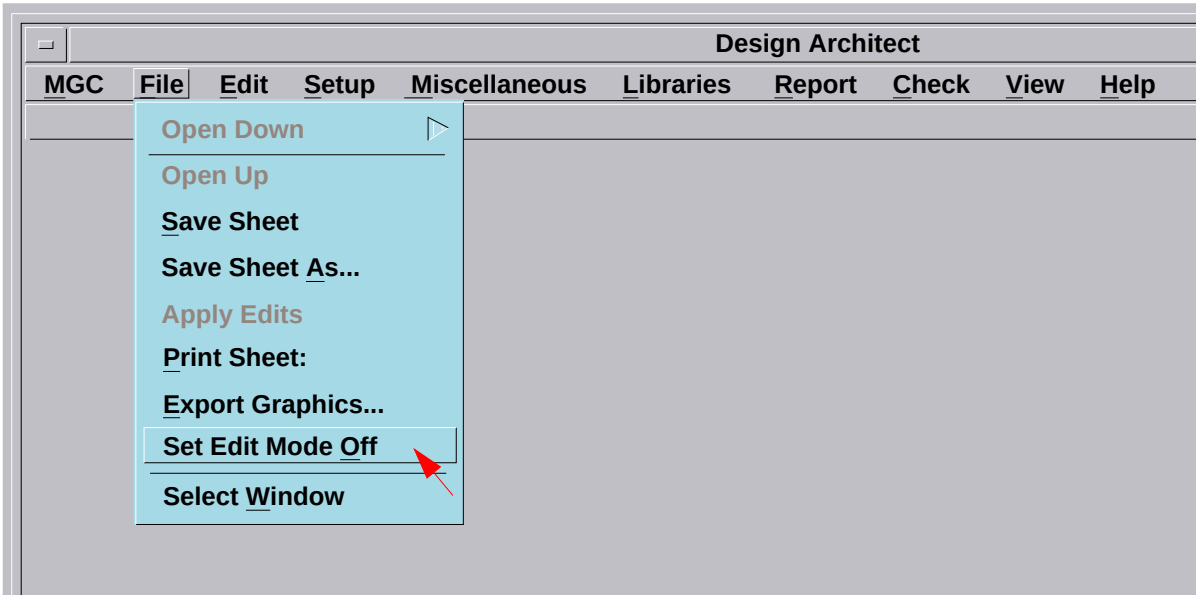
Editing in the Context of a Design Viewpoint



Editing in the Context of a Design

When you click on the SET VIEWPOINT icon in Design Architect and specify the name of a design viewpoint, you are opening the sheet in the context of a design viewpoint. Back annotation properties can be viewed on the sheet, along with the properties that were added when the schematic sheet was originally created. Both sources of properties can be displayed on the schematic sheet and viewed in their evaluated or unevaluated state. When viewed in its unevaluated state, the property values appear as when you created them on the source sheet. When viewed evaluated, all variables in the expressions are evaluated using the defined parameters. When back annotations are displayed, you can edit the annotations and save them in the back annotation object, or you can merge them to the sheet, where they appear subsequently as the property values for every occurrence of that sheet in any design.

Edit Mode vs. Annotation Visibility



	Annotations On	Annotations Off
Edits On	Properties edited on back annotation object	Properties edited on schematic sheet
Edits Off	Properties edited on back annotation object	Properties cannot be edited on any sheet objects

- A parent instance with a Source_Edit_Allowed property set to “false” locks the schematic underneath for edit.

Edit Mode vs. Annotation Visibility

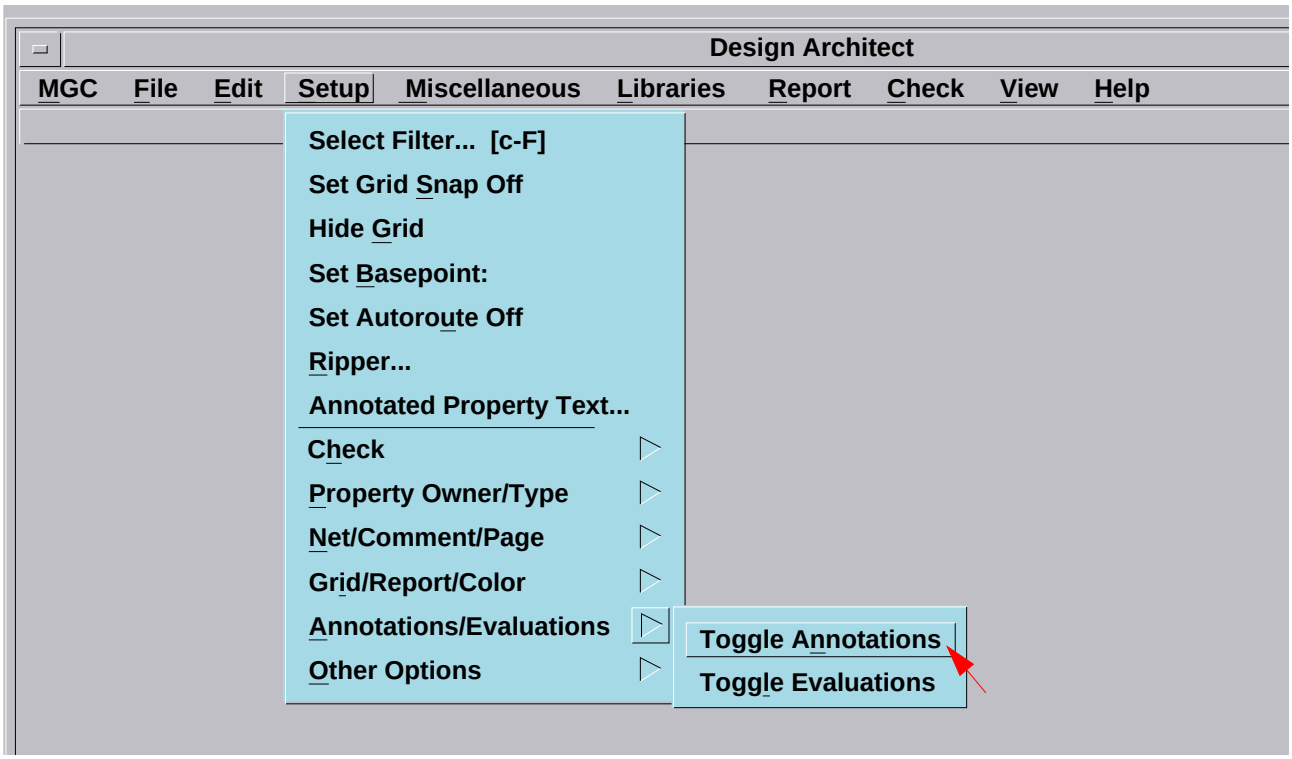
There are three menu items that control whether properties are added or modified on the schematic sheet or to the back annotation object when you are editing in the context of a design viewpoint. The **File > Set Edit Mode On/Off** menu items control whether properties or property values are editable on the schematic sheet. The **Setup > Annotations/Evaluations > Toggle Annotation**s changes the current state of editing to either editing back-annotated data (annotations are on), or editing the schematic sheet (annotations are off).

The setting of the edit mode and the current state of editing controls where and how the properties are added or modified as the table on the facing page shows. If the current state of editing is set to back annotations, then all additions or modifications of properties (except of SLD properties) are added to the back annotation object, no matter how the edit mode is set. If the current state of editing is set to the schematic sheet and the edit mode is to set to “on,” then the additions and modifications to the properties are performed on the schematic sheet. If the current state of editing is set to the schematic sheet and edit mode is set to “off,” then no property additions or modifications are allowed.

When the current state of editing affects only back-annotated data, properties whose back-annotated value is shown are displayed in red, and the properties on the schematic sheet are displayed in the color of the owning object. When the current state of editing affects only the properties on the sheet, back-annotated data is not displayed.

Using a Parent Instance to Lock a Schematic Sheet for Edit. You can also lock schematic sheet edits by attaching the **Source_Edit_Allowed** property with the value of “false” to the parent instance on another sheet. In this case, when you traverse down to the sheet of the parent instance, edits cannot be made to the schematic sheet until the Source_Edit_Allowed property value is changed to “true” and the source sheet of the parent instance is checked and saved to disk. Changing the value of a Source_Edit_Allowed property through a back annotation has no effect. The change must be made directly to the parent instance on the source sheet.

Annotations vs. Evaluations



	Evaluations On	Evaluations Off
Annotations On	View evaluated properties from back annotation object and schematic sheet	View unevaluated properties from back annotation object and schematic sheet
Annotations Off	View evaluated properties from schematic sheet	View unevaluated properties from schematic sheet

Annotations vs. Evaluations

There are two menu items that control how properties are viewed on the schematic sheet. The **Setup > Annotations/Evaluations >Toggle Evaluations** menu item controls whether property values are displayed in their unevaluated or evaluated form. Design Architect uses the design configuration rules defined in the design viewpoint to resolve and evaluate the properties.

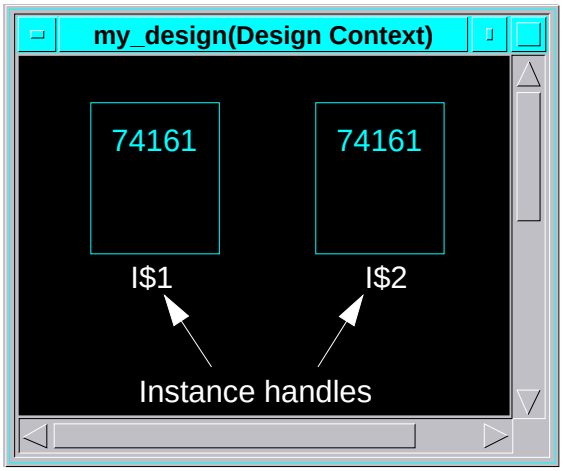
The **Setup > Annotations/Evaluations > Toggle Annotations** changes the current state of viewing to either viewing properties from the back annotation object or viewing properties on the schematic sheet only.

The results of the annotation and evaluation settings are displayed in the table on the facing page. If evaluations and annotations are both set to on, the sheet displays evaluated properties from both the back annotation object and the schematic sheet. If evaluations are on and annotations are off, the sheet displays evaluated properties from the schematic sheet only; back annotations are not displayed. If evaluations are off and annotations are on, the sheet displays unevaluated properties from both the back annotation object and the schematic sheet. If both evaluations and annotations are off, the sheet displays unevaluated properties from the schematic sheet.

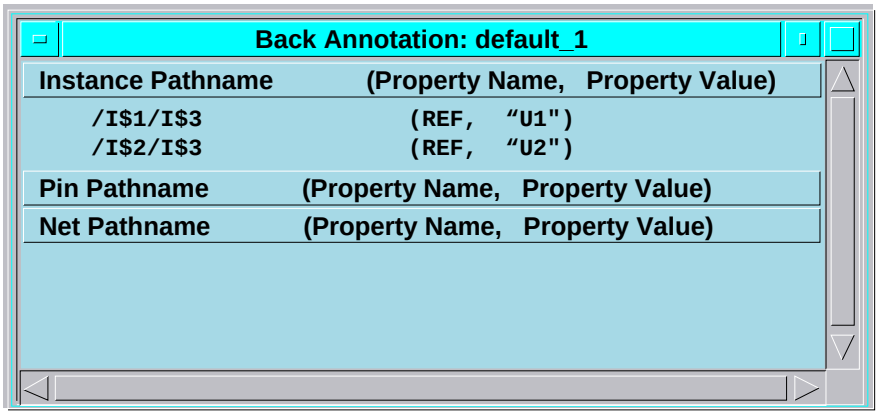
If you change or add a property value as an expression and evaluations are set to on, and you would like to see the new property expression in its evaluated state, but you must first execute the **Miscellaneous > Recalculate Properties** menu item.

Viewing and Editing Properties

- **Design:**



- **Back annotation object:**



Viewing and Editing Properties

The example on the facing page and next few pages, shows how back annotations are viewed and edited in Design Architect in the context of a design viewpoint. The facing page displays the aspects of this example:

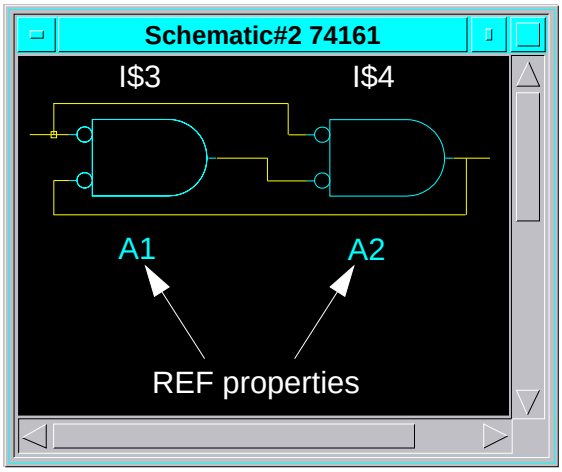
- A design named **my_design** has two 74161 instances whose handles are I$1 and I$2.
- A design viewpoint called “default,” which is associated with **my_design**.
- A back annotation object called “default” is connected to the viewpoint called “default”. Version 1 of the back annotation object is displayed in the window at the bottom of the facing page.

The next page illustrates the results of displaying back annotation data on the schematic sheets associated with instances I$1 and I$2.

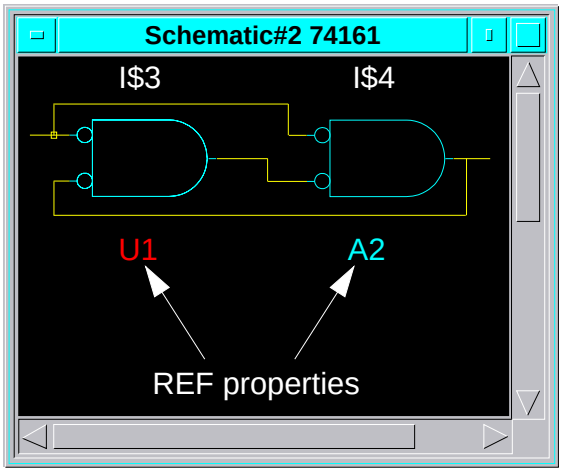
Viewing and Editing Properties (continued)

- **From I$1:**

Before

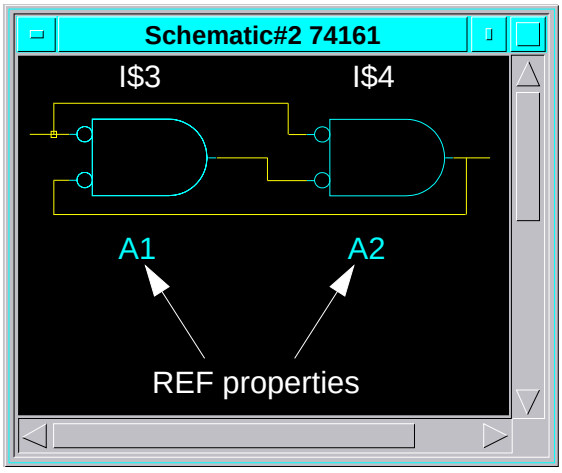


After

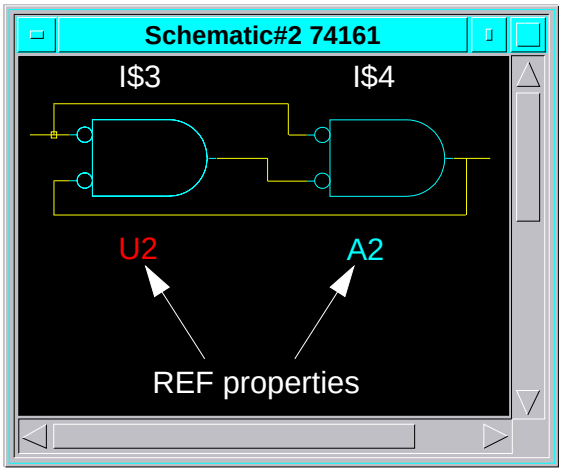


- **From I$2:**

Before



After



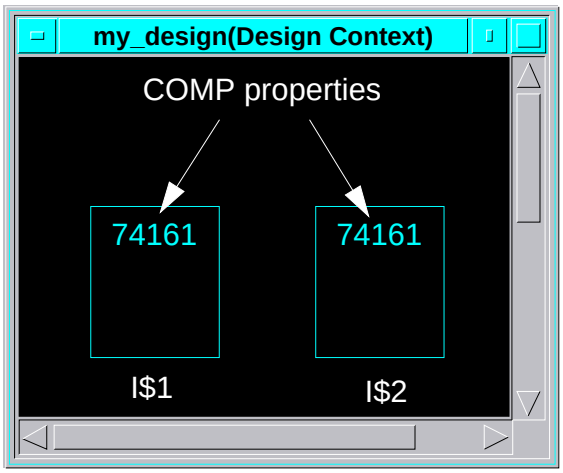
Viewing and Editing Properties (continued)

The top two windows on the opposite page illustrate the schematic under the I$1 instance of 74161. The top-left window shows the REF property values with the annotations turned off. When the **Setup > Annotation/Evaluations > Toggle Annotations** menu item is executed, the property value of A1 changes to U1 and turns red in color. This is because the back annotation object contains an entry for /I$1/I$3 whose REF property value is U1.

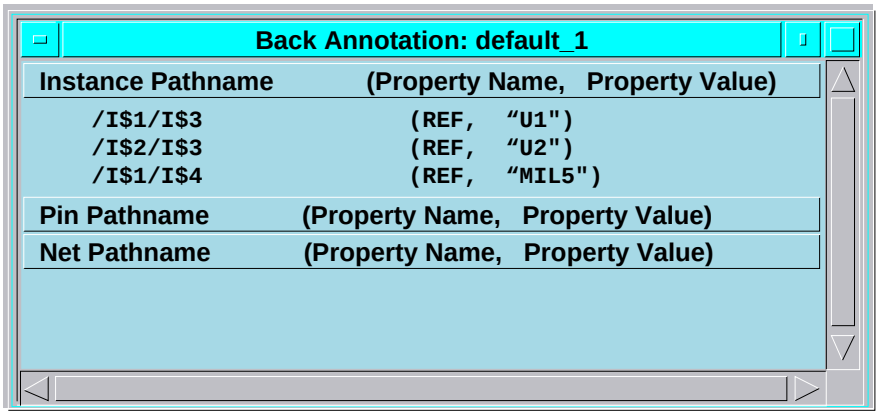
The bottom two windows on the opposite page illustrate the schematic under the I$2 instance of 74161. The bottom-left window shows the REF property values with the annotations turned off. When the **Setup > Annotation/Evaluations > Toggle Annotations** menu item is executed, the property value of A1 changes to U2 and turns red in color. This is because the back annotation object contains an entry for /I$1/I$3 whose REF property value is U2.

Back-Annotated Property Evaluation

- **Design:**



- Back Annotation Object:



Back-Annotated Property Evaluation

The example on the facing and the next pages shows how properties are evaluated with an expression as the property value on the schematic sheet. The facing page displays the aspects of this example:

- A design named **my_design** has two 74161 instances, each of which has a COMP property whose value is 74161 and whose handles are I$1 and I$2, respectively.
- A design viewpoint called **default** is associated with the **my_design** design.
- A back annotation object called “default” is connected to the viewpoint “default”. The “default” back annotation object has a new REF property value defined for /I$1/I$4.

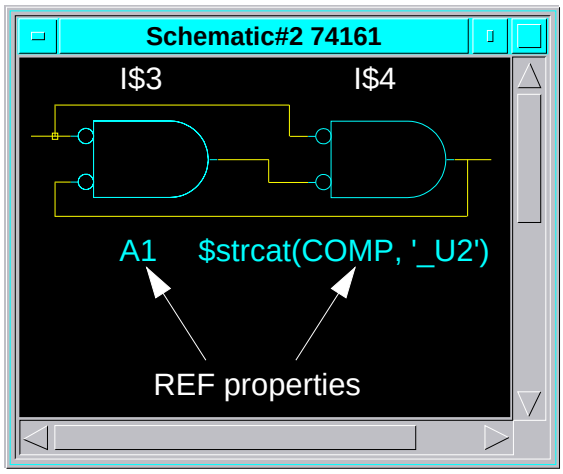
The next page displays the results that are displayed when the annotations and evaluations are toggled on and off.

Remember the property value evaluation rules that were previously discussed.

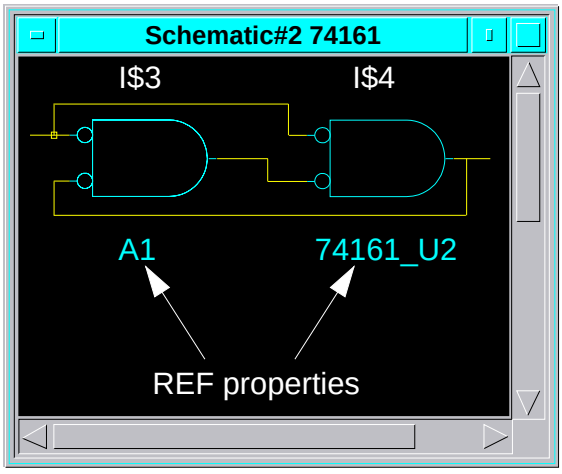
Back-Annotation Property Evaluation (Continued)

From I$1:

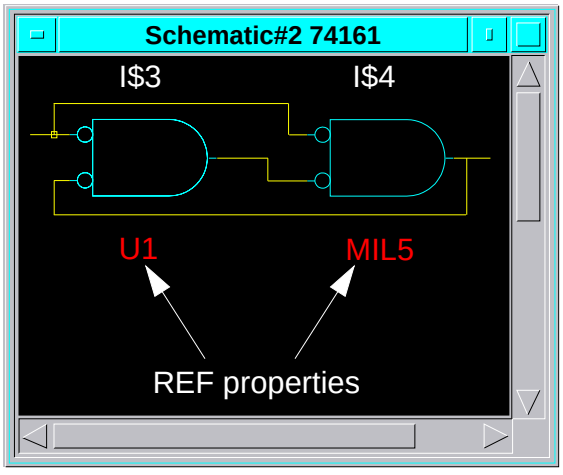
- **Evaluations off, annotations off**



- **Evaluations on, annotation off**



Evaluations on/off, annotations on



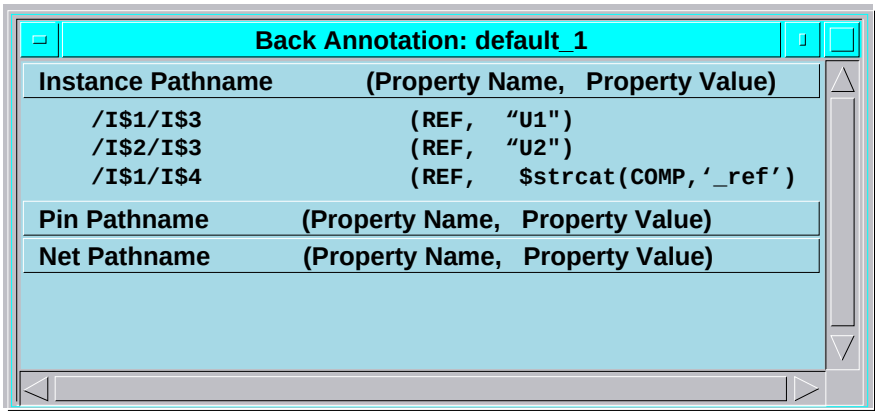
Back-Annotated Property Evaluation (continued)

The schematic under the I$1 instance of 74161 is shown on the left. In the top window, both annotations and evaluations are turned off, to the REF property values appear as they were entered on the source sheet. The REF property value for I$4 is an expression with an AMPLE string concatenation function.

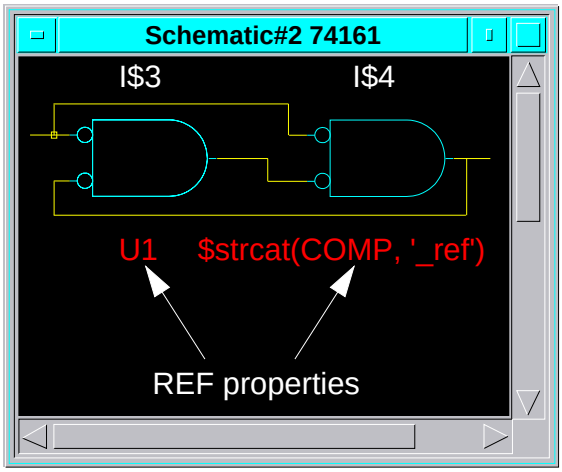
When evaluations are turn on, the REF property for I$4 is evaluated to the string “74161_U2”. The value of the COMP variable is taken from the parent instance above. When annotations are turned on, the value of this REF property is replaced by MIL5, which is the value specified in the back annotation object.

Expressions in Back Annotations

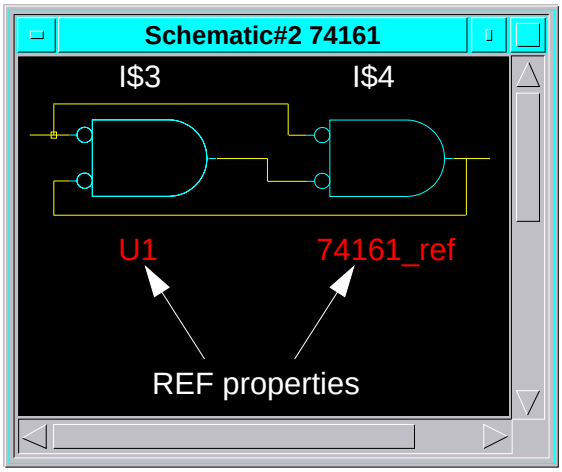
- **Back annotation object has been modified**



- **Annotations on, evaluations off**



Annotations on evaluations on



Expressions in Back Annotation Objects

You can also place expressions in back annotation objects. For example, you may want to replace an expression of a property that is either attached to the symbol or the instance with a new expression that is back-annotated to the attached property. In this situation, the display setting of the evaluation and back annotations is important. If back annotations are displayed while evaluation is disabled, you will see the unevaluated property value in the back-annotated property. If evaluation and back annotations are enabled, you will see the evaluated back annotation value.

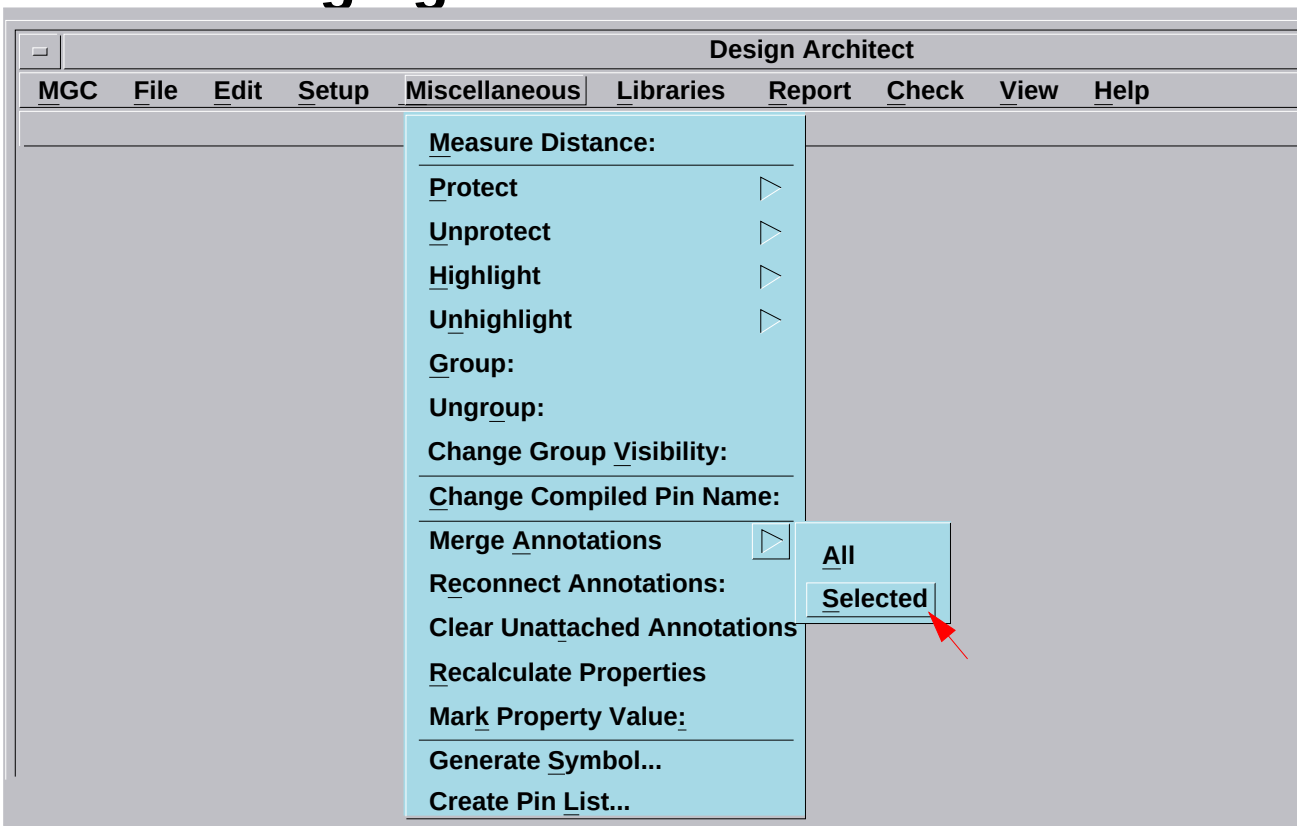
In the example on the facing page, the **my_design** design, the default design viewpoint, and the schematic sheet for I$1 are the same as in the previous example. Only the back annotation object has been modified, such that the REF property value for the /I$1/I$4 instance is now $strcat(COMP,'_ref').

When annotation are turned on, the REF property value for /I$1/I$3 becomes U1 and the REF property value for I$1/I$4 remains $strcat(COMP, '_ref').

When evaluations are turned on, the REF property value of the /I$1/I$4 instance changes to 74161_ref.

When property values change in the context of the design viewpoint and the annotated values are re-displayed, the property values are automatically recalculated.

Merging Back Annotations



- **Property values that are merged are normally removed from the back annotation object**
- **Property values are not merged if the stability switch is fixed or protected**
- **Property values are not merged if the viewpoint is latched on an old version of the schematic**

Merging Back Annotations

You can merge back annotations to the schematic sheet when you are using Design Architect in the context of a design viewpoint. When a schematic sheet is open with back annotations displayed and schematic edit mode is set to “on”, you can merge all back annotations displayed on the current schematic sheet using the **Miscellaneous > Merge Annotations** menu item.

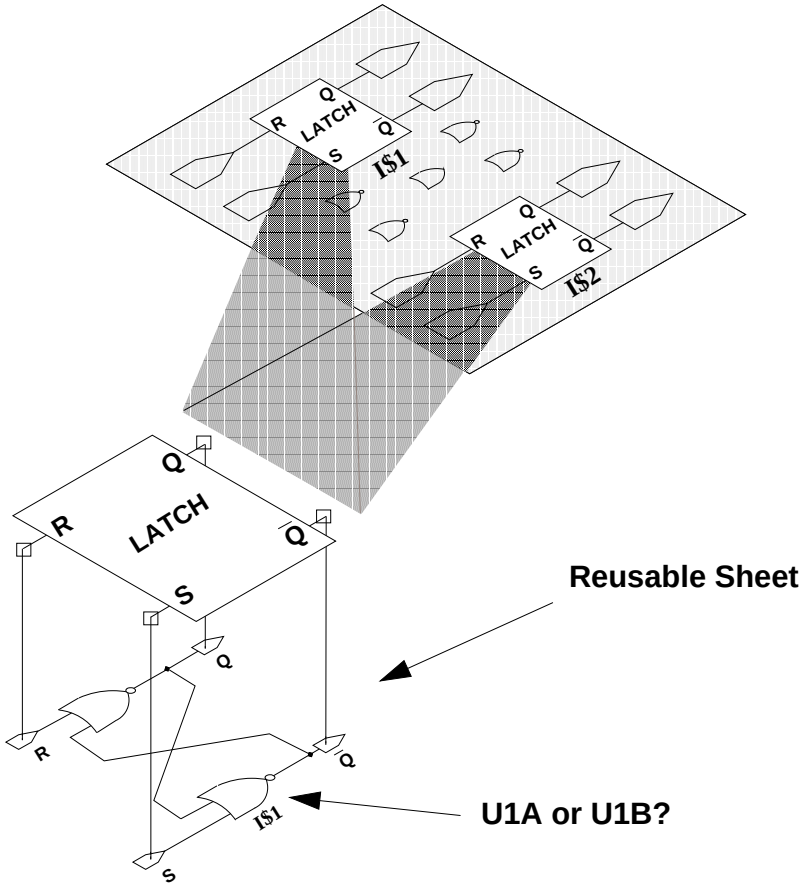
To merge selected back annotated properties, you must first select the properties that you want to merge onto the schematic sheet. After you have selected the visible back annotation properties, you can then execute the **Miscellaneous > Merge Annotations > Selected** menu item.

If you view a schematic sheet after a successful merge and save, you will notice that the schematic sheet displays the previously-merged properties and property values in the color of the owning object.

Property values may not be successfully merged if the property has its property stability switch set to fixed or protected. In addition, if the viewpoint is latched on anything other than the most current version of the schematic, they won’t be merged.

If the back annotation object is connected in read-only mode, the annotations will be merged, but won’t be removed from the back annotation object.

Back Annotations and Reusable Sheets



Back Annotation: pcb_design_vpt_1

Instance Pathname	(Property Name, Property Value)
/I$1/I$1	(REF, "U1A")
/I$2/I$1	(REF, "U1B")
Pin Pathname	(Property Name, Property Value)
Net Pathname	(Property Name, Property Value)

Back Annotations and Reusable Sheets

The design on the left has a root sheet with two latch instances I$1 and I$2. The LATCH component has a schematic with a **nor** instance I$1. The sheet is called *reusable*, because it is used more than once in the design. The logic on the lower sheet is also called *repetitive logic*.

The design is viewed by a downstream tool through a viewpoint called **pcb_design_vpt** and REF properties are applied through a back annotation object as shown in the window at the bottom of the illustration. As seen through the eyes of the downstream tool, the design appears to have two separate lower-level sheets, one sheet for I$1 and another sheet for I$2. As shown in the back annotation window, REF properties U1A and U1B are applied to the **nor** gate on the lower sheet.

If the owner of this design decides to merge these annotations back to the source sheet at the end of the design cycle, a conflict will occur because a property can only take on one value at a time. In this case, the REF property on the **nor** gate will take on the last value merged to it. All other previously merged values will be overwritten.

The general rule is that if you decide to merge annotations back to the source sheet, only merge annotations to non-repetitive logic. The alternative is to archive the source schematics, the top-level design viewpoint and the back annotation objects as a single design unit.

Lab Exercises

Print Out the Lab Exercises

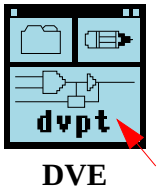
If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Creating a Simulation Viewpoint

In this first exercise, you will learn how design viewpoints are created by using DVE to manually setup your own simulation viewpoint. You will use the back annotation mechanism to globally control design-wide rise and fall properties for a particular instance and you will used the DVE checking mechanism to perform design-wide checks.

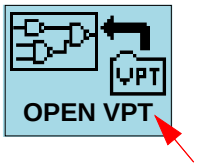
Create a Simulation Viewpoint

1. Bring up the Design Manager if you haven't already done so.
2. Double click on the DVE icon to open the Design Viewpoint Editor:

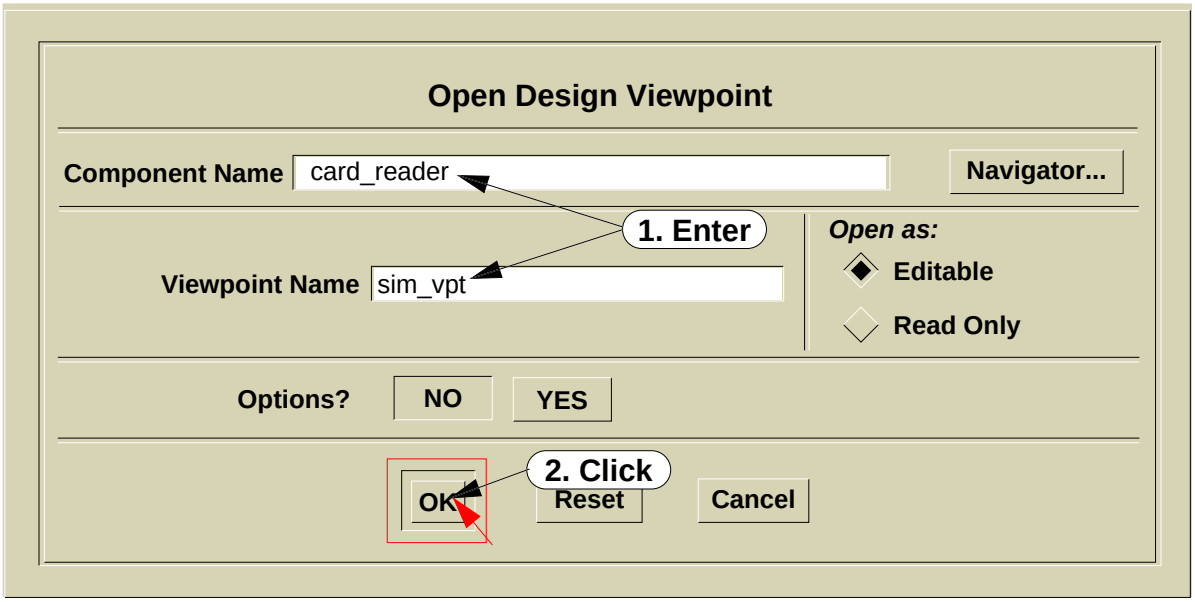


DVE

3. Maximize the DVE window, then set the working directory to**...training/da_n**
4. Click the OPEN VPT icon:



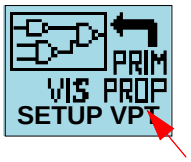
The Open Design Sheet dialog box is displayed.



5. Fill in the information shown above, then click **OK**:

Setup the Viewpoint for QuickSim

1. Click the SETUP VPT icon:

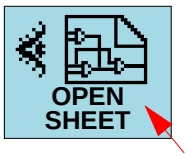


2. Select the name **Quick_Sim_Fault_Path_Grade**.

3. Click **OK** and watch the information being added to the Design Configuration window for QuickSim.

Open a Schematic View Window on card_reader

1. Click the OPEN SHEET icon:



   The **/:sheet1** in the window title indicates that you are looking at the root sheet for **card_reader** (top level).

Check the Design

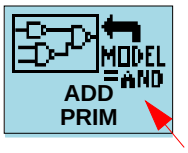
1. Check the whole design by executing the pulldown menu **Miscellaneous** > **Check Design**.

   Notice that the check software is indicating that it expects three instances on the root sheet to be non-primitive and can't find models for these instances. You should explicitly tell the system that these blocks are primitive. This will speed up the checking process and eliminate the warning messages. The other warnings about the /TEST and /PARITY nets are normal and expected.

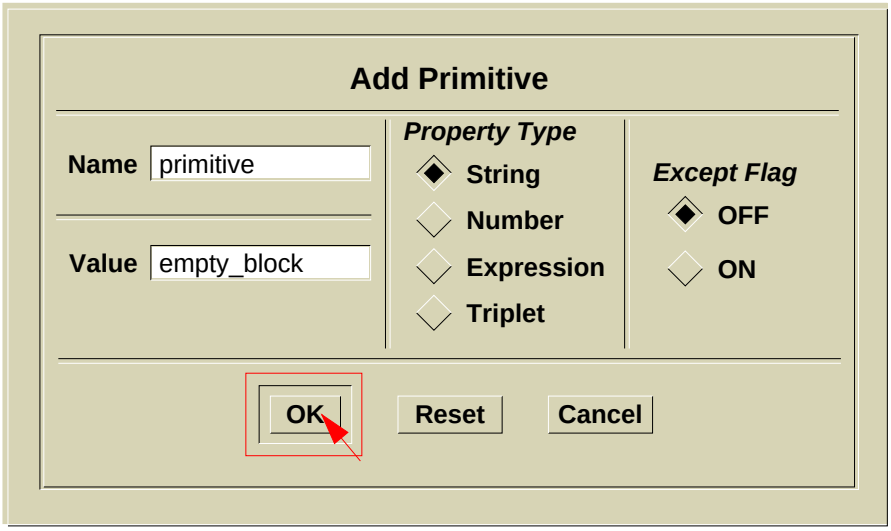
2. Close the Report window

Declare Empty Blocks as Primitive

1. Click the ADD PRIM icon:



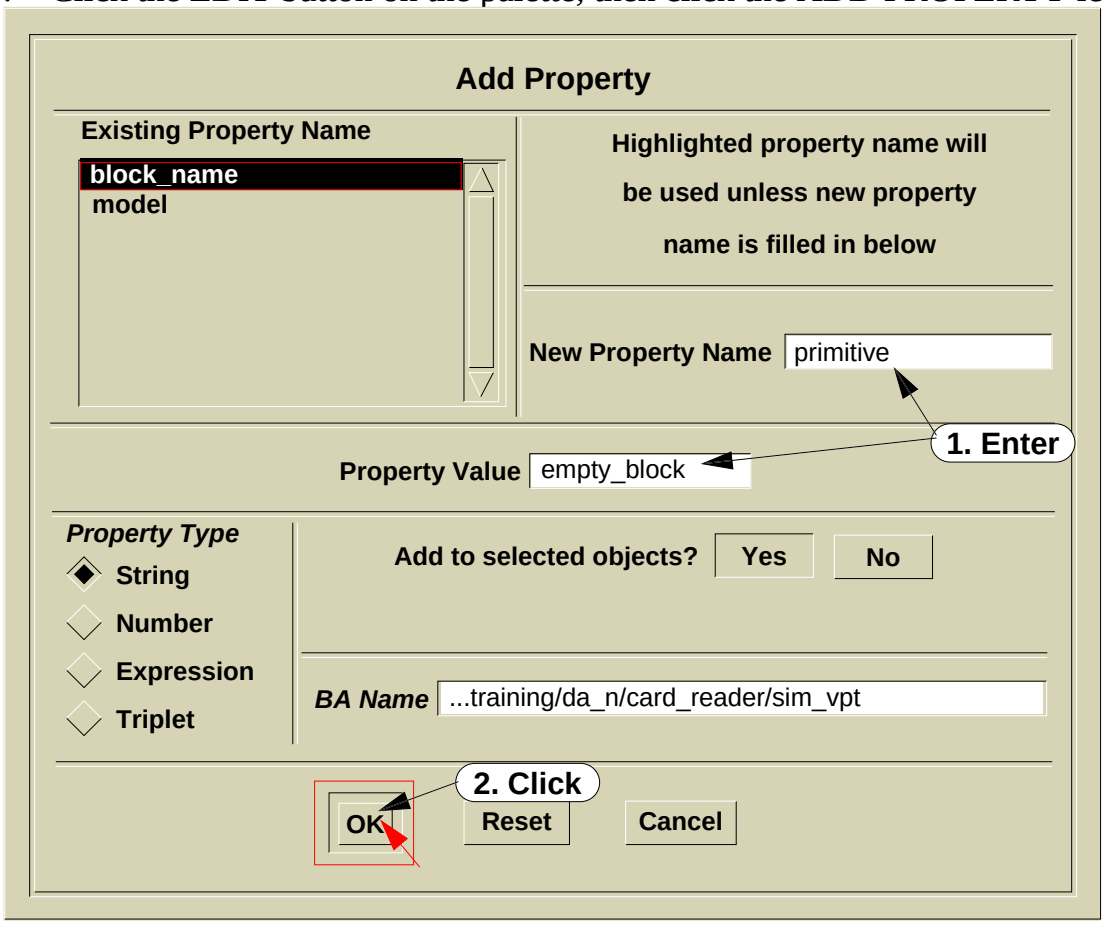
2. Fill out the form as shown in the following illustration:



3. Click **OK**. Observe that the primitive property has been added to the PRIMITIVE rule in the Design Configuration window.

4. Select the ACCESS_CHK, FREQ_DET, and ANALOG blocks in the Schematic View window.

5. Click the EDIT button on the palette, then click the ADD PROPERTY icon:

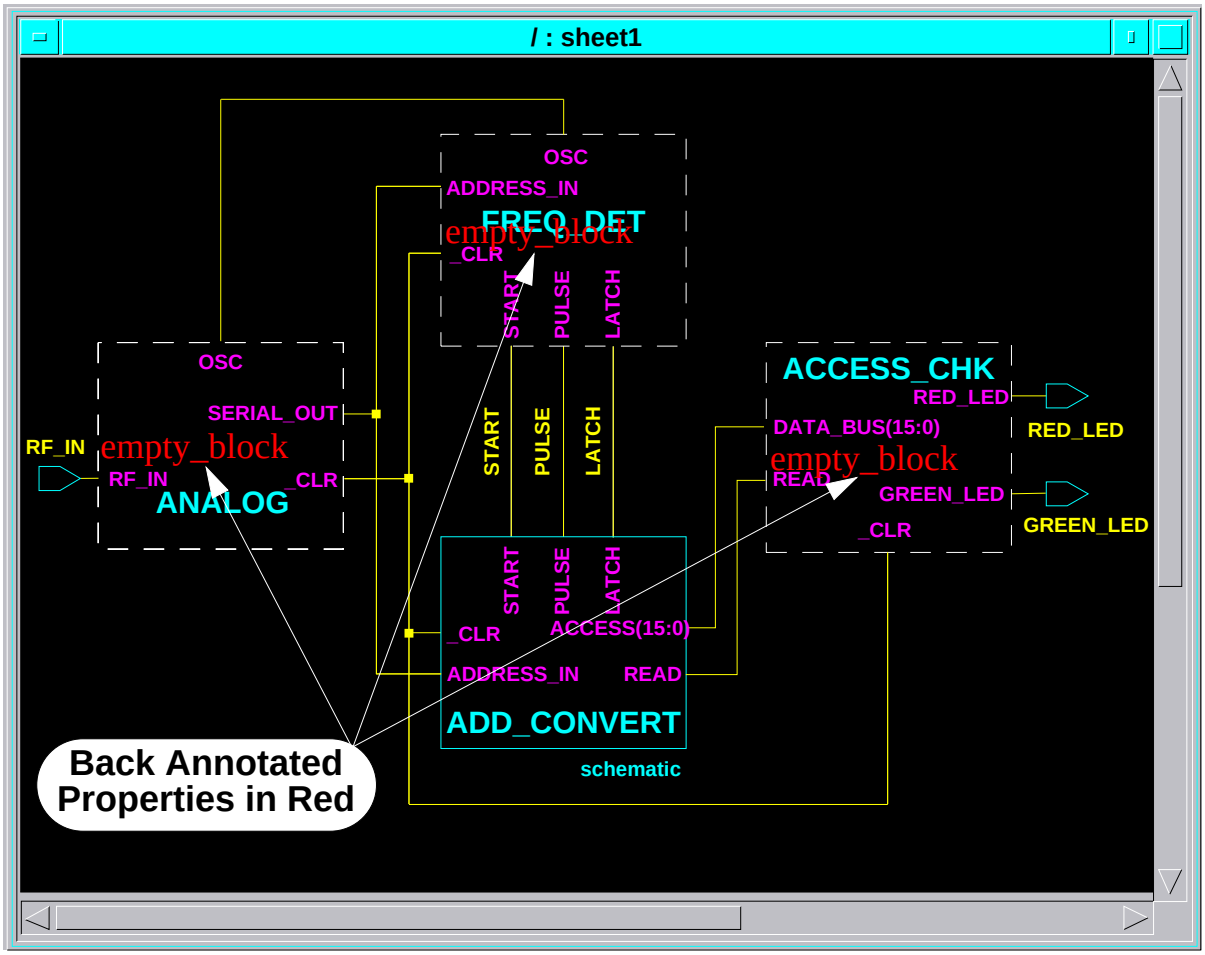


6. Fill out the form as shown above, then click **OK**.

   The system pops a form telling you that a back annotation object has not yet been created and asks if you want to create/attach one.

7. Verify **yes**, then click **OK**.

The **primitive** properties are added in red to the selected instances through the back annotation object as shown in the following illustration:.



Check the Design Again

1. Check the design again by executing the pulldown menu **Miscellaneous > Check Design.**

   Notice that the Warnings have gone away concerning the lack of models for the three empty blocks.

2. Close the Report window.

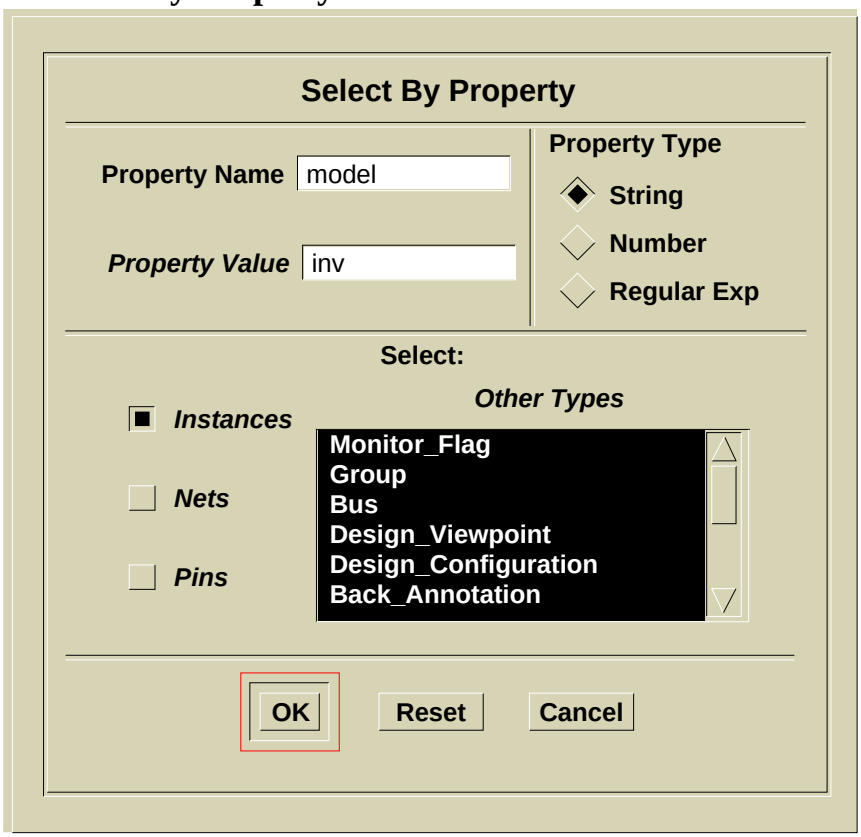
Open the add_convert and my_dff Schematics

1. Open the schematic under the **ADD_CONVERT** instance by drawing a vertical down stroke ↓ across the instance.
2. Sheet 1 of the add_convert schematic appears in a new Schematic View window. (The root schematic view is underneath the new window.)
3. Open the schematic under the **my_dff** instance by drawing a vertical down stroke ↓ across the instance.
4. Sheet 1 of the my_dff schematic appears in a new Schematic View window.
5. Click the minimize button on the Design Viewpoint window (top-left window).
6. Unselect All.
7. From the pulldown menu choose: **MGC > Setup > Session...**
8. Click the **Quadrant Tiling** button in the Window Layout area, then click **OK.** The three Schematic View windows and the Design Configuration window should now be completely visible.

Add RISE and FALL Values to the INV instances

In this step, you are going to add a variable to the rise and fall property values for every INV instance in the design. You are then going to globally control the values by defining parameters in the viewpoint PARAMETER rule.

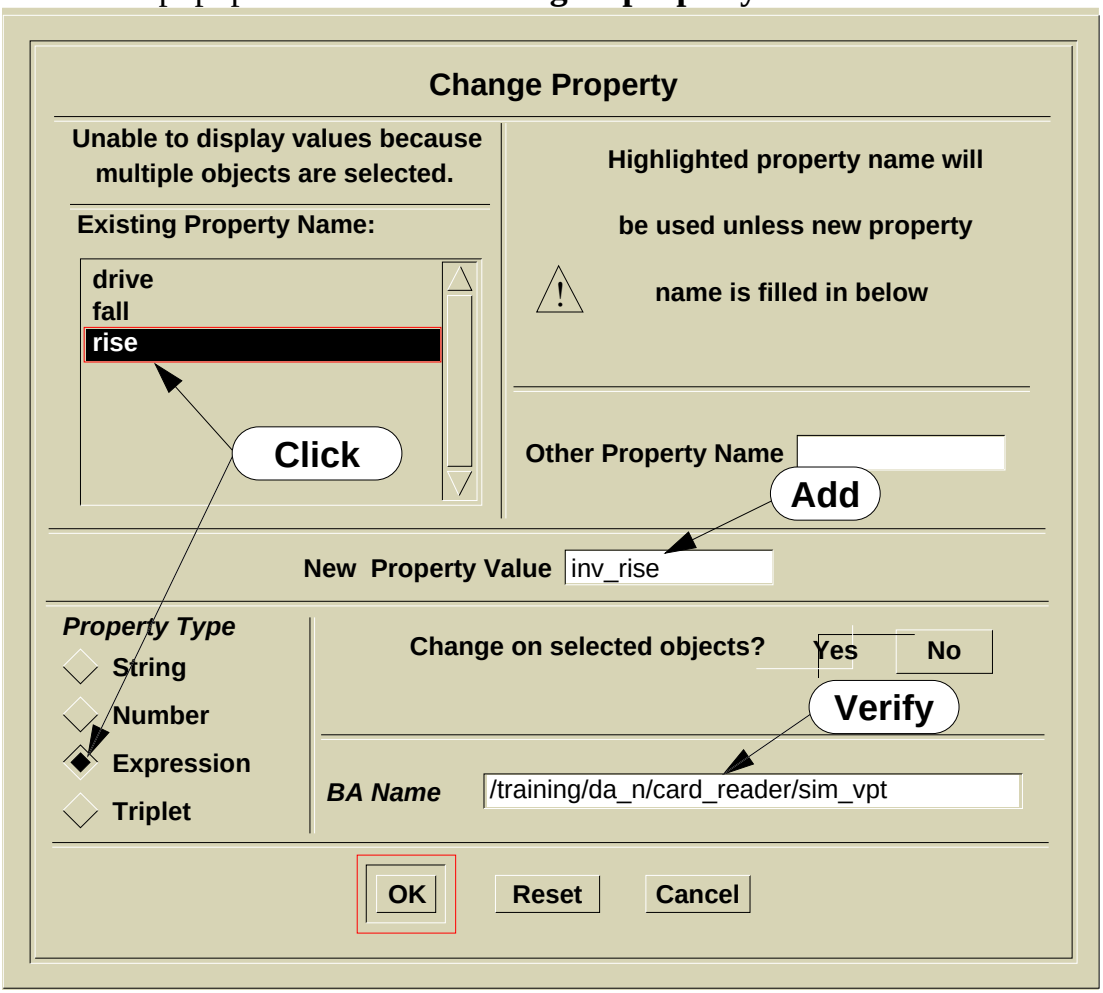
1. Activate the card_reader root Schematic Window, then from the popup menu choose: **Select > By Property...**



2. Fill out the form as shown above, then click **OK**. Notice that the inverter instances on every sheet in the design are selected.

3. From the popup menu, choose: **Select > Connected > Pins.** The **inv** instance pins as well as the **inv** instance bodies are now selected.

4. From the popup menu choose: **Change > property...**

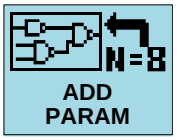


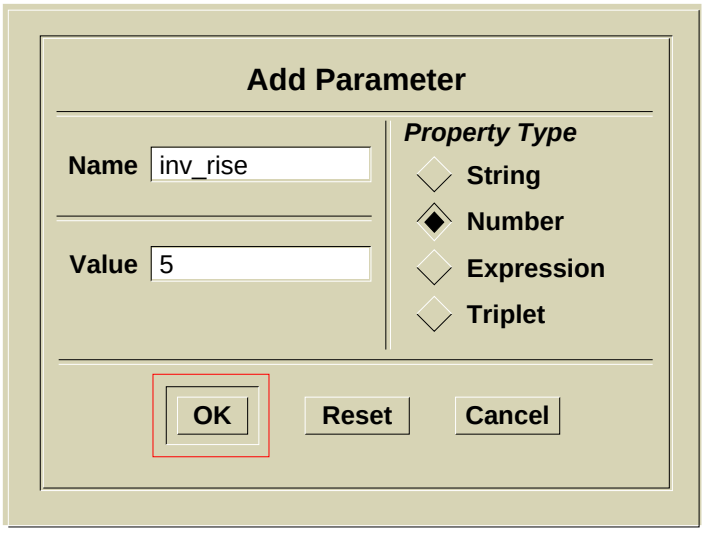
5. Fill out the form as shown above.

6. Click **OK**. Notice that all the **rise** property values change to **inv_rise**. (Zoom into a window area if you need a closer look.)

7. Repeat steps 4 and 5 and change the **fall** property values to the expression **inv_fall.**

8. Click the ADD PARAM icon on the SETUP palette:





9. Fill out the form as shown above, then click **OK**. Notice that the rise property value on all inverter instances in the design changes to **5**. Also notice that **inv_rise 5** has been added to the PARAMETER rule.

10. Repeat steps 8 and 9 and add the **inv_fall** parameter with a value of **10** to the viewpoint parameter rule. Notice that the fall value on all the inverter instances changes to 10.

Save the Viewpoint

1. From the pulldown menu bar, choose **File > Save Design Viewpoint**.

Latch the Viewpoint

1. From the pulldown menu choose **EDIT > Latch Version > Latch Version**

2. Verify that the ALL button is selected, then click **OK**.

Generate a Report on the Latched Objects

1. From the pulldown menu, choose **Report > References...**
2. Maximize the report window and observe that the version number and the latch status is recorded for each design object.
3. Close the Report window.

Unlatch the sim_vpt Back Annotation Object

You are now going to unlatch the **sim_vpt** back annotation object, so future changes can be recorded in the object.

1. Selecting **EDIT > Latch Version > Unlatch Version** from the pulldown menu.
2. Click the **BA** button, then click **OK**.

Save and Close the Simulation Viewpoint

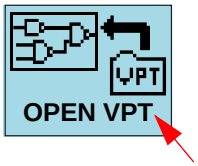
1. From the pulldown menu bar, choose **File > Save Design Viewpoint**.
2. Click the CLOSE VPT icon on the Setup palette.

Exercise 2: Creating a PCB Viewpoint

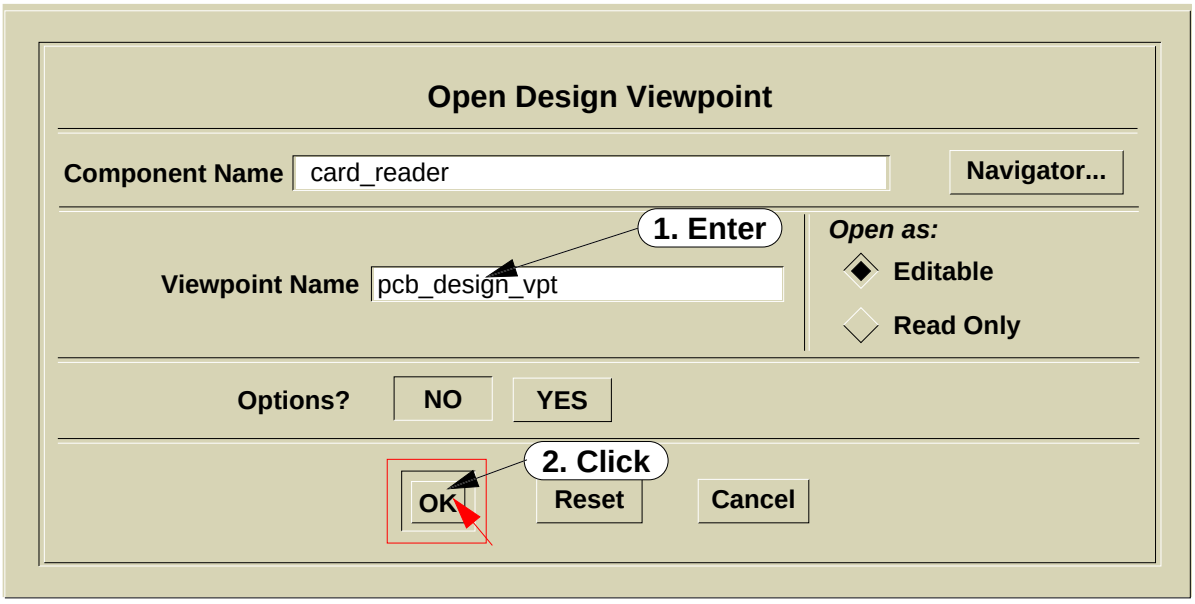
In this lab exercise, you will create a PCB viewpoint on the same design. You will annotate the design with different property values and the configuration will be set differently so that all instances with a **comp** property will be treated as primitive.

Create a PCB Viewpoint

1. Click the OPEN VPT icon:



The Open Design Sheet dialog box is displayed.



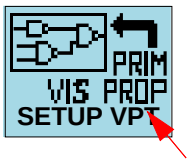
2. Fill in the information shown above, then click **OK**:

Note

The name **pcb_design_vpt** is the only valid name you can use for a PCB design viewpoint.

Setup the Viewpoint for PCB

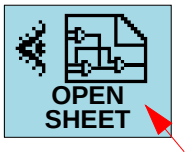
1. Click the SETUP VPT icon:



2. Click the **PCB** choice, then click **OK.** Watch the information being added to the Design Configuration window for Board Station tools.

Open a Schematic View Window on card_reader

1. Click the OPEN SHEET icon:



   Notice that the primitive property values “empty_block” that were previously added in the last DVE session don’t appear.

Check the Design

1. Check the whole design by executing the pulldown menu **Miscellaneous** > **Check Design**.

   Notice that the check software is indicating that it expects a number of instances to be non-primitive and can’t find models for these instances. In the next step you will explicitly tell the system that these instances are primitive. This will speed up the checking process and eliminate the warning messages. The other warnings about the /TEST and /PARITY nets are normal and expected.

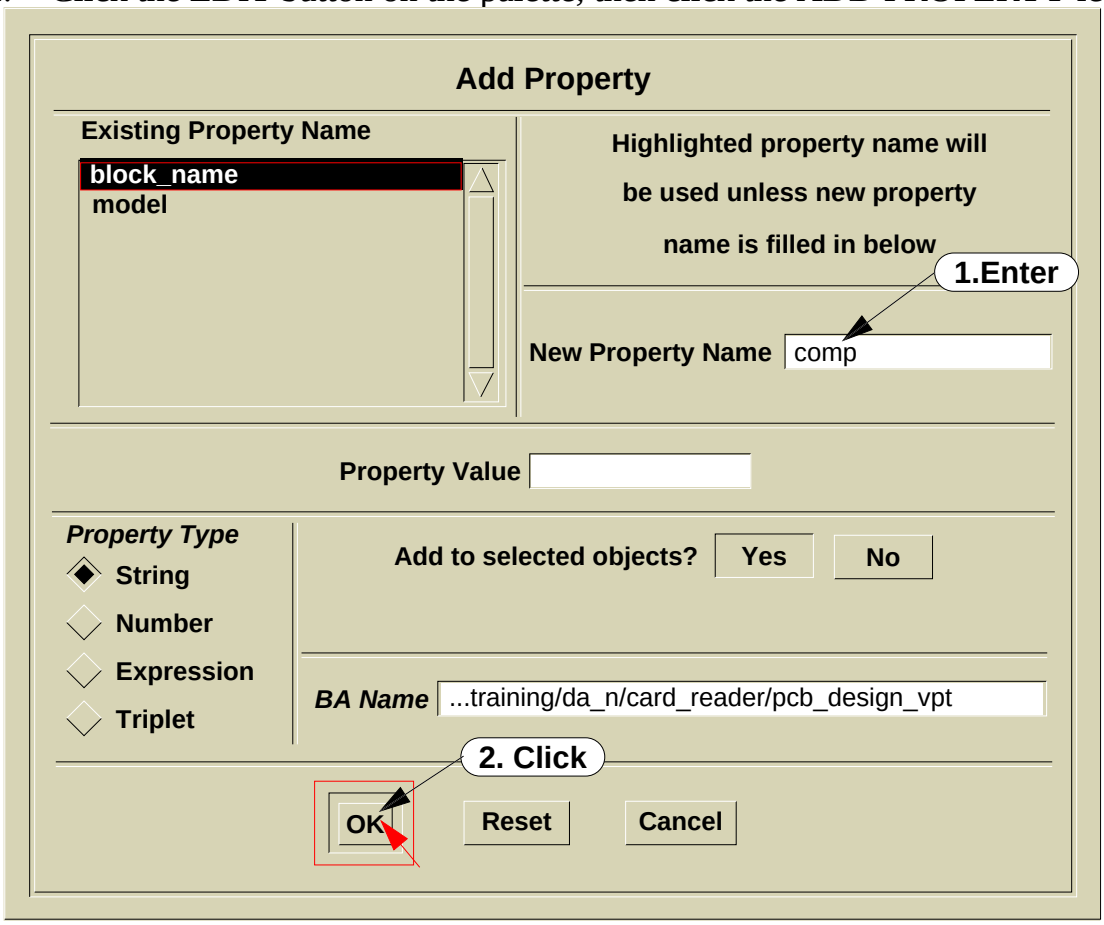
2. Close the report window.

Add a COMP property to each Block on the Root Sheet

Assume that the four functional blocks on the **card_reader** root sheet are four ASICs that will eventually be placed on a single circuit board. Although these symbols are treated as functional blocks by the simulator, they should be treated as primitive parts by the PCB layout tools. For simplicity, assume for now that these instances will eventually be replaced by instances with all the correct PCB properties. For this exercise, you will add some common PCB properties to the **card_reader** root sheet to observe how the design is seen differently through the PCB viewpoint.

1. Select all four functional blocks on the **card_reader** root sheet.

2. Click the EDIT button on the palette, then click the ADD PROPERTY icon:



3. Fill out the form as shown above, then click **OK**.

4. Check the design again by executing the pulldown menu **Miscellaneous > Check Design.**

   Notice that the Warnings have gone away concerning the lack of models for non-primitive instances. Within a PCB viewpoint, every instance with a COMP property is considered primitive.

5. Close the Report window.

Open a Back Annotation Window

1. From the pulldown menu bar choose **File > Open > Back annotation...**

2. Click **OK.**

   A Back Annotation window opens showing you the content of the **pcb_design_vpt** back annotation object. Notice that the COMP properties you just added were added to the back annotation object.

Open the add_convert Schematic

1. Draw the Unselect All stroke in the Schematic View window, then select the ADD_CONVERT instance. (Zoom in if you need to.)

2. From the pulldown menu bar choose **File > Open > Down.** Why won't the system open down on the add_convert sheet?

   _____

Add REF Properties to the Functional Blocks

Add a REF property/value pair to each functional block on the root sheet. Use the following list as a guide:

U1 ANALOG

U2 FREQ_DET

U3 ADD_CONVERT

U4 ACCESS_CHECK

Notice that a REF property is recorded in the Back Annotation window each time you add one to an instance.

Latch the PCB Viewpoint

1. From the pulldown menu choose **EDIT > Latch Version > Latch Version**
2. Verify that the **ALL** button is selected, then click **OK**.
3. Unlatch the **pcb_design_vpt** back annotation object by selecting **EDIT > Latch Version > Unlatch Version** from the pulldown menu.
4. Click the **BA** button, then click **OK**.

Save and Close the PCB Viewpoint

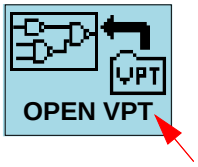
1. From the pulldown menu bar, choose **File > Save Design Viewpoint**.
2. Click the CLOSE VPT icon on the SETUP palette.

Exercise 3: Cross-connecting a Back Annotation Object

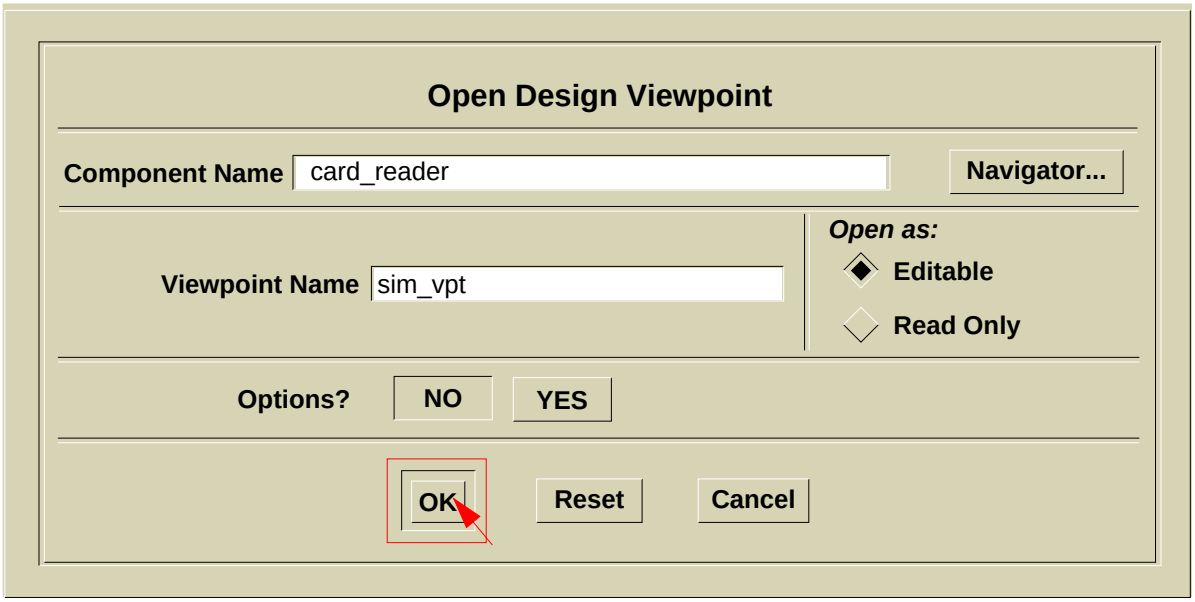
In this exercise you will again open a DVE session on the **card_reader/sim_vpt** design viewpoint. You are going to "connect" the **pcb_design_vpt** back annotation object to the simulation viewpoint in read-only mode. This will allow you to see PCB layout annotations in the simulation viewpoint.

Open the sim_vpt Design Viewpoint

1. Click the OPEN VPT icon:



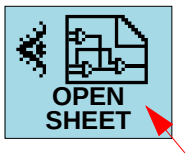
The Open Design Sheet dialog box is displayed.



2. Fill in the information shown above, then click **OK**:

Open a Schematic View Window on card_reader

1. Click the OPEN SHEET icon:



Connect the pcb_design_vpt Back Annotation Object

1. Move any window that may be covering the Design Viewpoint window, then Active the Design Viewpoint window.
2. From the popup menu choose **Back Annotation > Connect...**
3. Click the Navigator button and navigate to the area underneath **card_reader**.
4. Select the pcb_design_vpt back annotation object, then click **OK**.
5. Click the Read-only: **Yes** button on the form, then click OK.

   The **pcb_design_vpt** back annotation object is now connected to the **sim_vpt** viewpoint in read-only mode. Notice that the **pcb_design_vpt** back annotation object is listed as the highest priority back annotation object, because the priority was set to 0 (the default). Also notice that the REF property values are now added to the blocks on the root sheet.
6. Place the mouse pointer on the MODEL property value “schematic” of the ADD_CONVERT instance.
7. Press SHIFT F7.
8. Specify a new value of **$hdl** in the form, then click **OK**.

   Was the change added to the back annotation object? _____ If not, why not?

   _____
9. Repeat steps 6 and 7.
10. Specify a new value of **$hdl** in the form and change the BA Name from **pcb_design_vpt** to **sim_vpt**, then click **OK**.

11. The change is recorded in the **sim_vpt** back annotation object even through it is not the highest priority object.

Change the pcb_design_vpt Connection Priority

Normally a read-only back annotation object is connected in a lower priority position, so newly created back annotations are recorded in the highest-priority object.

1. Click on the **pcb_design_vpt** back annotation object in the Back Annotation window, choose **File > Back Annotations > Disconnect...,** then click **OK**.
2. From the popup menu choose **Back Annotation > Connect...**
3. Select the pcb_design_vpt back annotation object from the Navigator, then click **OK**.
4. Click the Read-only **Yes** button, enter a “1” in the **Priority** entry box, then click **OK**.

   This connects the read-only **pcb_design_vpt** back annotation object in the second highest priority position. Now any new back annotation will be recorded in the **sim_vpt** back annotation object.

Unlatch the sim_vpt Design Viewpoint

In the next exercise, you will merge back annotations onto the ADD_CONVERT source sheet, so you must first unlatch the viewpoint.

1. Selecting **EDIT > Latch Version > Unlatch Version** from the pulldown menu.
2. Click the **ALL** button, then click **OK**.

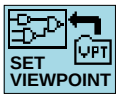
Save and Close the Viewpoint

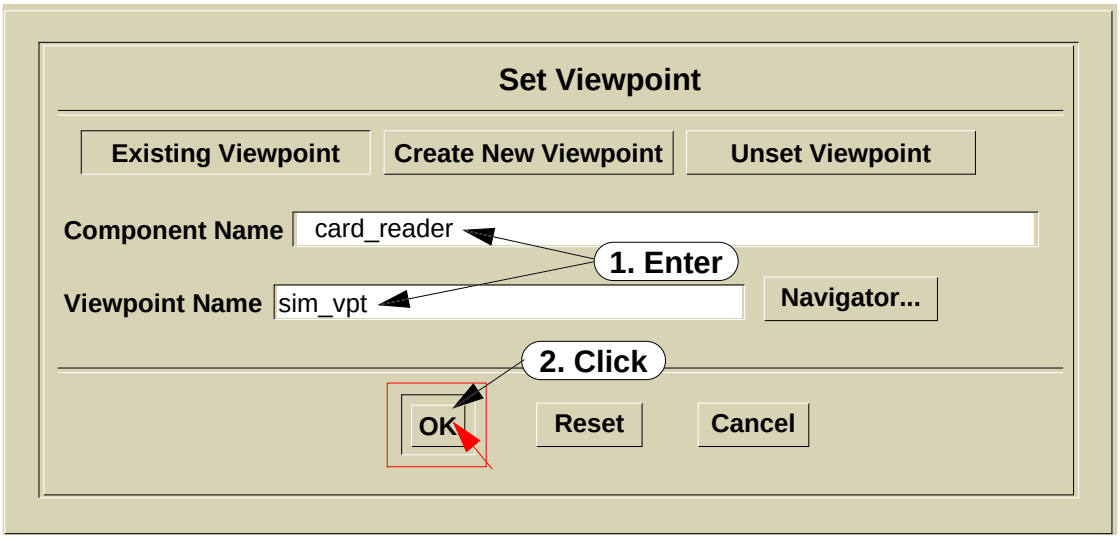
1. From the pulldown menu bar, choose **File > Save Design Viewpoint**.
2. Click the CLOSE VPT icon on the Setup palette.

Exercise 4: Merging Annotations to the Source Sheet

In this exercise, you will use the Design Sheet editor in Design Architect to view back annotation properties in their evaluated and unevaluated states. You will then selectively merge some of the properties onto the source sheet.

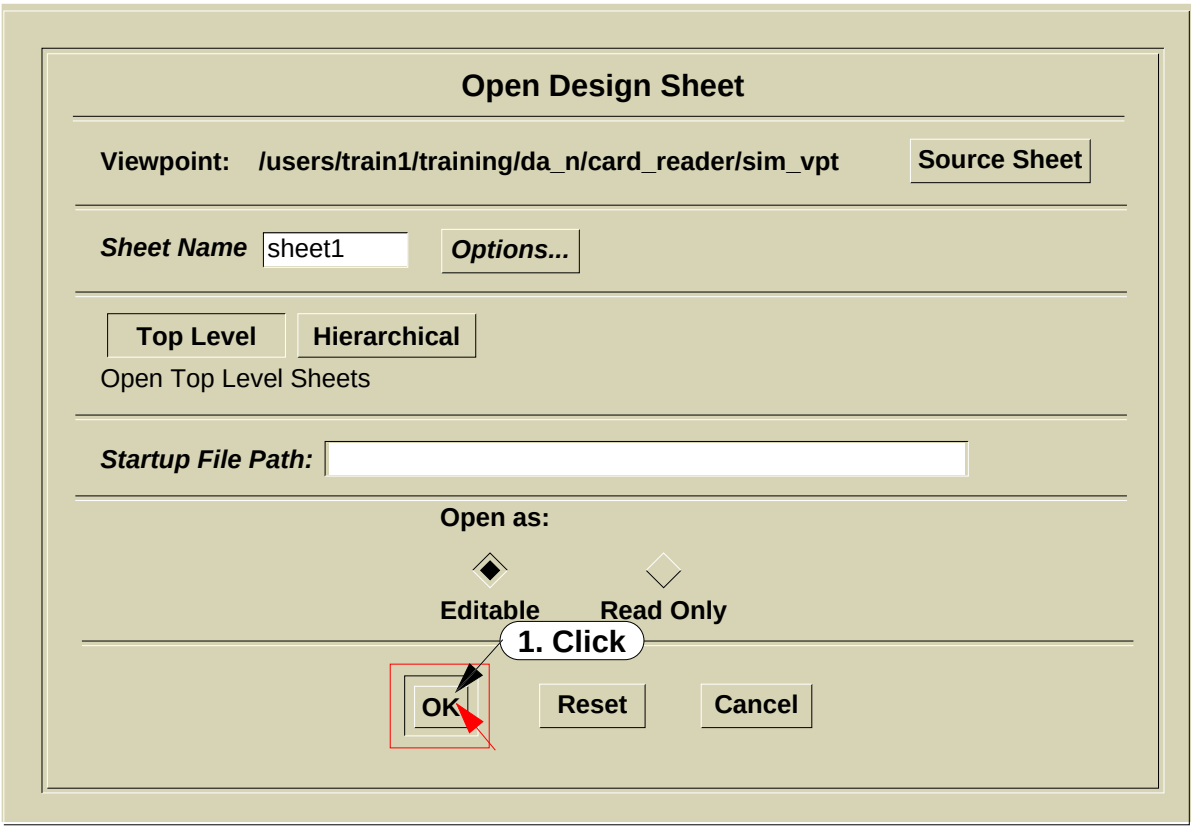
1. In Design Architect, open the card_reader design in the context of a design viewpoint by clicking on the SET VIEWPOINT icon:





2. Fill out the form as shown above, then click **OK**.

   After the viewpoint is set, the following dialog box appears:



3. Click **OK**.
4. Double click on the border of the ADD_CONVERT instance to open down.
5. Click **OK** on the Sheet Name prompt form.

   A window with the add_convert schematic should appear.
6. Zoom into an area so you can clearly see the properties on an **inv** instance.
7. Choose the pulldown menu item:
   Setup > Annotations/Evaluations > Toggle Evaluations

   The annotated rise property now displays as the parameter name **inv_rise** and the annotated fall property now displays as the parameter name **inv_fall**.

8. Choose the pulldown menu item:
   Setup > Annotations/Evaluations > Toggle Annotations

   The annotations are turned off and the rise and fall properties are displayed as they appear on the source schematic.

9. **Toggle Annotations** back on.

10. Select the RISE and FALL property value of one inv instance.

11. Choose the pulldown menu item:
    Miscellaneous > Merge Annotations > Selected

12. Unselect All. Notice that the selected property values turn from red to the color of the design object that own the properties (magenta for a pin).

13. **Toggle Evaluations** back on. Notice that the merged property values are evaluated to constants because they are still being viewed in the context of a design viewpoint.

14. Check and Save the Sheet.


Note

The merged property values may turn back to the red color during a check sheet because Evaluations and Annotations are turned back on during a check sheet.

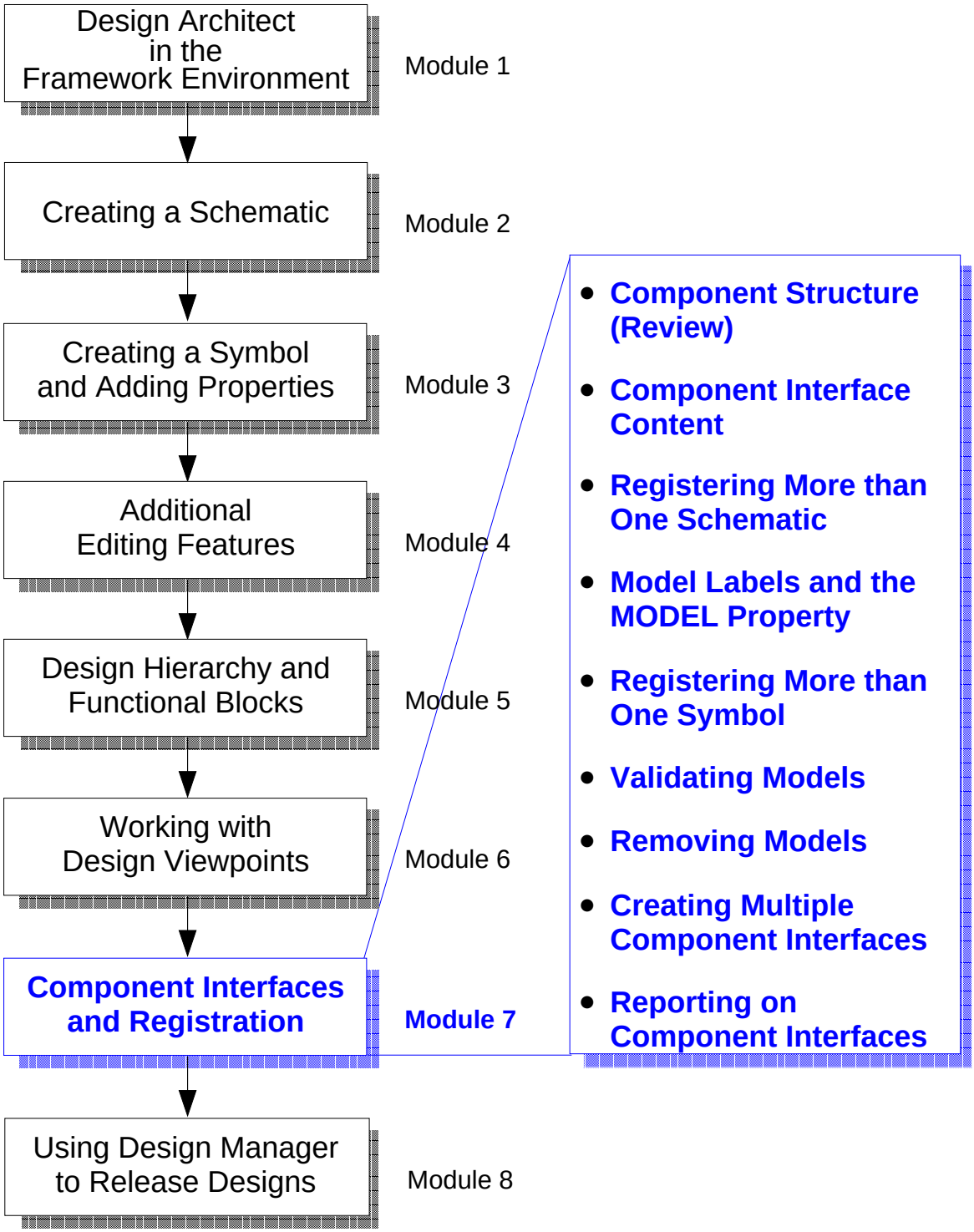
15. Close the **add_conver**t window. Notice that the annotated property values on the **card_reader** sheet are still displayed in red (not merged). The back annotations must be merged one sheet at time.

16. Close the card_reader window.

End of Lab Exercises

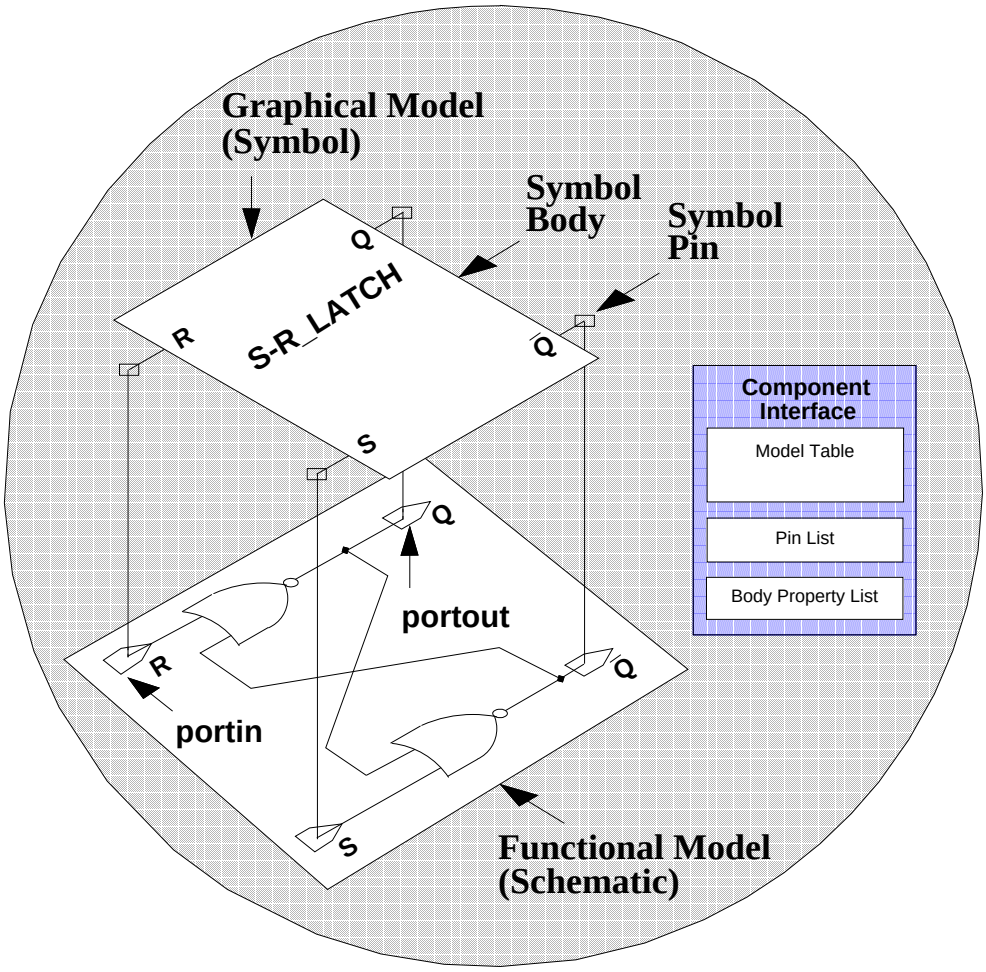
Module 7
Component Interfaces and Registration

Module 7 Overview



Lesson

Component Structure (Conceptual View)



Simple Component Structure (Conceptual View)

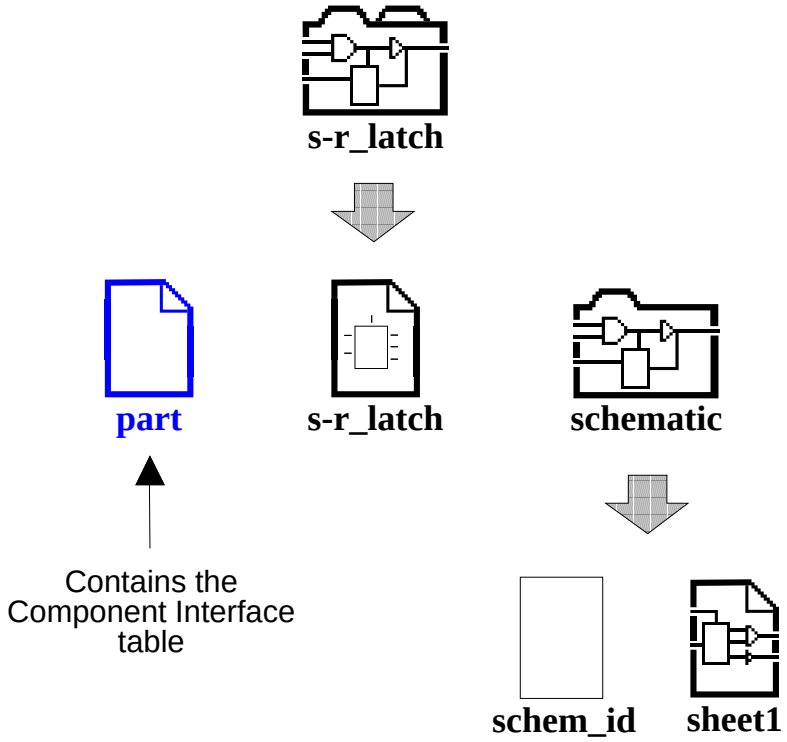
The basic unit structure of the EDDM is called a component. In other systems, this unit structure might be called a cell. A component can be thought of as a sphere containing a collection of models that represent a “chunk” of electronics. The simple structure illustrated on the facing page shows a component that models an S-R latch. The component contains a graphical model called a symbol and a functional model in the form of a schematic. The control center of the component is called the “component interface” and may be thought of as the “nucleus” of the cell.

- **Graphical Model (symbol).** Composed of symbol body graphics, symbol pins, and properties. A component may have more than one symbol model associated with it.

- **Functional Model (schematic)**. Describes the functional behavior of the electronics being modeled. More than one functional model may be present. A non-schematic functional model is called a “primitive”. Each functional model must have input and output “ports” that match the input and output “pins” on the symbol.

- **Component Interface.** Acts as the control center for the component structure. This design object takes the form of a table that collects and retains information about the symbol pins, symbol body properties and each functional and timing model associated with the component. Placing a model in the model table of the Component Interface “registers” the model with the component.

Component Structure (Iconic View)



- **Component Icon - represents the directories and files in a component structure**
- **Design Object Icons - represent other objects within the component structure (symbols, schematics, sheets**
- **Part Object - a binary object that contains the Component Interface table**

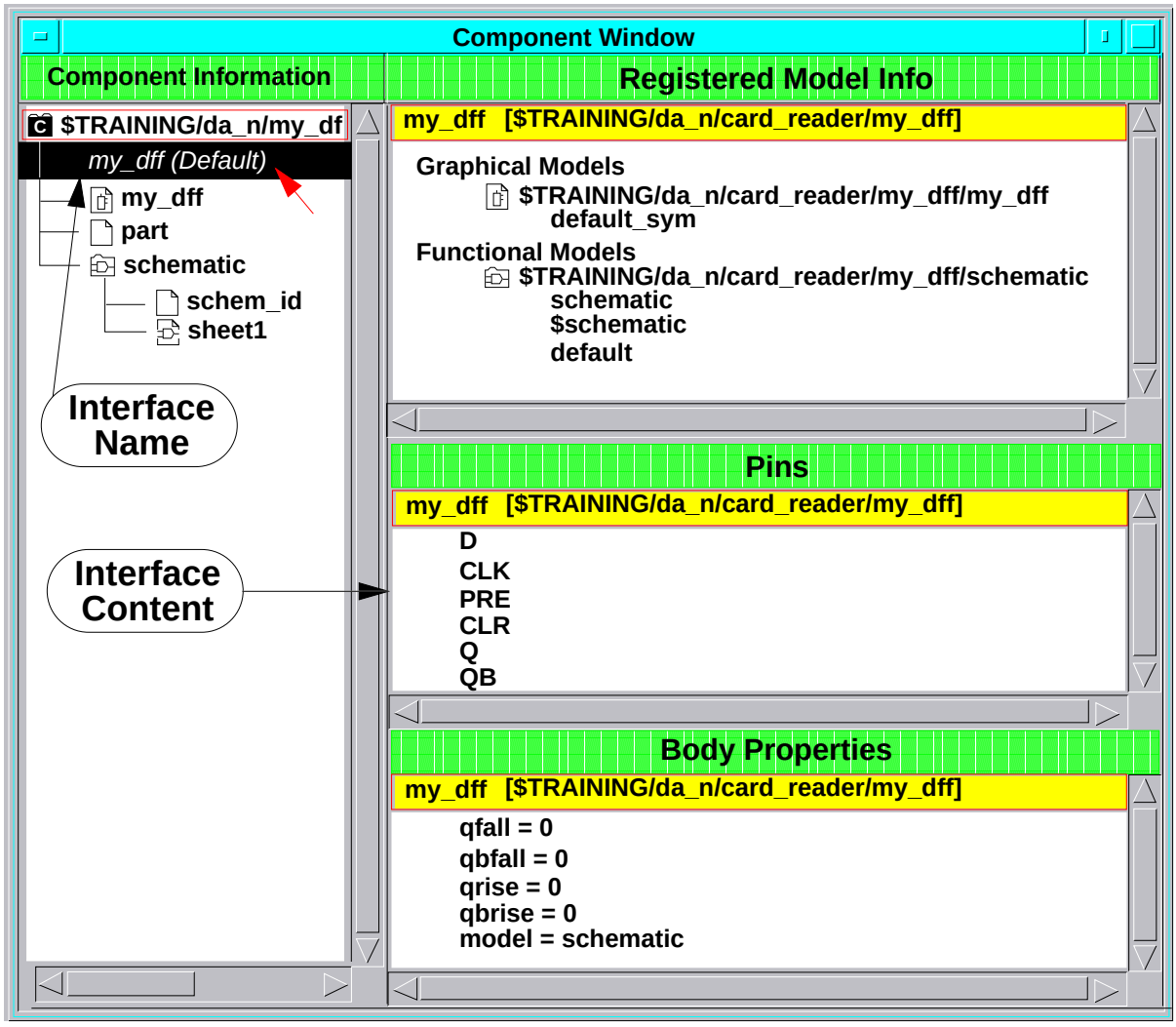
Component Structure (Iconic View)

Your design data is modeled by an object-oriented database and each “object” is represented by one or more directories or files in the Unix file system. To make things simpler, these objects are represented by icons when you view them through a window such as the Navigator.

If an object is really a Unix directory in the file system, it is called a “container.” A container can contain other objects. The icon at the top of the illustration on the facing page shows the icon for a component structure. Because a component is a container, it contains several other objects such as the part object, the symbol object, and the schematic object. The schematic object is also a container and can contain one or more “sheet” objects. The “schem_id” object is a special object that helps the system manage the assignment of system identifiers (handles) to various objects on the schematic sheets. (The subject of handles will be covered in a later module.)

The part object is a special object that contains the Component Interface table. Remember that this table acts like the control center of the component where information about the symbol pins, symbol body properties and each model is collect and retained.

Content of Component Interface

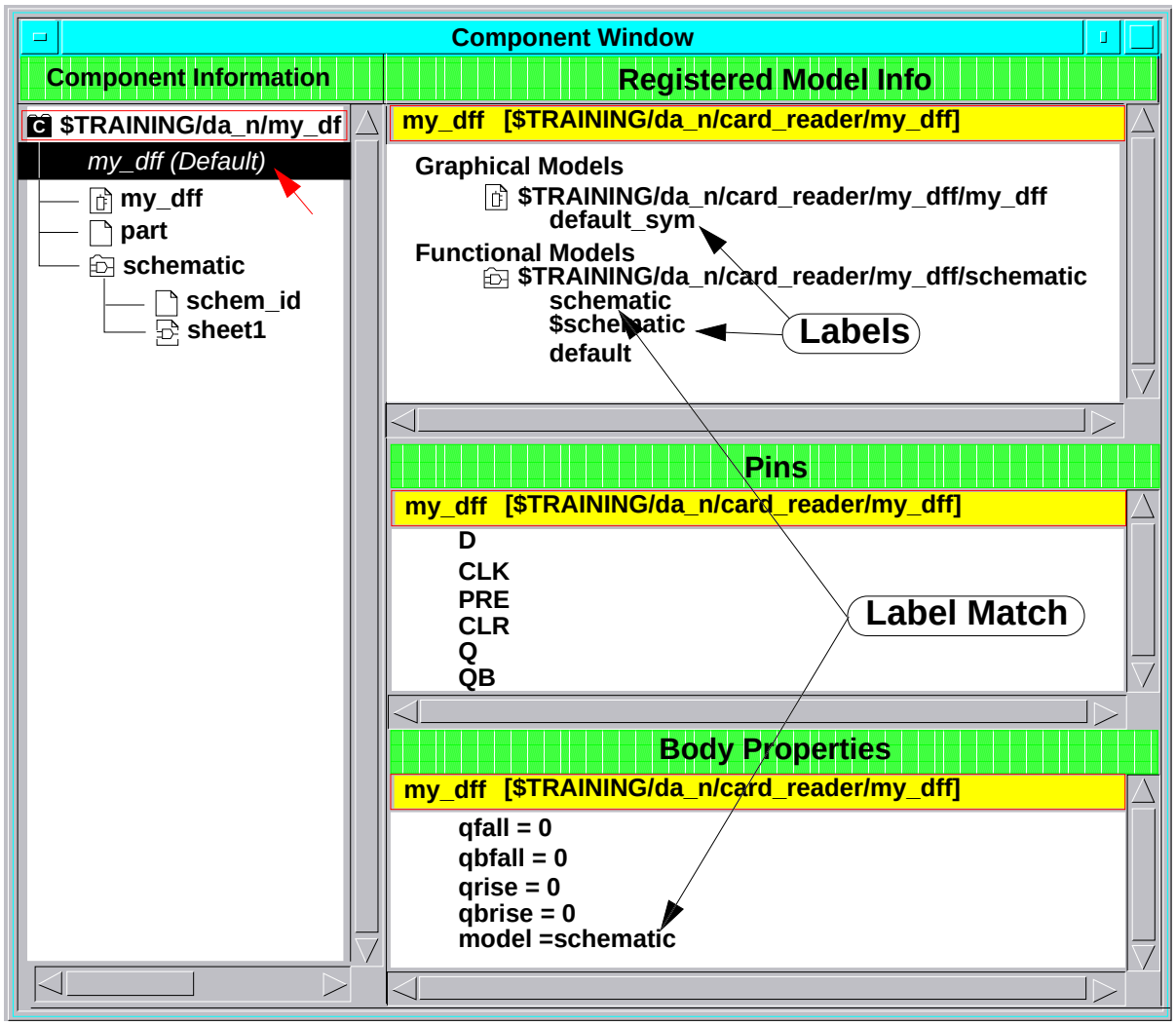


Content of Component Interface

The figure on the left shows the structure and content of the Component Interface table as seen through the Component Window. The structure of the component is shown on the left side of the window. When the name of the component interface is selected as shown in the illustration, the content of the interface is displayed in three windows on the right side.

The top window displays information about the models that are registered to the interface. The center window displays information about the symbol pins and pin properties. The bottom window displays a list of the symbol body properties and logical symbol body properties.

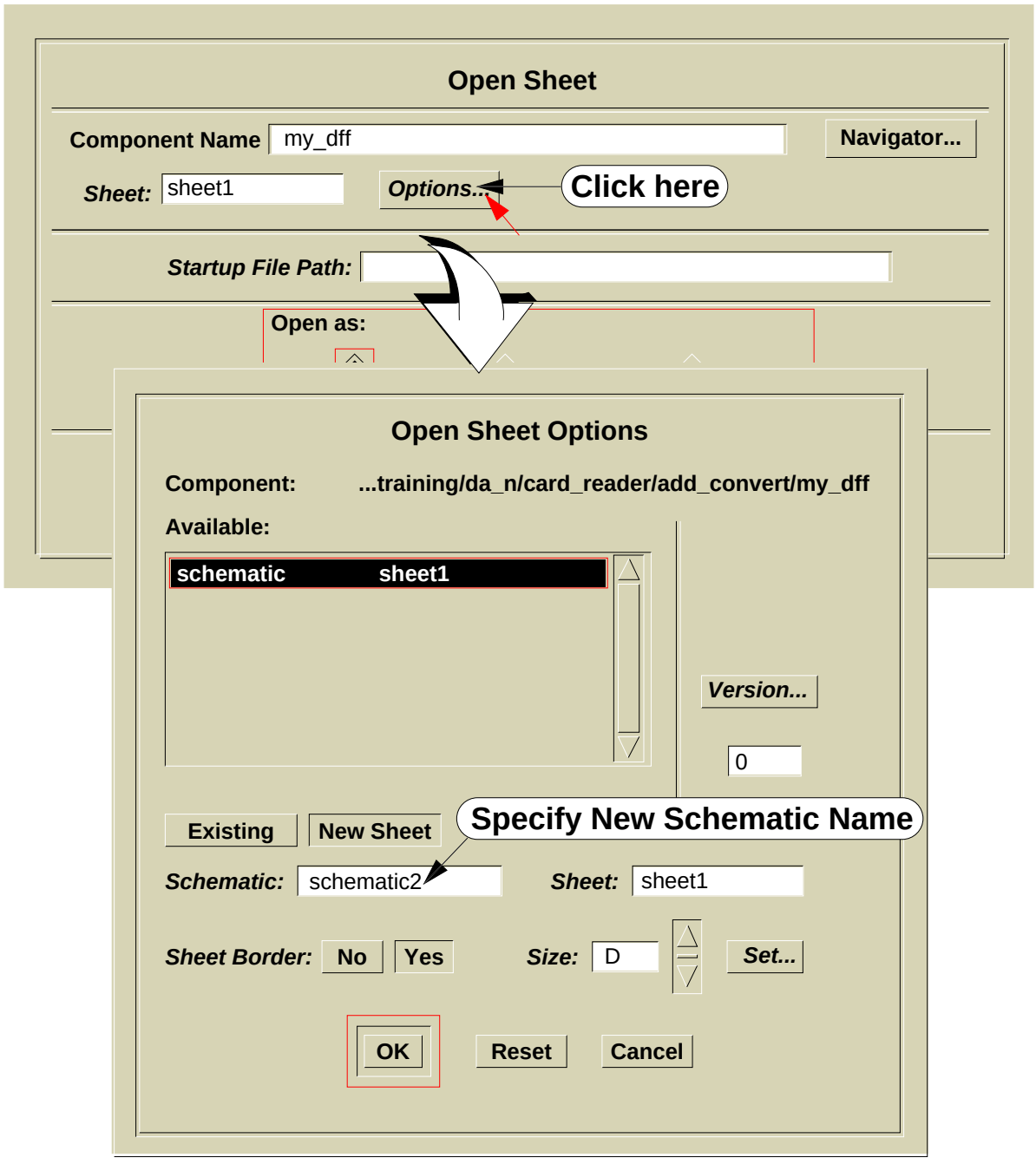
Model Labels and the MODEL Property



Model Labels and the Model Property

Registered models in the model table are assigned one or more “labels” that are used during the design evaluation process to select models for use. The figure on the left page shows how the selection mechanism works. When the value of the MODEL property on the symbol body matches a given label for a functional model in the model table, that model is selected for use.

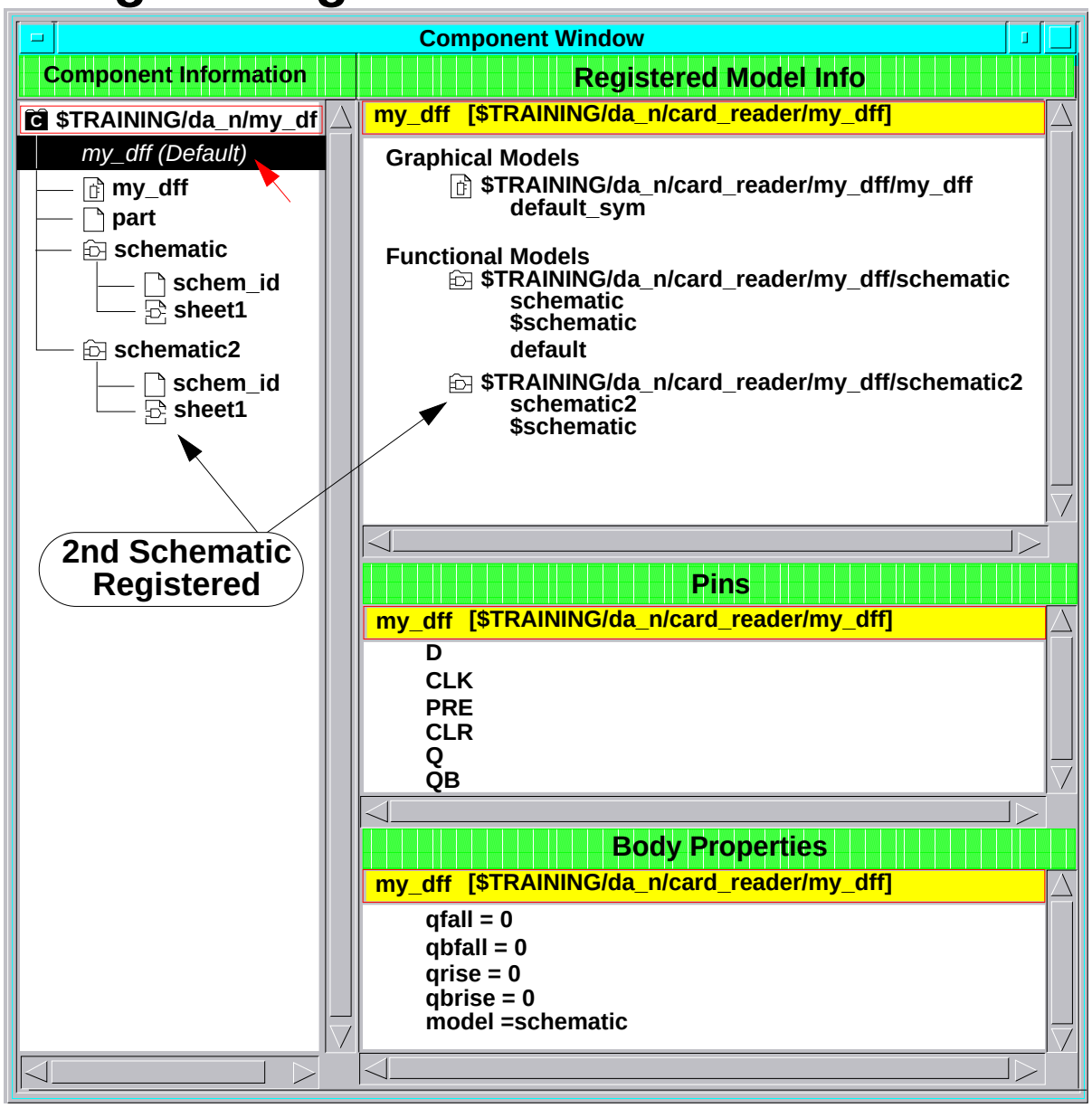
Creating More than One Schematic



Creating More than One Schematic

You may create more than one schematic for a component and register it to the component interface. As illustrated on the facing page, you create a new schematic by clicking on the *Options...* button on the Open Sheet form, then specifying the new schematic name.

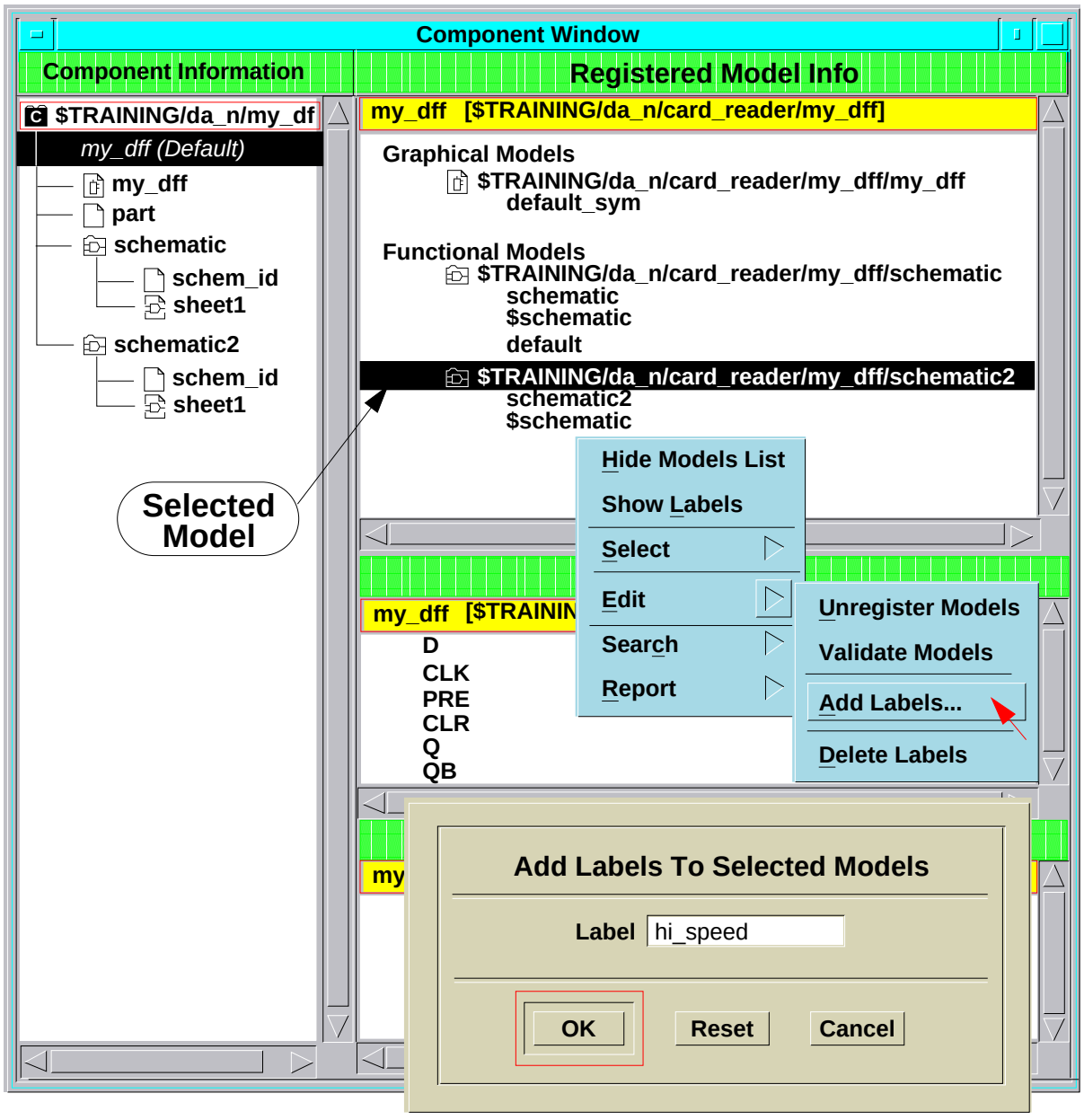
Registering More than One Schematic



Registering More than One Schematic

When you save a schematic from the Schematic Editor window, the schematic is automatically registered with the default component interface. The results of saving a second schematic are shown on the facing page. Notice that only one schematic can have label “default”. This schematic is selected whenever you open a schematic and don’t specify which schematic you want. When you save a schematic, you may tell the system at that time if you want that schematic to have the default label.

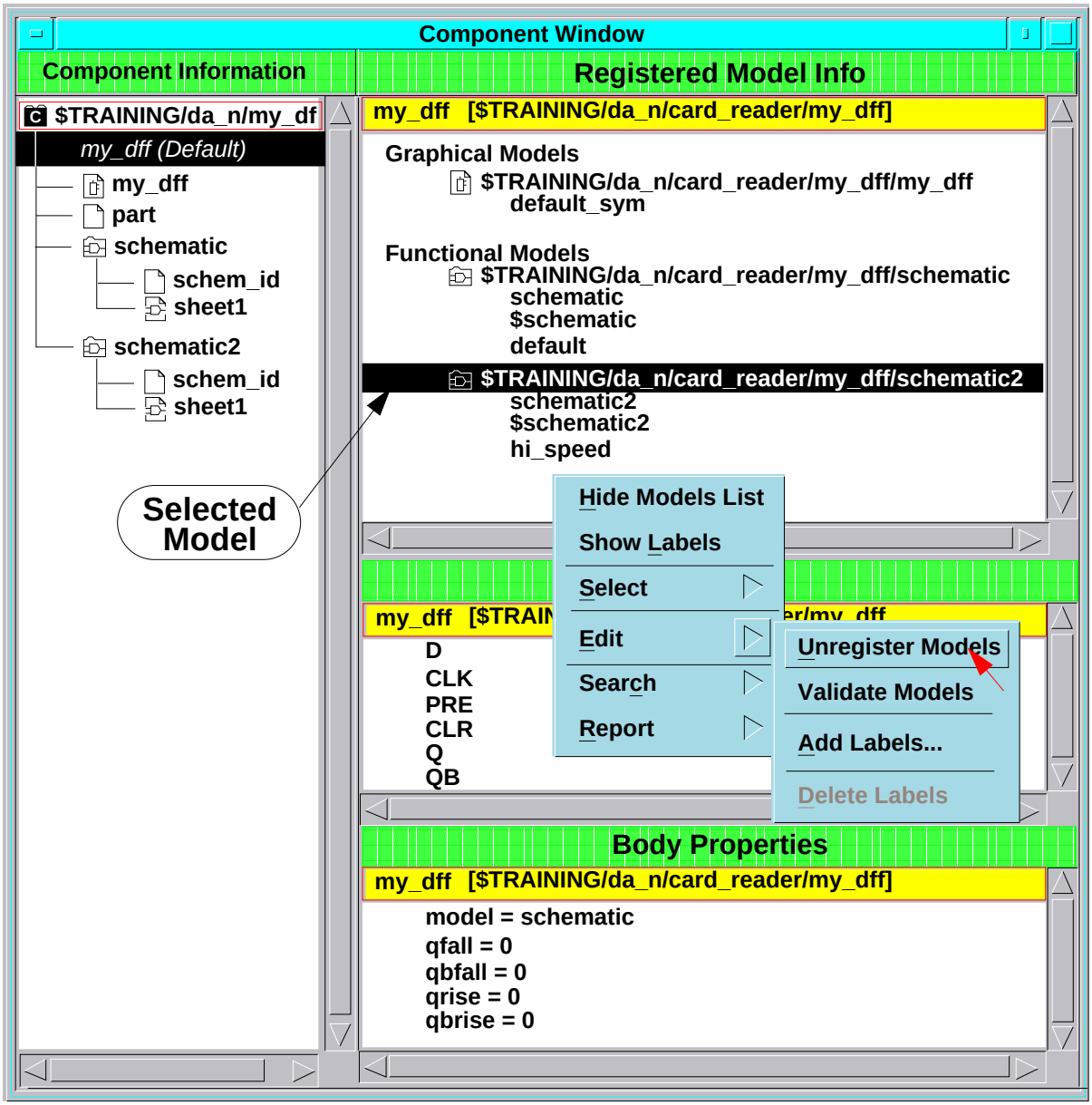
Adding Labels to Models



Adding Labels to Models

You may add labels to models from the Component window by selecting the model and choosing the popup menu **Add Labels...** In the illustration on the facing page, the label “hi_speed” is being added to schematic 2. This means that you may change the value of the MODEL property to“hi_speed” and schematic2 will be selected for use.

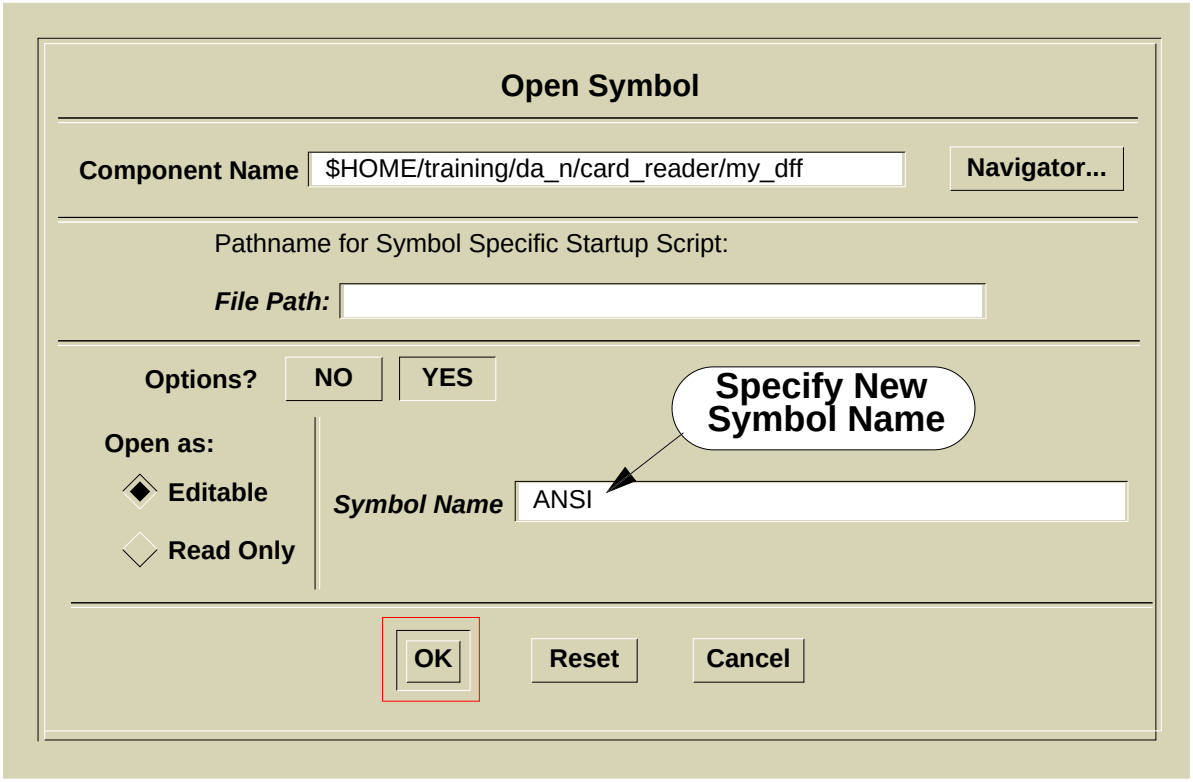
Unregister Models



Unregister Models

The component window also allows you to unregister models from a component interface. In the illustration on the left page, the functional model schematic2 is being removed from the model table in the component interface.

Creating More than One Symbol

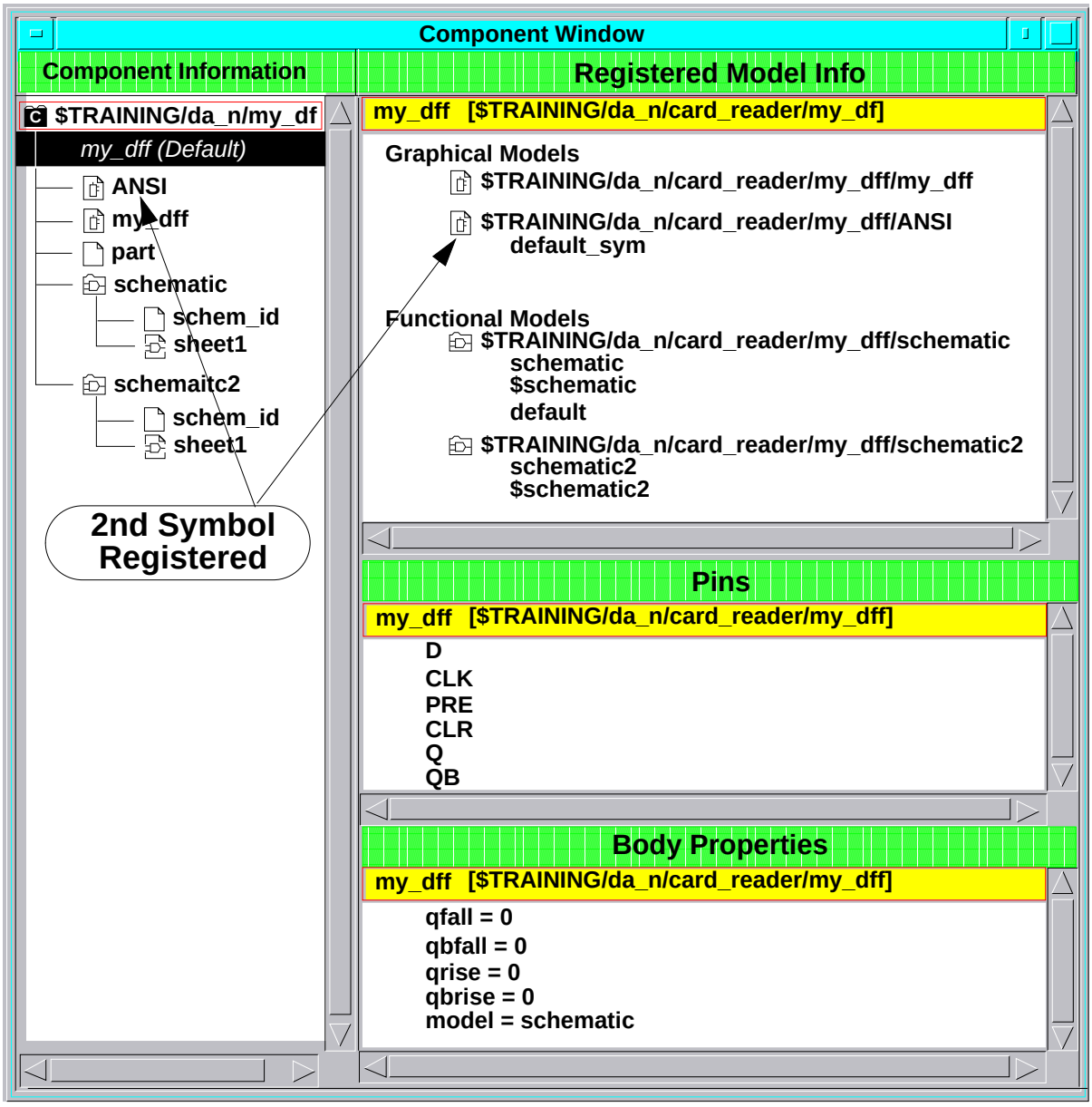


Creating More than One Symbol

Sometimes it is desirable to have more than one symbol for a particular component. In the Mentor Graphics libraries, each component has an MG_STD symbol, and ANSI symbol, and sometime a DeMorgan equivalent symbol.

As shown on the facing page, you can create addition symbols by specifying a different symbol name in the Open Symbol dialog box.

Registering More than One Symbol



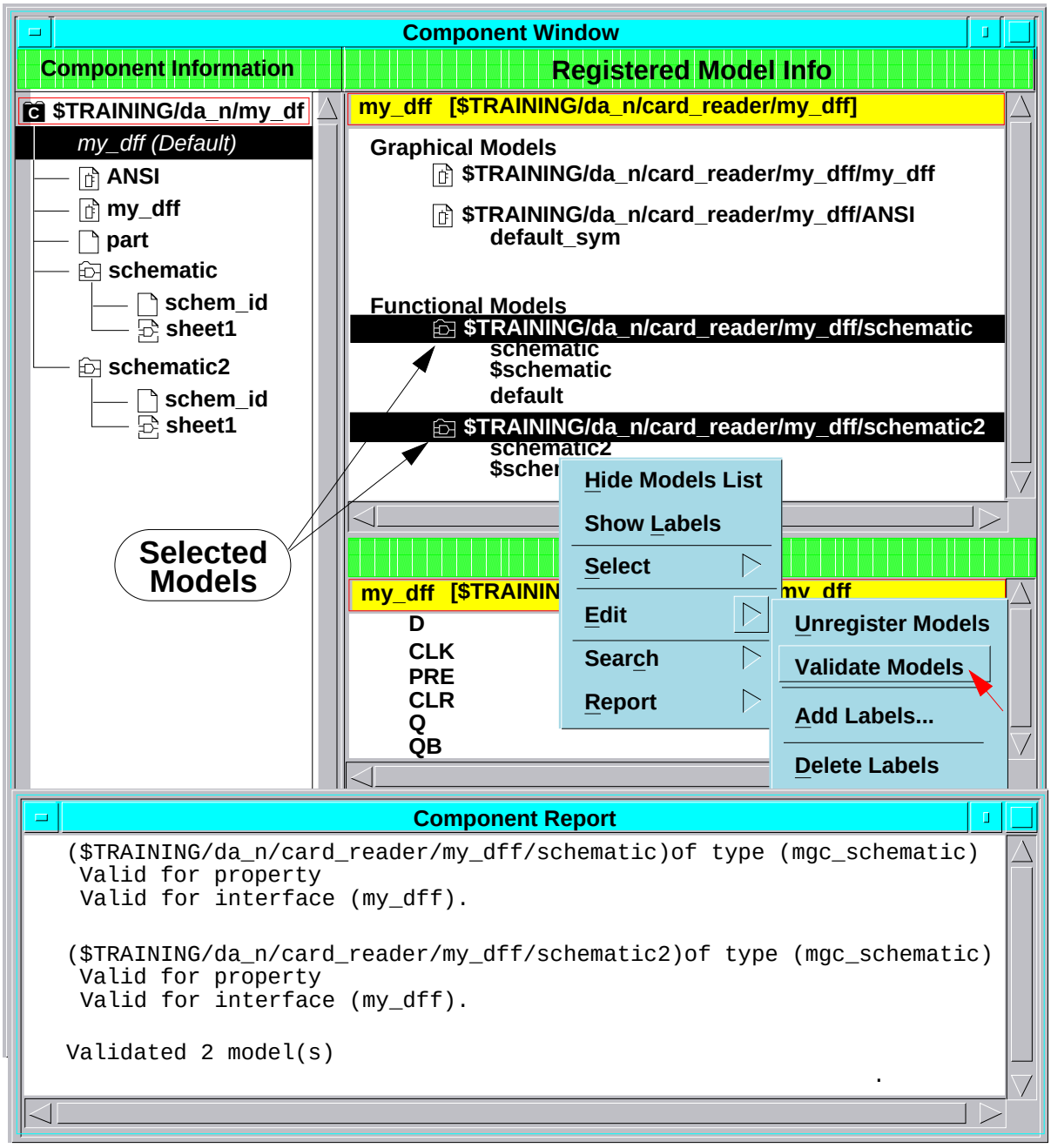
Registering More than One Symbol

The illustration on the facing page shows the results of registering more than one symbol to a component interface.

Any one symbol can only be registered to one component interface at a time and if more than one symbol is registered to the same component interface, the symbol pins, pin properties, and body properties must be identical. Only the symbol graphics may differ.

When there is more than one symbol registered to a component interface, only one of the symbols may have the label “default_sym”. This symbol is used when you instantiate the component and don’t specify which symbol you want to use.

Validating Models



Validating Models

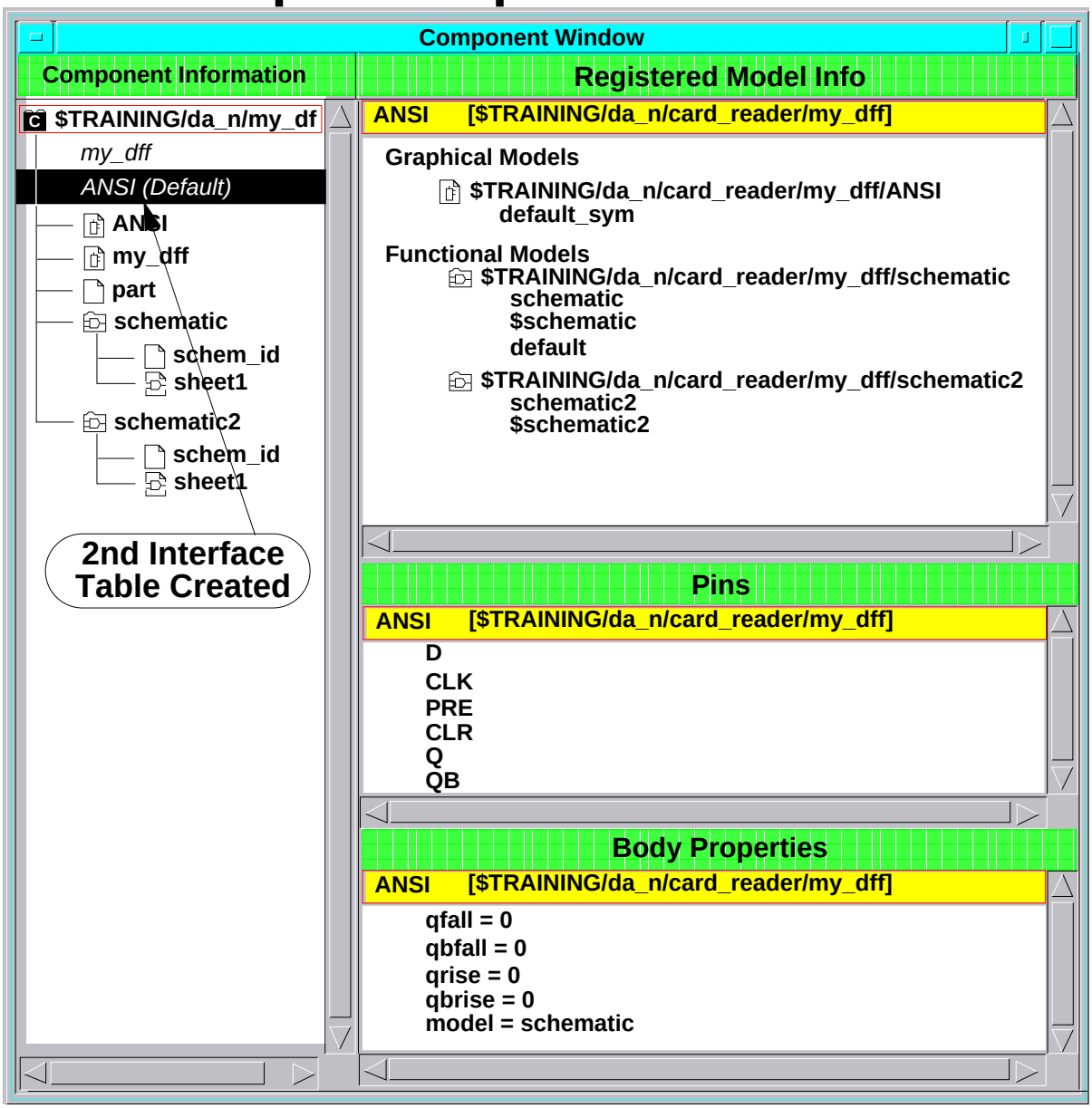
The information in the component interface table about symbol pins, symbol pin properties, and body properties is take from a symbol when the symbol is registered with the component interface. When a functional model is registered with the component interface, a software routine is run to check if the *ports* on the functional model match the registered *pins* in the interface. A few other checks are also made. If the ports match the pins, the model is marked *Valid*. If a mismatch is found, the model is marked *Not Valid*.

Normally, when a schematic is saved and registered to a component interface, the validation routine is run to check if the model is valid. If functional models are registered and a symbol is re-saved and registered to the interface, the already registered functional models are marked “Not Valid” at that time, because it is unknown whether the ports still match the pin list in the interface table.

The validation routine can be run on schematics marked “Not Valid” by opening the schematic in the Schematic Editor and re-saving the sheet. In addition to running the validation routine, this increments the version number. The other way to revalidate a functional model is shown on the facing page. You can open a component window, select the models to be validated, then choose the **Edit > Validate Model**s menu item.

Some downstream tools will not invoke properly on models marked Not Valid, while other tools don’t care about the validation status. If you receive a “model not valid” warning message, it is always best to revalidate the model before invoking a downstream tool on it.

Multiple Component Interfaces



Multiple Component Interfaces

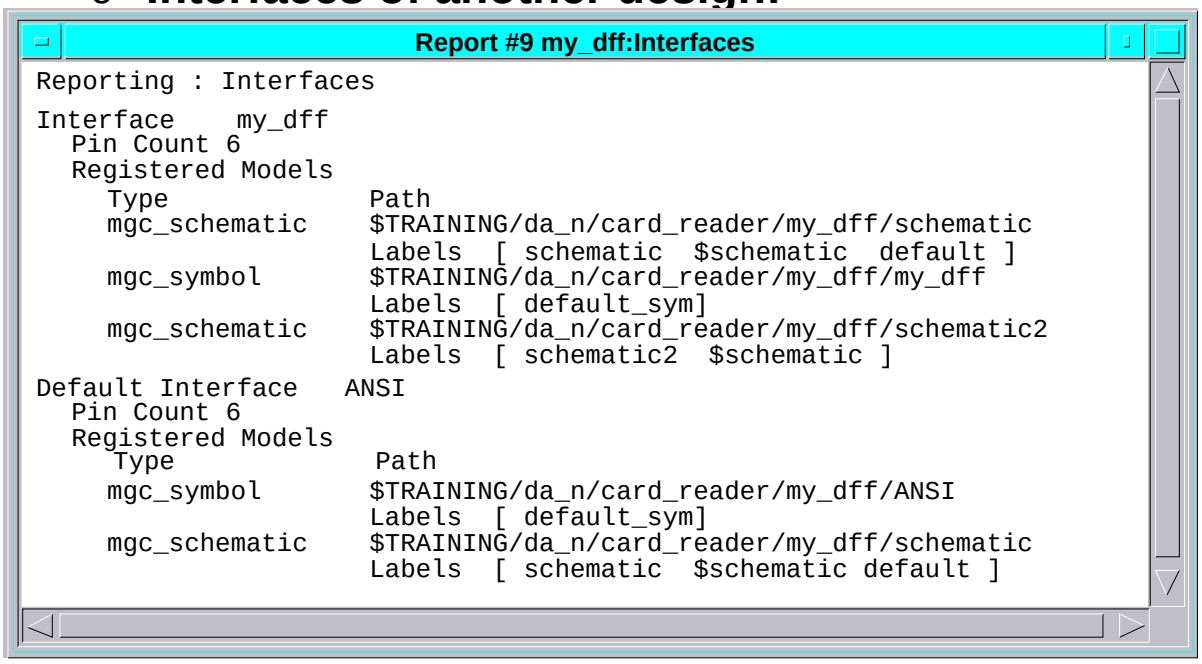
Sometimes it is desirable to have a component with more than one symbol with differing symbol body properties and possibly differing pin counts. The *rip* component in the Mentor Graphics **genlib** is an example. There are a number of ripper symbols within one component, each with a different pin count.

The ability to create more than one component interface table within one component allows you to create a component with multiple symbols with differing pins counts and symbol body properties.

Even though you may register more than one symbol to a single component interface, the common practice is to create a different component interface table for each symbol registered. This allows for greater flexibility. The example on the facing page shows a component with a *my_dff* component interface and an *ANSI* component interface. Only one component interface is marked *Default* so if you instantiate the component and don't specify which component interface you want to use, the interface marked *Default* is used.

Reporting on Interfaces

- **Report > Interfaces**
- **This Design**
  - **Interfaces relating to component of sheet**
- **Selected (Schematic Editor only)**
  - **Select one instance on sheet**
  - **Interfaces relating to component**
- **Other**
  - **Interfaces of another design:**



Reporting on Interfaces

It is not always necessary to bring up a Component window in order to get information on a component interface. Quick summary reports can be generated from the Design Architect Schematic and Symbol Editor windows.

Select the **Report > Interfaces** pulldown menu in Design Architect. The following information is displayed in a popup message window: interface name, number of pins, and associated model entries.

From the Schematic Editor, if you choose **Report > Interfaces > This Design**, information on the interfaces of the component associated with the active sheet is reported. If you choose **Report > Interfaces > Selected**, information on all interfaces relating to the single selected instance is displayed (this is not available in the Symbol Editor). If you choose **Report > Interfaces > Other**, you can specify the component name (whose symbol instance may or may not be placed on the sheet), and optionally an interface name in the prompt bar that is displayed.

The **Report > Interfaces > Other** menu item is useful when there is more than one symbol defined for a component and you are not sure of all the symbol names. The information from this menu item provides the names of all symbols, their registered interfaces, and pin names.

You can view this information in a popup message window (the default), and/or display it in the transcript (the default), and/or store it in a file (not stored by default). You can change these defaults by changing the values in the Window, Transcript, File Mode, and File entry boxes on the prompt bar, for this one time only.

CIB Commands

```
dff::dff > help
CIB commands may be optionally terminated with a semicolon
Most commands have an abbreviation (listed to the right in {})
Commands are:
   open <component pathname>
   save ;
   forget
   close ;
   view ;
   help ;
   quit ;

   select_interface <interface name> ;                    {si}
   unselect_interface ;                                   {ui}
   rename_interface <new interface name> ;                {ri}
   delete_interface [<interface name>] ;                  {de}
   default_interface <new interface name> ;               {di}
   salvage_interfaces ;                                   {sa}

   validate_model [<model entry>] ;                       {vm}
   register_model <model pathname> <model type> ;         {rm}
   unregister_model <model entry> ;       -OR-            {um}
                    <model pathname> <model type> ;

   add_label <model entry> <label> ;                      {al}
   delete_label <model entry> <label> ;                   {dl}
   label_models <existing label> <label> ;                {lm}

dff::dff >
```

Lab Exercises

Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Creating a Second my_dff Schematic

In this first exercise, you will view the component structure of the card_reader circuit from the Component window, then view the content of the my_dff component interface. You will then the create and register a second schematic for the my_dff component.

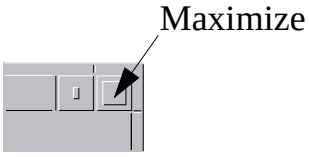
View the card_reader Component Hierarchy and Interfaces

1. From the Design Architect session window, verify and/or set the working directory to**...training/da_n**.

2. Click the COMP WINDOW icon:

3. Click on the **card_reader** component, then click **OK**.

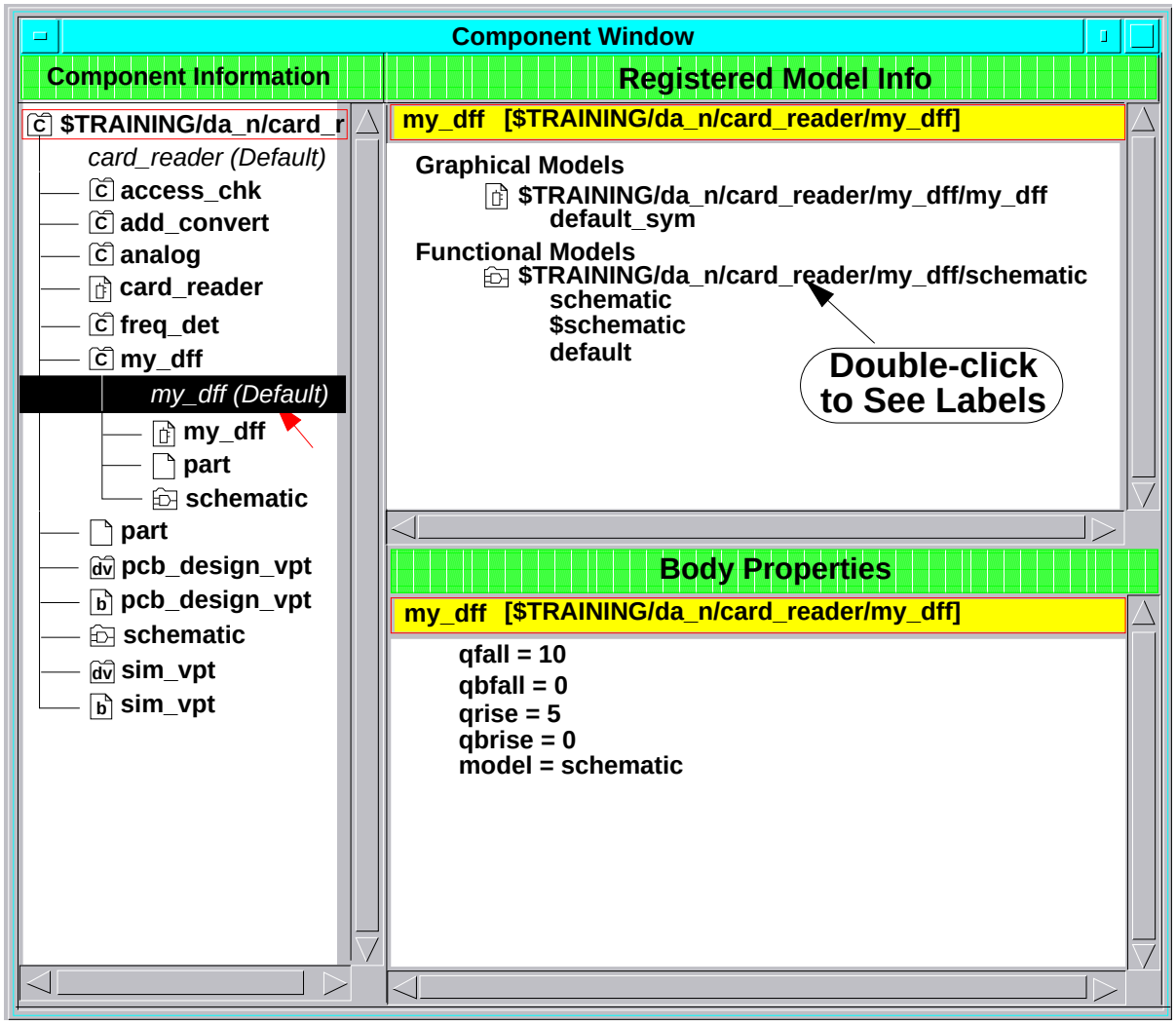
4. Click the Maximize button to fill the session area with the Component Window:



5. Double-click on the component icon at the top of the Component Information window. The structure under the card_reader component is displayed.

6. Double-click on the **my_dff** component icon, then click on the ***my_dff(Default)*** component interface name.

7. Double click on each model in the Registered Model Info window to reveal the labels. The window should appear as follows:



1. Examine the **my_dff** component interface structure. It should appear as shown in the illustration above.

2. Close the Component window.

Open a Schematic Window on my_dff

1. Activate the DA Session window and click the **OPEN SHEET** icon:

2. Navigate to and select the **my_dff** component, then click **OK**.

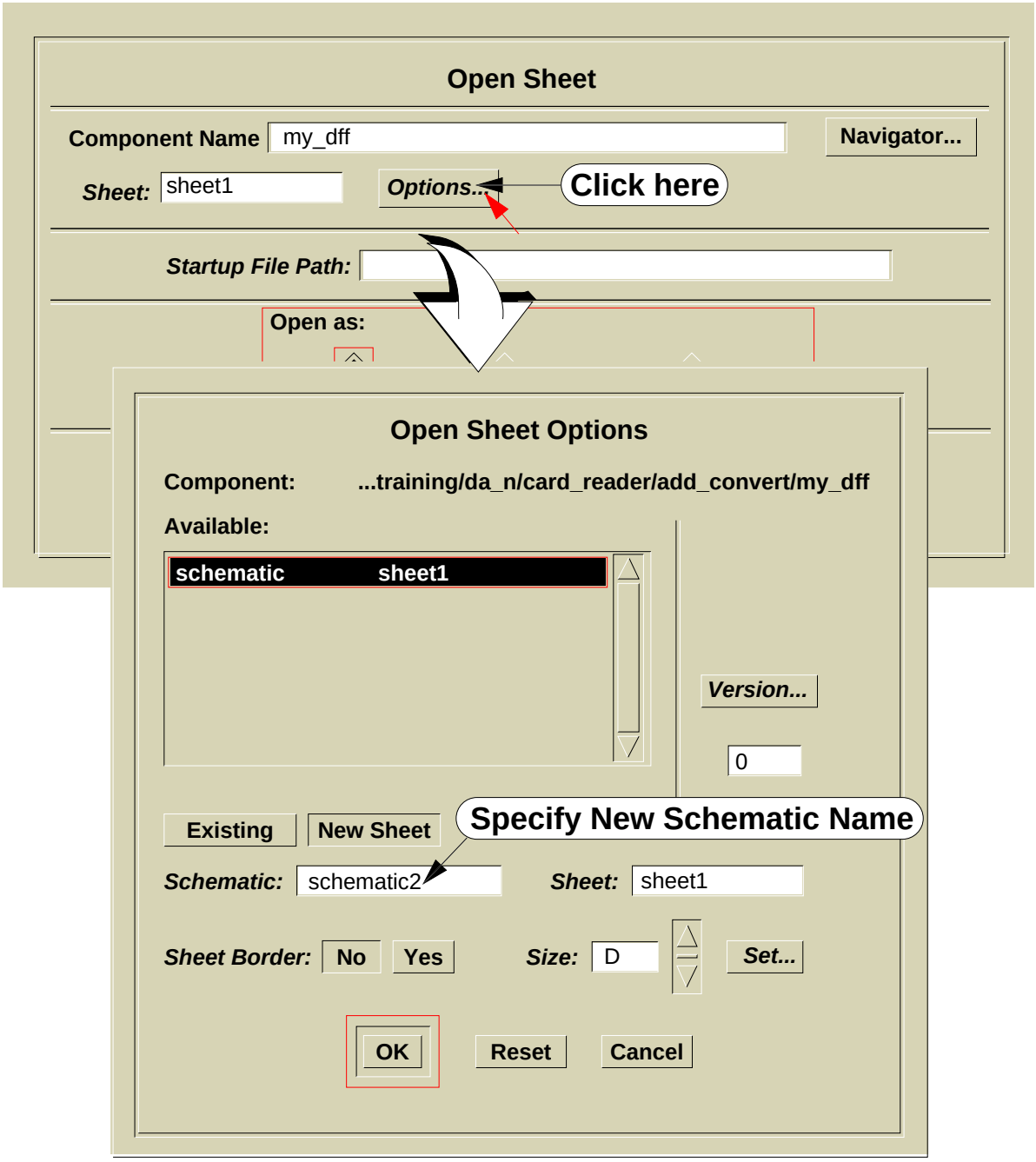
3. Click **OK** on the Open Sheet form. The **my_dff** Schematic window should appear.

4. Use the View All command  to center the my_dff schematic, then zoom out one time  .

Open a Second Schematic Window on schematic2

1. Activate the DA Session window again, click the OPEN SHEET icon, then the ***Options...*** button.

2. Click the **New Shee**t button.



1. Fill out the dialog box as shown above, then click **OK**.

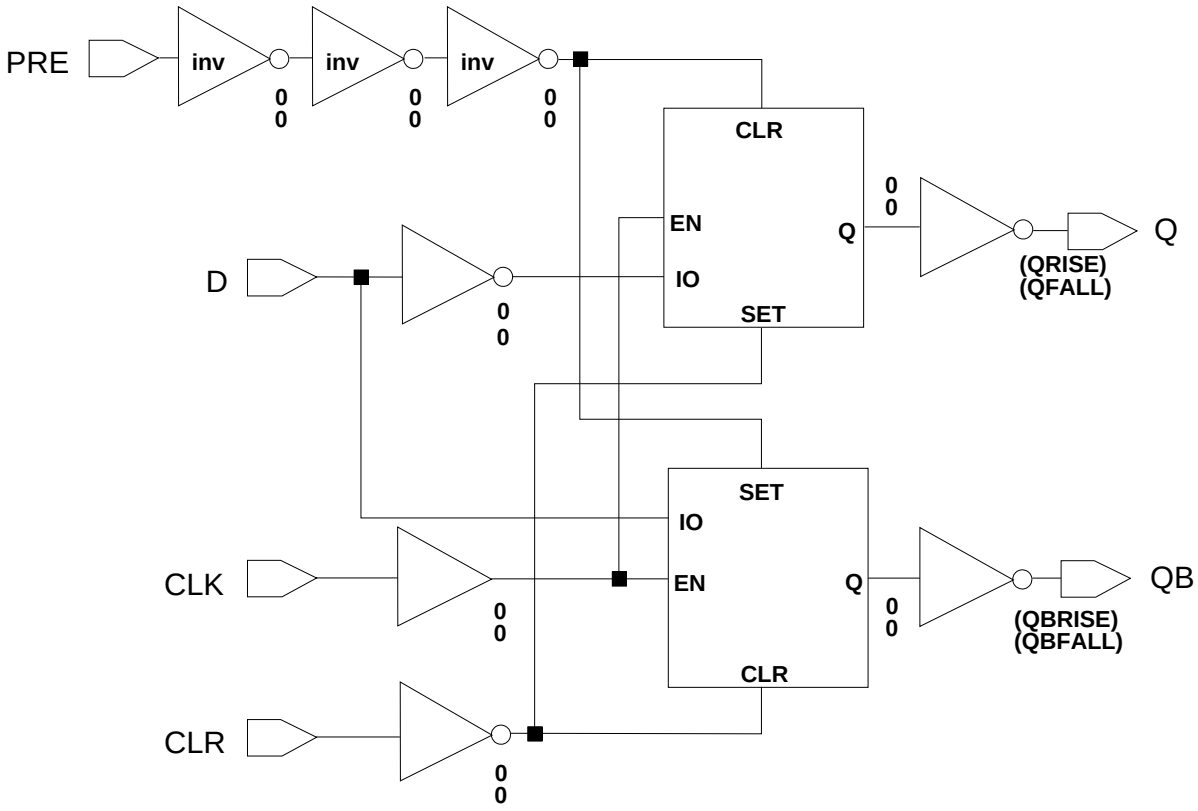
2. Click **OK** on the **Open Sheet** dialog box. A new(blank) Schematic window should come up. Notice that “schematic2” is specified in the DA Status line.

Copy the Original “schematic” into “schematic2”

1. Activate the schematic window that contains the original **my_dff** sheet and choose the following popup menu item: **Select > All**
2. Draw a “C” stroke for copy.
3. Move the mouse pointer to the schematic2 window, then click the left mouse button.
4. Draw a View All stroke, then and Unselect All stroke.

Add Two Inverters to “schematic2” in the “PRE” Wire Path

1. Maximize the schematic2 window.
2. Add two inverters to the PRE wire path as shown in the following diagram:

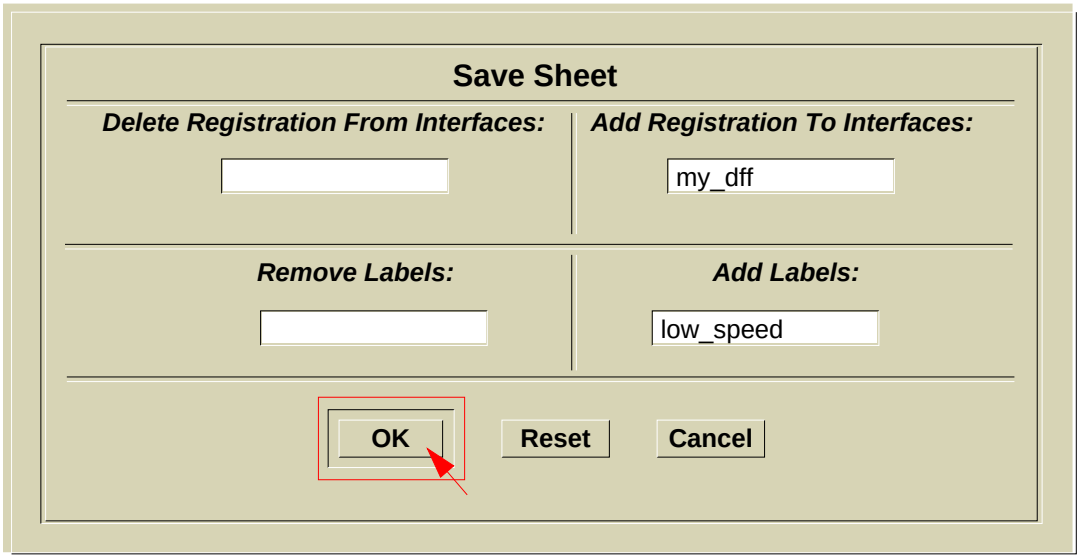


Check the Sheet

You should see 0 errors and 0 warnings in the check results window. If you get an overlap error, move your portins and inverter further left so that the inverter does not overlap the boundaries of the left **my_dff** instance. When your sheet passes all checks, close the Check Status window.

Save the Sheet and Add a Custom Label

1. Choose the pulldown menu **File > Save > Change Registration/Label...**



2. Fill out the form as shown above, then click **OK**. This registers the new schematic2 model with the component interface named “my_dff” and adds the label “low_speed”.

Verify that schematic2 was Properly Registered

1. Choose the following pulldown menu item: **Report > Interfaces**

   The labels for the “schematic2” model entry should be “low_speed”, “schematic2”, and “$schematic”.

2. Close the report window.

3. Close all the windows in Design Architect at this time.

4. Iconify the DA window at this time.

Exercise 2: Reload the my_dff Instance on add_convert, then Switch Models to schematic2

In this exercise, you will invoke DVE on the **card_reader/sim_vpt** viewpoint, then use changing values of the MODEL property to switch back and forth between the two schematic models under the my_dff instance.

Open a DVE Session on the card_reader/sim_vpt Viewpoint

1. Bring up the Design Viewpoint Editor and maximize the window.
2. Verify that the working directory is set to **...training/da_n/card_reader**.
3. Open the viewpoint named **sim_vpt** .
4. Click on the OPEN SHEET icon:
5. Select the *add_convert* instance, then choose **File > Open > Down**.

Switch Models by Changing the MODEL property

1. Select the *my_dff* instance, then choose **File > Open > Down**. Notice that the value of the MODEL property is "schematic", so the original my_dff schematic is opened.
2. From the *add_convert* Schematic window, choose the popup menu **Change > Model**.
3. Select "schematic2" from the model list, then execute the form. Notice that the *my_dff* schematic window now displays schematic2.

Close the Viewpoint

1. Click on the **CLOSE VPT** icon.
2. Click **YES** on the Save Viewpoint query form. All the windows in the DVE Session should close.

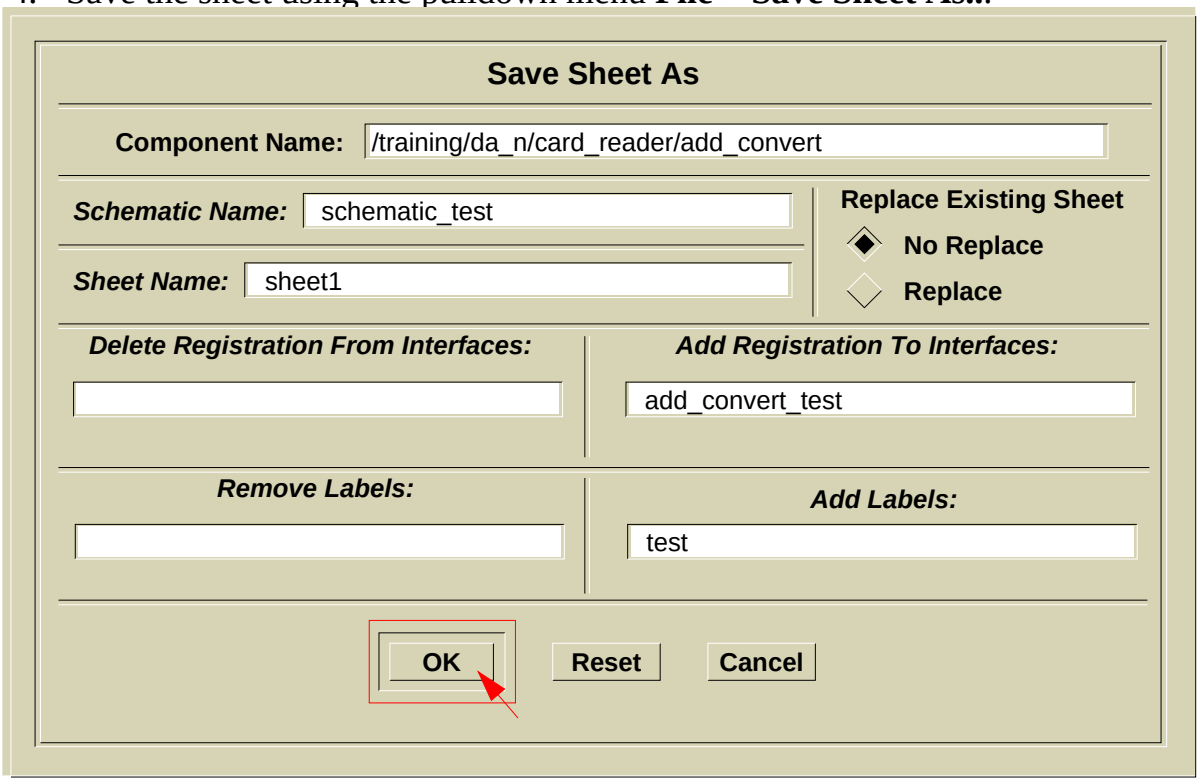
Exercise 3: Creating a Second add_convert Component Interface

In this lab exercise, you will create a new **add_convert** schematic by adding portin and portout instances to the TEST and PARITY nets, respectively. You will save the new schematic to a new component interface called add_convert_test. You will then create a new add_convert_test symbol with additional TEST and PARITY pins, then save the symbol to the add_convert_test component interface. Next, you will open a Schematic window on card_reader and Replace the add_convert instance with add_convert_test. FInally, you will open DVE on the sim_vpt viewpoint, unlatch the card_reader component, reload all models, then relatch the viewpoint.

Create an add_convert_test Schematic with TEST and PARITY Ports

1. Bring a DA Session window back up and Open a Schematic Window on the **add_convert** component.
2. Add a **portin** instance to the TEST net and a **portout** instance to the PARITY net.
3. Check the sheet.

4. Save the sheet using the pulldown menu **File > Save Sheet As...**.



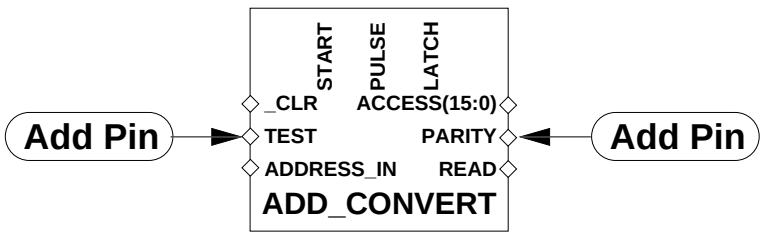
5. Fill out the form as shown above, then click **OK**.

6. Close the original add_convert Schematic window without saving.

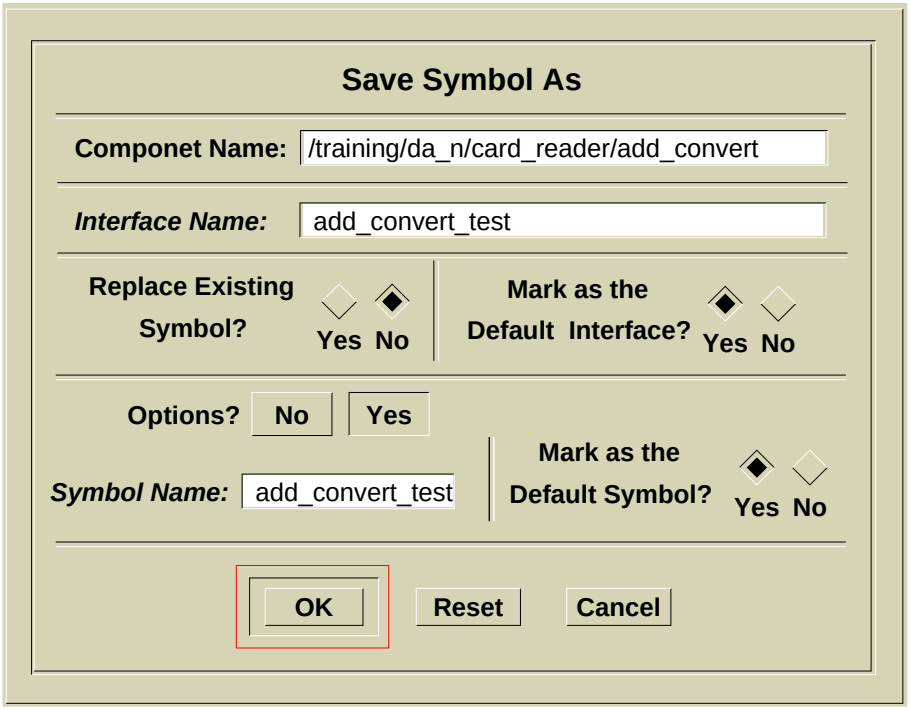
Create an add_convert_test Symbol and Register to a New Interface

1. Open a Symbol window on the original add_convert symbol.

2. Add a TEST and PARITY pin to the symbol as shown in the following diagram:



3. Check the symbol.
4. Choose the pulldown menu item **File > Save Symbol As...**



5. View the structure of the new add_convert component by choosing the pulldown menu item **Report > Interfaces > This Design**. Notice that there is now two component interface tables with the add_convert_test interface defined as the Default Interface.
6. Close the add_convert Symbol window without saving.

Replace the add_convert instance on the card_reader Schematic

1. Open a Schematic window on the card_reader Schematic
2. Select the add_convert instance.
3. Replace the model with the **add_convert_test** symbol by choosing **Edit > Replace > Alternate Symbol**.
4. Check and Save the sheet.

5. Open down into the ADD_CONVERT block, select **schematic_test**, then click **OK**. You now have access to both schematics. When the design is loaded into the QuickSim simulator, either schematic may be select just by specifying the matching label name as the value of the MODEL property.

6. Close all the windows in the DA Session.

Reload the add_convert Model from the Sim_vpt Viewpoint

1. Open DVE on the viewpoint **....training.da_n/card_reader/sim_vpt**.

2. Choose the pulldown menu **Edit > Latch Version > Unlatch Version...**

3. Click the **ALL** button, then click **OK**.

4. Reload all models with the **Edit > Reload Model > All** menu item. Observe that the updated card_reader schematic has the new **add_convert_test** instance.

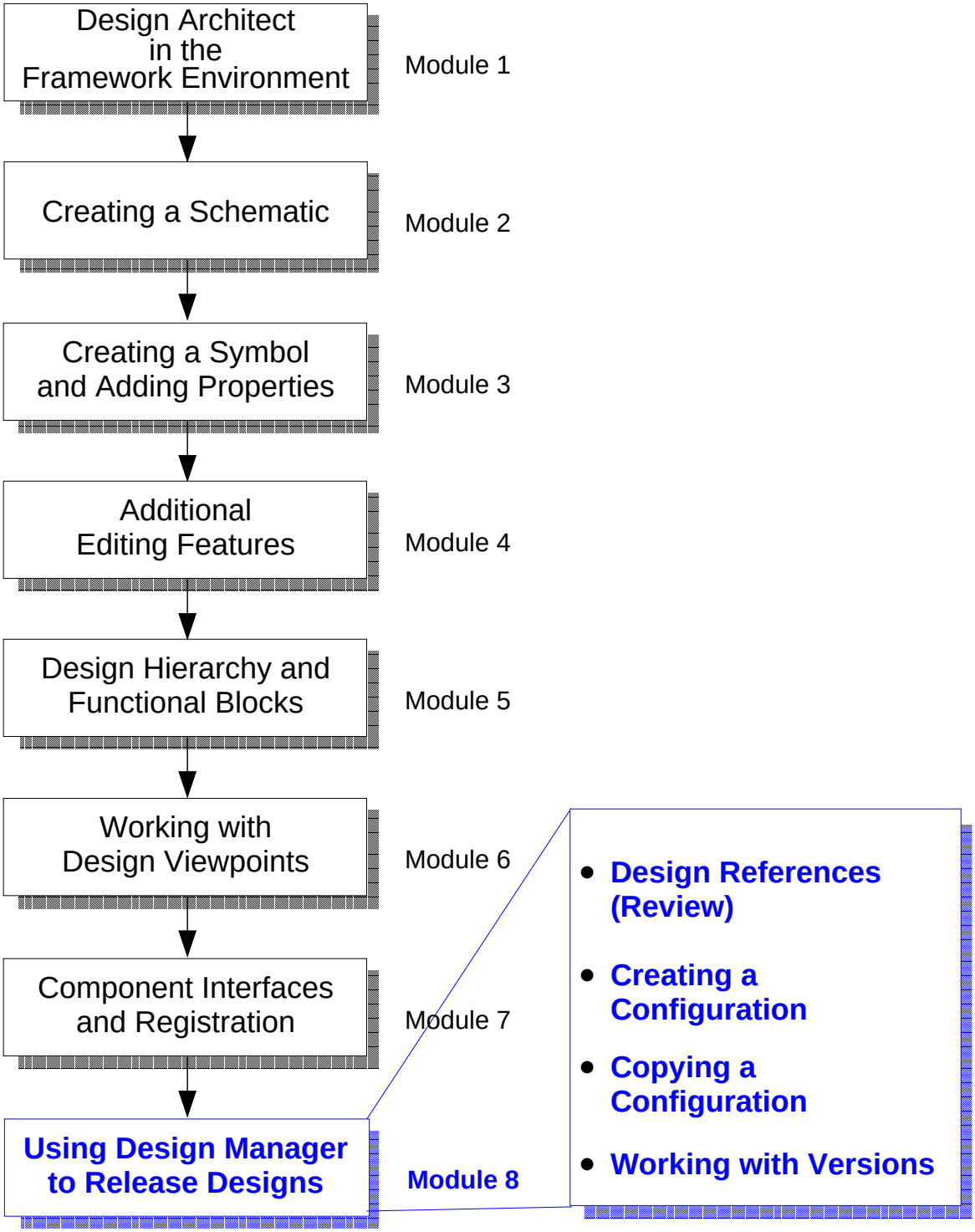
5. Relatch the viewpoint.

6. Save and Close the viewpoint.

End of Lab Exercise

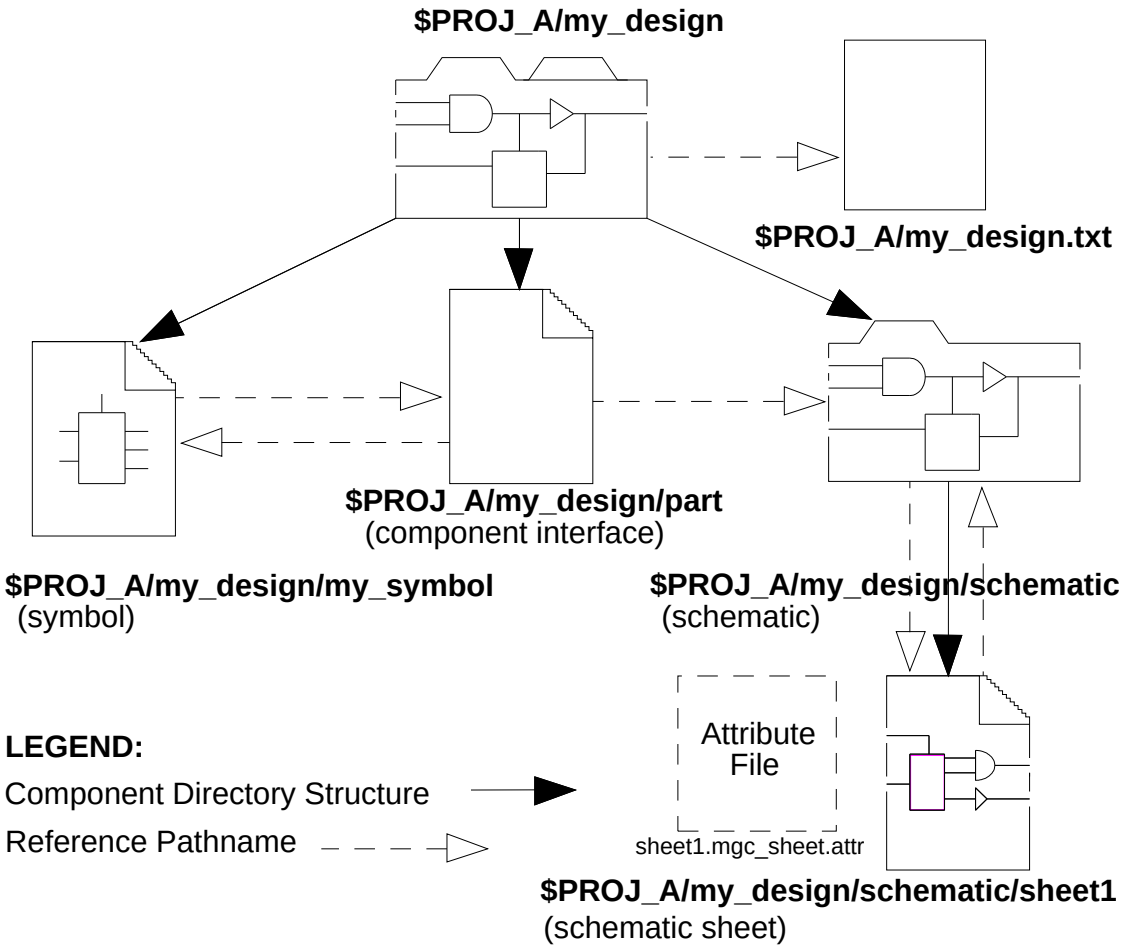
Module 8
Using Design Manager to Release Designs

Module 8 Overview



Lesson 1
Design References (Review)

Design Object References



- **Reference - a pointer between two design objects**
- **References are keep in associated ".attr" file**
- **You can check and modify references using Design Manager functionality**

Design Object References

A *reference* is a pointer from one design object to another design object. Each reference consists of the pathname to the design object, its type, and a version specifier. References show relationships between design objects.

Design Architect creates references within the component. You can create and modify references using the Design Manager. You can modify DA-created references using the Design Manager or Design Architect. However, if you modify these references within the Design Manager, you run the risk of modifying them incorrectly.

You can display design object references by invoking the **Report > Show References** menu path in the Design Manager pulldown menu or you can click on the **Show References** (right arrow) icon in the Navigator window. The Design Manager also provides other navigation buttons to allow you to explore a design object's references, enabling you to traverse the design hierarchy.

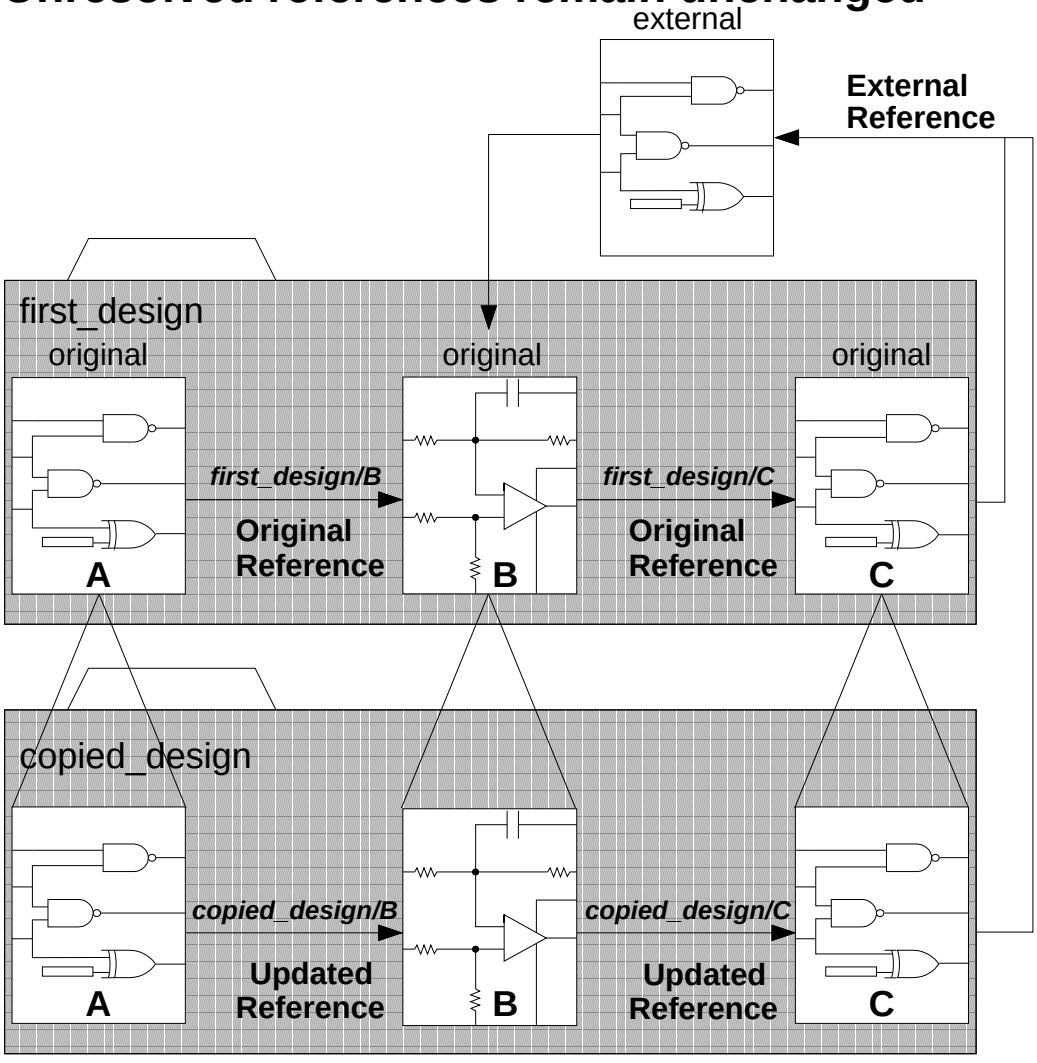
The illustration on the facing page shows two concepts: (1) the component hierarchy and the reference pathnames, and (2) references that are created by the Design Manager, and those that are created by Design Architect. The component hierarchy is defined by the solid arrows; the reference pathnames are defined by the dashed arrows.

When a symbol or schematic sheet is created, they are placed under the specified component. Reference pathnames are automatically defined by Design Architect. Thus, the symbol model *$PROJ_A/my_design/my_design* contains a reference to the component interface *$PROJ_A/my_design/part*. Notice that *$PROJ_A/my_design/part* also contains a reference to the symbol *$PROJ_A/my_design/my_design*.

The schematic model also contains a reference to *$PROJ_A/my_design/part*. In addition, the schematic model contains a reference to the sheet *$PROJ_A/my_design/schematic/sheet1* and *sheet1* contains a reference back it its parent *schematic*. The references for sheet1 are keep in an associated file called a ".attr" file.

Copying Design Objects

- **In Design Manager**
  - **Copy by containment or by reference**
- **Resolved references are updated**
- **Unresolved references remain unchanged**



Copying Design Objects

You can use the Design Manager to copy your design or component. The Design Manager copies objects in two modes: by reference or by containment. The simple copy uses containment to determine which objects are copied. All objects contained in the component container are copied.

All resolved references are automatically updated. Any references that were unresolved before the copy operation remain unchanged. You can modify these unresolved references to point to existing objects using the Design Manager. The Design Manager allows all objects within a design object to be copied.

The figure on the facing page shows schematic reference updating during a simple copy operation. A set of schematics A, B, and C, is copied from the *first_design* directory to the *copied_design* directory. In the directory, *copied_design*, the references of A, B, and C now point to local locations. The Design Manager automatically updates references. If you did not use the Design Manager to copy, the original references would have remained unchanged.

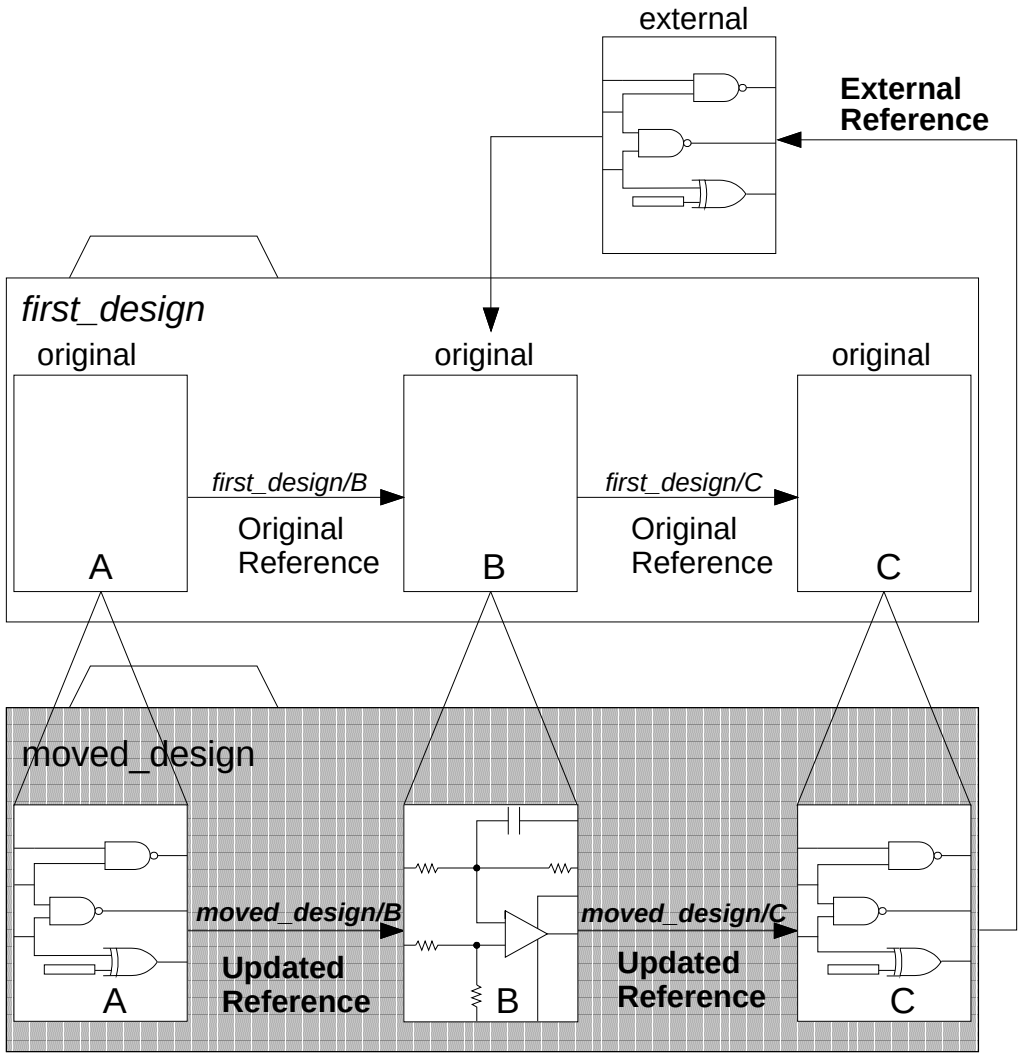
References to external objects are also copied. You can optionally choose that the Design Manager copy the referenced objects into the copied design configuration, instead of just copying the references. Thus, any design object referenced by the original design can optionally become part of the new design configuration. However, any references attached to outside objects that point to the original design remain the same; that is, they reference the original object and not the new copied object. You need to understand the design well enough to decide whether the copied design should reference other objects like the original design, or whether the copy should include the objects in the new configuration.

Note

If you copy a schematic or sheet model within a component, you must register the newly-copied model within Design Architect. You will learn more about model registration later in this training course.

Moving and Deleting Design Objects

- **Resolved references are updated**
- **Unresolved references remain unchanged**
- **References to moved/deleted object outside or at the same level as the component are not updated**



Moving and Deleting Design Objects

You can use either the Design Manager to move or delete a design object. You can also use Integrated Design Management (iDM) functions, which enable you to manage design data that you create in Mentor Graphics applications by providing easy access to copy, move, delete, and change references.

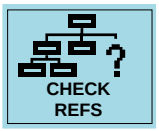
In essence, a moved design object is one that is copied and then deleted. When you move an object within a component or design, all objects in the containment hierarchy of the selected object are also moved. When you move design objects that refer to other design objects in the selected set, the Design Manager automatically updates those references to reflect the new location. Unresolved references or references to external objects remain unchanged.

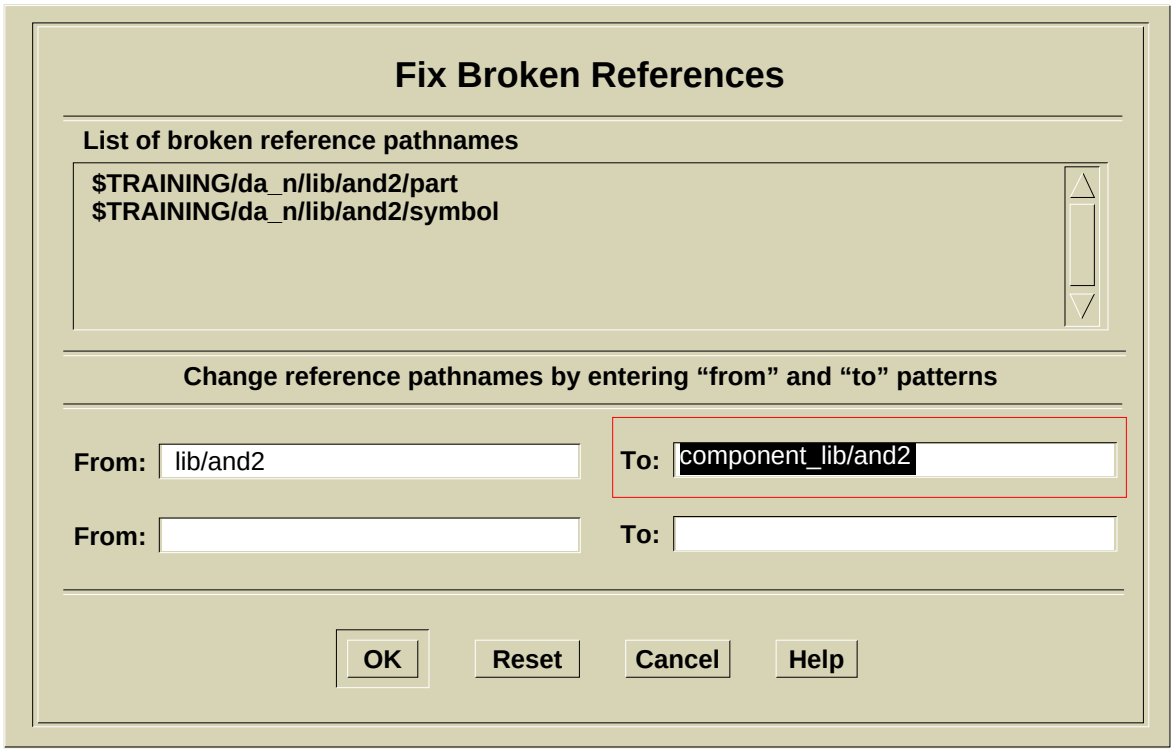
Any design objects that reference the moved object within the containment of a component are also automatically updated to reflect the new location. However, any external references that point to the moved object are not updated; that is, they continue to point to a design object that no longer exists. You need to understand the design well enough to decide whether moving the design will break external references.

The Design Manager allows all objects within the component container to be moved with the exception of symbols. Symbols are not allowed to be moved outside of their owner component container. It you attempt to move a symbol outside of its component container, Design Manager issues an error message and does not move the symbol.

When you delete an object, all objects and references in the containment hierarchy are also deleted. Any external references that point to the deleted object are not updated and are, therefore, invalid; that is, they simply point to an object that no longer exists.

Checking and Changing Design References





Checking and Changing Design References

It is a good practice to always check for broken references before you invoke an application on design data that has been relocated. You can check for broken references by selecting the icon in the Navigator window that represents the top (root) level of the design. When you click on the CHECK REFS icon in the Design Manager palette, a search for broken design references begins at that point and extends down the tree.

Broken references are reported in the Fix Broken References form as shown on the left. You may fix a broken reference by typing the complete “old” pathname in the left entry box, then the complete “new” pathname in the right entry box. To save time typing, you may just specify a pathname segment. For example, in the illustration on the left, the broken reference was created by someone changing the **component_lib** directory name to **lib**. You may fix this broken reference by replacing the pathname segment **lib/and2** with **component_lib/and2**. The important thing to keep in mind is to make sure that the pathname segment is unique, so you won’t be changing similar correct pathnames from right to wrong.

It is a good practice to always repeat the CHECK REFS operation until the message “**No broken references were found**” is reported.

Lesson 2
Creating a Configuration and Releasing a Design

Configuration Objects

- **Contains a set of rules that define a collection of design objects**
  - **Called a design configuration**
  - **Interrelated by containment or by reference**
- **Treated as one unit in the Design Manager**
- **Manipulate design objects as one operation**
- **Represented by a unique icon**
- **Creating/manipulating configurations called design data configuration management**

Configuration Objects

A *configuration object* contains a set of rules that allows you to define a collection of design objects and to treat them as one unit in the Design Manager. The design objects in this collection are called a *design configuration*, and they are interrelated by containment or by references. A configuration object allows you to find all of the design objects that are associated with a design and operate on them as a single unit. These operations include copy, move, delete, release (protected copy), and lock. Only copy and release are described in this module.

The design objects in a design configuration may be related by very complex paths of containers and references. You might be able to recreate the relationship of these objects manually, by navigating and selecting, but the task would be difficult and lengthy. In addition, you would have to do this before every Design Manager operation. The configuration object records all of the information needed to recreate the configuration instantly, at a later time.

Like all design objects, configuration objects are represented by a special icon. You can manipulate a configuration by selecting the unique icon which represents it. Configuration objects are versioned. As a result, the configuration can evolve with the design it describes.

The process of creating and manipulating design configurations is called *design data configuration management*.

Design Data Configuration Management

- **Lets you distribute a design across several locations**
- **Consists of:**
  - **Configuration window**
  - **Configuration object**
- **Steps to create a configuration:**
  a. **Open a configuration window**
  b. **Gather design objects into window**
  c. **Specify a set of build rules**
  d. **Build the configuration**
  e. **Save the configuration**

Data Design Configuration Management

Design object references allow you to distribute your design across many locations in the file system. For example, your design may be a schematic that references components in common libraries on another workstation. In addition, you may have used the Design Manager to create a reference from your schematic to the documentation that describes it, and that documentation may reside in a different directory than the schematic.

Using references to distribute designs is a powerful feature, but makes operating on the entire design as a single unit difficult. For example, you might want to copy the entire design to a different workstation. To accomplish this, you must locate and select all of the elements in the design before the copy. The Design Manager provides an easy way to perform this task by providing the following:

- **Configuration window**. This window provides a convenient way to gather all elements of a distributed design into one place. These gathered elements are called a *configuration*. After you create the configuration, you can perform copy or release operations on the entire configuration.

- **Configuration object**. This object (displayed as an icon in a Design Manager Navigator window), is a special design object that corresponds to the contents of the configuration window. The configuration object records the exact contents of the configuration after you create it. By navigating to and opening the configuration object, you can recreate a configuration after you have closed the configuration window.

To create a configuration, follow these steps (1) open a configuration window, (2) gather your design objects (called primary entries) into the window by executing a command or by dragging the objects into the configuration window from a navigator window, (3) set your build rules that the Design Manager uses to search for secondary entries (which are related to the primary entries by containment or reference), (4) build the configuration; when completed, the configuration window displays the entire configuration, and (5) save the configuration so that you can recreate the configuration at a later time.

Configuration Operations

- **Use configuration objects to:**
  - **Copy designs**
  - **Release designs**
- **One version depth of configuration**
- **References are automatically updated**
- **Release is a protected copy of configuration**
- **To modify a released design:**
  - **Fix original and release again**
  - **Fix copy and release**

Configuration Operations

After you create a configuration, you can operate on it with the commands that are available in the configuration window. These commands operate on every design object version in the configuration, in a single operation.

In a single operation, you can copy each design object version in the configuration to a single target directory. When you copy the design object, you are only copying a single version of the design object. If the original design object is at version number 8, the copied design object version number becomes 1. Containment relationships are preserved. References are automatically updated to reflect the new location. Important record keeping information is stored in the copied configuration object.

A release is a protected copy of the configuration. Containment relationships are preserved, references are automatically updated, the versions are renumbered starting at 1, and record keeping information is stored. You are not allowed to modify a released design using Idea Station applications. The Protect property is added to these design objects. If you need to edit released data, use one of the following options:

- Fix the original design and release it again using the same configuration. Only the files that have changed since the original release will be merged. This may not be possible if the original design has significantly evolved.
- Copy the released design to a new location. This copy is not protected. Make changes to the copy and then release it.

Versions

- **Types of data: versioned and unversioned**
- **Directories: unversioned, containers: both**
- **Idea Station maintains two versions of design objects**
- **You can:**
  - **Change version depth**
  - **Copy version**
  - **Delete version**
  - **Revert to previous version**
  - **Display version number**
  - **Freeze/unfreeze a version**
  - **Release multiple versions**

Versions

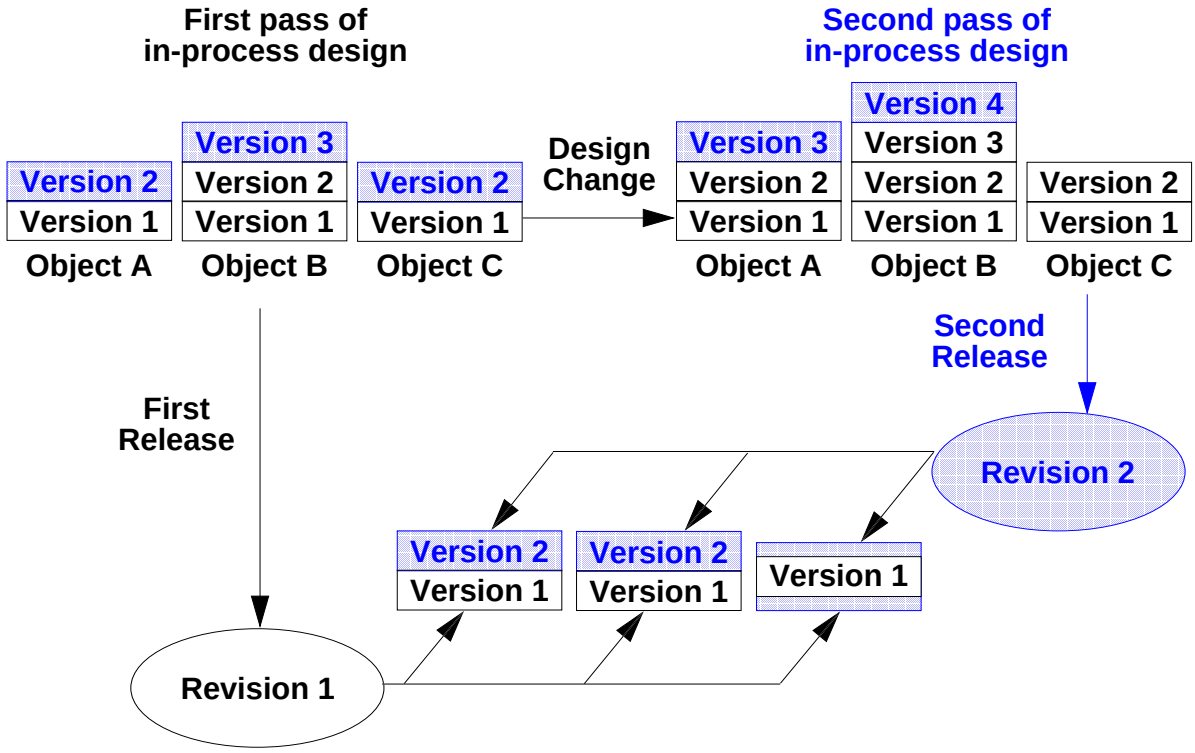
When you invoke an application and develop your design, you create design objects. As you edit your design, those design objects change. The current and previous states of a design object are called *versions*. Mentor Graphics provides two kinds of design data: *versioned* and *unversioned*. Versioned design objects retain previous versions of your design. Unversioned design objects retain only one version at a time.

Directories are not versioned. Containers can be unversioned or versioned design objects. However, a versioned container does not version its directories; only its attribute file metadata and other fileset members are versioned. Mentor Graphics applications normally maintain two versions of a design object. Realize that for large designs, retaining two versions can consume large amounts of disk storage.

Some of the operations that you can perform on versioned data include: displaying the number of versions, setting the version depth, copying a version, deleting a version, freezing or unfreezing a specific version, reverting to a previous version, and releasing multiple versions of a design object.

Changing the version depth does not immediately remove excess versions. It only prunes versions when the next version manager operation occurs. The next Design Manager or application save that occurs will update the versions using the version manager

Releasing Designs



- **Creates a protected copy**
- **Releases a single version of each design object**
- **Release Configuration command assigns the release attribute to every versioned design object**
- **Extracted copies of designs can be opened for further editing without harming released design**

Releasing Designs

Releasing a configuration creates a protected copy of its entries. In other words, the Design Manager will not allow you to create new versions of the released design objects. A copy becomes protected when the Release Configuration command assigns the “released” attribute to every versioned object in the release directory.

Releasing a configuration releases a single version of each design object. The first time that you release design objects to the destination directory, all versioned design objects are rolled to version 1. In subsequent releases to the same destination directory, new versions are layered on top of the existing versions, creating a version history of the released configuration.

The illustration on the facing page shows an example of creating multiple revisions of a design by releasing a configuration multiple times. In this example, the design consists of objects A, B, and C. Before the first release, you have several versions of each design object and a configuration that contains the current version of each object. When you release the configuration, you attach the annotation “Revision 1” to the release.

If you modify the design and create version 3 and 4 of objects A and B, respectively, without changing C, you can release the design again, this time attaching the annotation “Revision 2” to the release. This release adds version 2 to released object A and version 2 to released object B. Because object C has not changed since the last release, its version number is not incremented.

When you have released a configuration, such as Revision 1 of the design, that version remains intact. However, you can extract another copy of the configuration, such as Revision 2, in which you can open and edit design objects without damaging the released design.

Lab Exercises

Objectives

In these lab exercises, you will do the following:

1. Create a reference from the **card_reader** design to a document called *card_reader.rel_notes* using the Design Manager.
2. View the contents of the **card_reader** design and the references within it.
3. Check for broken references.
4. Create a configuration to copy the **card_reader** design and its associated design objects.

Print Out the Lab Exercises

If you are reading this workbook online, you might want to print out these lab exercises to have them handy when you are at your workstation.

Exercise 1: Exploring References

The purpose of this exercise is to familiarize you with viewing references that are either created by the Design Manager or Design Architect. First you will manually create a reference to the **card_reader** component using the Design Manager. Then you will then view the references that were generated by Design Architect when you created **card_reader** circuit in the previous lab exercises.

1. Bring up the Design Manager if it hasn't already been invoked.
2. Navigate to the <*your_path*>*/training/da_n* directory.
3. Create a reference from the card_reader component to the document *card_reader.rel_notes as follows:*

   a. Select the **card_reader**.

   b. Choose the following popup menu item: A**dd > Reference:**

   A dialog navigator is displayed.

   c. Double click on the **com** directory. The contents of the *com* directory is displayed in the Navigator window.

   d. Click on *card_reader.rel_notes*, then click **OK**.

4. Verify that a reference points from card_reader to *card_reader.rel_notes*.

   a. Select the **card_reader** icon, then click the **Explore References** (right arrow) button in the Navigator window.

   A report window is displayed which contains the reference pathname to the file *card_reader.rel_notes*.

   b. Click on the **Explore Back to Parent** (left arrow) button to close the report window.

5. View the contents of the card_reader component.

   a. Double click on the **card_reader** icon.

b. What type of objects do you see at the level directly below the **card_reader** component?

_____

6. View the contents of the my_dff component.

a. Double click on the **my_dff** component.

The contents of the *my_dff* directory is displayed in the Navigator window.

b. Click on the **my_dff** symbol icon and click the **Explore References** button.

A report window is displayed.

c. To what other object(s) does the **my_dff** symbol reference?

_____

d. Click on the **Explore Back to Parent** button to close the report window.

e. Click on the **part** icon and click the **Explore References** button.

A report window is displayed.

f. To what other object(s) does the **part** object reference?

_____

g. Click on the **Explore Back to Parent** button to close the report window.

h. Click on the **schematic** icon and click the **Explore References** button.

A report window is displayed.

i. To what other object(s) does the **schematic** model reference?

_____

j. Click on the **Explore Back to Parent** button to close the report window.

k. With the **schematic** icon still selected, click on the **Explore Contents** button.

The contents of the *schematic* directory is displayed in the Navigator window.

l. Click on the **sheet1** icon and click the **Explore References** button.

A report window is displayed.

m. To what other object(s) does **sheet1** reference?

_____

n. Click on the **Explore Back to Parent** button to close the report window.

7. View the design viewpoint, and back annotation objects under the card_reader component.

a. Traverse up the design hierarchy until you are directly below the **card_reader** component.

b. Click on the **sim_vpt** design viewpoint icon, then click the **Explore References** button. A report window is displayed.

c. To what other object(s) does the **sim_vpt** design viewpoint reference?

_____

d. Close the report window, then click on **Explore Back to Parent**.

e. Click on the **default** back annotation icon, then click the **Explore References** button. A report window is displayed.

f. To what other object(s) does the **default** back annotation object reference?

_____

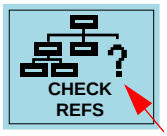
g. Close the report window, then click on **Explore Back to Parent**.

Exercise 2: Verifying and Changing References

Whenever you move design data from a different location, especially from a different network, it is a good practice to verify that all references resolve correctly. In Module 1 of this course, you made a local copy of the training data from a master location, but you did not check the references after you copied the data. If there were broken references in the master copy of the data (possibly due to not being checked after being loaded from tape) the broken references will be copied to your local location. In this exercise, you will check for broken references in your local copy of the training data.

1. From the Design Manager Navigator window, select the **da_n** icon in your local *training* directory.

2. Click on the **CHECK REFS** icon:



Design Manager searches the entire directory structure from that point down.

Were any broken references found? If so, what are the references?

_____

If broken references are reported, fill in the form as follows to repair the broken reference(s):

1. Use the Navigator to navigate down to the indicated design object and find the true pathname.

2. Replace the broken pathname segment. For example, if the segment *lib* should be *component_lib*, then enter something like replace ***lib/and2*** with ***component_lib/and2*****.** Make sure that the pathname segment is unique to the branch you are on.

3. Click **OK**.

Design Manager replaces all old broken reference segments with the new reference segment you specified. Design Manager than asks if you want to check for more broken references.

4. Click on **YES**.

5. Repeat the above process until no more broken references are reported.

6. Examine the repaired reference with the Navigator. If the referencing object is a **part** object and it points to a **symbol** object, make sure that the new reference points to a **symbol** object that is in the same directory as the **part** object.

Exercise 3: Creating and Copying a Configuration

Before starting this exercise, make sure you have closed all the schematic and symbol windows within Design Architect. In order to create a configuration object within the Design Manager that includes ***card_reader, add_convert****, and* ***my_dff****, they must not be opened within another application.*

In this exercise, you will create a configuration object and then you will use that configuration object to copy your **card_reader** component to another directory.

Check the References to Make Sure They are Interoperable.

Use the steps described in the first lab exercise in this module to check the references of the **card_reader, add_convert**, and **my_dff** components and all the components found in the **component_lib** directory. Use the **Explore Contents** button to display the references within the part and other models within the component. Make sure that all the references begin with either *$MGC_GENLIB* or *your_path/training/da_n.*

Open a Configuration Window

Make sure that the Design Manager Session window is active, the click on the CONFIG icon: This brings up a blank configuration window.

Drag Primary Entries into the Configuration Window

1. Reactivate the Navigator window and use the navigator buttons to display the contents of the *your_path/training/da_n* directory.
2. Using the Select mouse button, drag the following icons into the configuration window:
    - card_reader
    - component_lib
3. Check the contents of the configuration window to make sure that you have three entries displayed in it. These are called the *primary entries*.

Build the Configuration

Normally, you would set your build rules for each of the primary entries in the configuration window. However, in this exercise, assume that the default build rules are adequate.

1. Activate the configuration window.
2. Choose the following menu item in the popup menu:

   Configuration > Build

   The message area contains the following information:

   Working....

   When the build is complete, the configuration window contains the full build contents. If you completed the build successfully, the following information is displayed in the message window:

   The Build operation was successful.

Save the Configuration Object

After you have built a successful configuration and are satisfied that it contains the entries that you want, you can save it for later use.

1. Choose the following menu item:

   Configuration > Save As:

2. Type the following information in the prompt bar:

   Path: your_path**/training/da_n_config**

3. View the *your_path/training* directory to verify that the configuration object *da_n_config* exists.

Copy the Design Configuration to Another Directory

1. Activate the configuration window and choose the following menu item:

Configuration > Global Operations > Copy...

You will see the following message in the message area:

The configuration is not locked.

A Copy Configuration dialog box is displayed:

2. Type in the following information:

   Destination Directory: your_path**/training/da_n_copy**

   Overwrite Mode: **Cancel**

   Preview Only?: **No**

3. Click **OK**.

   A message window is displayed with the following information:

   Create destination directory?: <your_path>/training/da_n_copy

4. Click **Yes**.

   The configuration window displays the status of the configuration copy. When it is completed, the following information is displayed in the message area:

   The Copy operation succeeded.

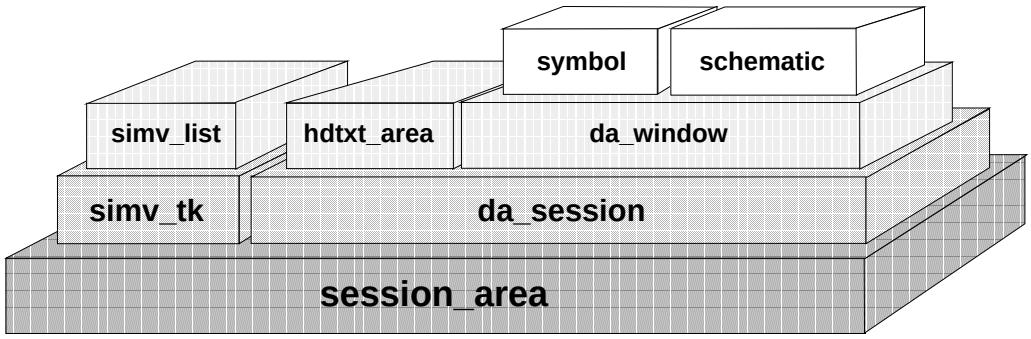
View the Contents of the *da_n_copy* Directory

Explore the contents of the *your_path/training/da_n_copy* directory using the navigator buttons. Verify that the references in *da_n_copy* for **card_reader, add_convert**, and **my_dff** are correct.

End of Lab Exercise

Appendix A
Customizing Exercises

Common Scopes in DA and QuickSim



$window_scope_name() ← Returns the scope name of the active window.

$ask_scope_frame_name() ← Returns a hierarchy of scope names for the active window.

$ask_scope_function_name() ← Returns the function names that are defined in the active window.

$HOME

mgc

userware

simv

simv_list.ample
simv_tk.ample

des_arch

da_session.ample
da_window.ample
schematic.ample
symbol.ample

base

session_area.ample

startup

da_session.startup
da_window.startup
schematic.startup
symbol.startup
simview.startup
quicksim.startup

Common Scopes in DA and QuickSim

The block structure to the left provides a simplified view of common scopes in Design Architect and QuickSim. You may think of the scope structure as an apartment building with several floors. Each apartment is a scope and has a scope name. The building is unique in that a person in an upper apartment can look down and see everyone in the apartments below, but a person in a lower apartment cannot see into the apartments above.

Each scope typically represents a window in the application. For example, the *schematic* scope represents the Schematic Editor window, the *symbol* scope represents the Symbol Editor window and the *da_session* scope represents the DA Session window. Sometimes in-between scopes are defined to hide some functions from a tool. For example, a function like **$add_pin()** may be defined in the *da_window* scope rather than the *da_session* scope, because the VHDL Text Editor (scope *hdtxt_area*) would not understand the meaning of the function. Some functions like **$set_working_director**y are loaded into a lower scope like *session_area* so that all applications can see them.

If you viewed the structure from above, it would look similar to viewing the window structure of an application with the outside windows (like *da_session*) being broader in scope and the inner windows (like *schematic*) being narrower in scope.

When an application like Design Architect is invoked, AMPLE functions get loaded into the different scopes from the master tree. The system then searches the **$HOME/mgc/userware** tree for your custom userware. In this case, when DA is invoked, the custom functions in **des_arch/da_session.ample** get loaded into the *da_session* scope. New function definitions are added and functions by the same name as default functions are “overloaded” (replaced). When the Schematic Editor is invoked within DA, the functions in **des_arch/schematic.ample** get loaded into the schematic scope.

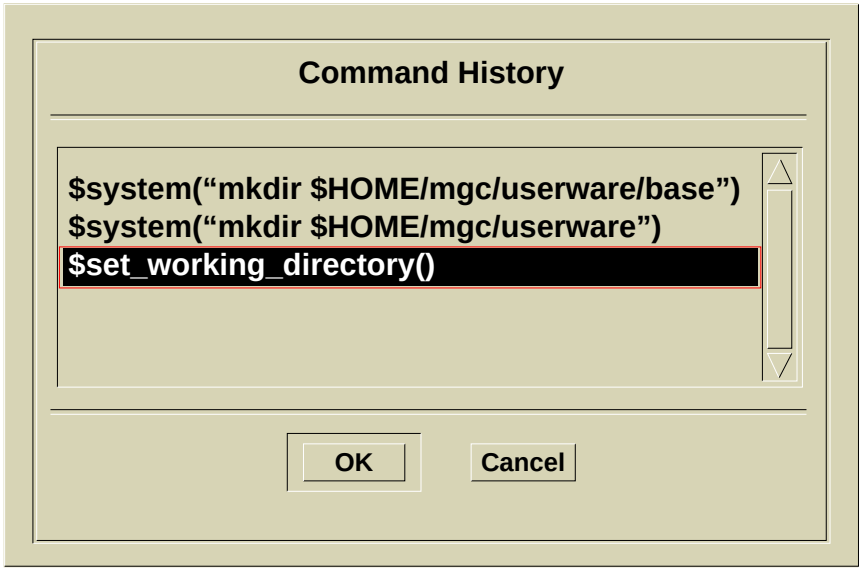
AMPLE functions in the **userware** directory are loaded into the scopes, but they are not executed. If you want to execute AMPLE functions upon invocation, the functions must be placed in a startup file under the **startup** directory as shown in the illustration.

Command Window

CTRL P ← Returns the previous entry to the window.

CTRL N ← Moves forward in the History List and returns that entry.

CRTL H ← Displays a complete History List. Select the entry you want.



ALT **Back Space** ← Returns the previous entry to the window.

Pre-V8.4 Behavior

Command Window

When you start typing in a window, the command window automatically pops up with your entry. You may enter commands or functions in this fashion. The name of the active window is shown on the left side of the COmmand window and the command or function you type must be defined within a scope that is visible to this window.

A history list is keep for this window. With the Command window displayed, type **Ctrl P** (for previous) to bring the last entry back into the window, type **Ctrl N** to move forward in the history list, and type **Ctrl H** to bring up a form with all the entries listed. Select one and click OK.

For software versions prior to V8.4, type **Alt BackSpace** to bring back the previous entry.

Lab Exercises

The following exercises are designed to show you how to customize the User Interface to increase your productivity. Each exercise corresponds to a previous Module by the same number and should be considered an “extra credit” exercise.

Exercise 1 - You will create a startup file for the bold_browser. In the file you will place a **$setup_page()** function that will bring up two pages side-by-side upon invocation and allow you to turn two pages at-a-time when you click on the Page icons.

Exercise 2 - Shows you how to create a startup file for the Design Architect Session Window. In the file you will place a **$set_working_directory()** function that will execute upon DA invocation and remind you to verify the setting of the working directory.

Exercise 3 - You will “overload” the **$set_working_directory()** function with pre-defined userware from an ASCII file. The new userware will add a Navigator button to the form and make the entry box longer to accommodate longer pathnames. After you compile the new function, you will save the code in your personal userware directory.

Exercise 4 - You will change the Modify Property stroke from  to  , which is much easier to draw, especially with an optical mouse. You will then save this customization in you personal Design Architect userware file, so it will always be there when you invoke either the Schematic or Symbol Editor.

Exercise 5 - You will create a new function key definition called “Zoom-to-Previous”. After you zoom into an area on a large schematic with a  stroke, then zoom in again, you will be able to return to the previous zoom by pressing this key.

Exercise 6 - This exercise is a departure from customizing. In this exercise, you will be given a “broken” hierarchical design and be challenged to fix it. Before

you start the exercise, you are encouraged to examine the broken data with your instructor and discuss several strategies on how to fix it.

Exercise 1: Creating a .startup file for BOLD Browser

Introduction

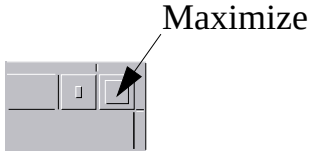
When you invoke BOLD Browser and bring up a manual, only one page comes up. In addition, clicking the Page icons turn the pages one at a time. Many people prefer to see the manual opened like a book - two pages up. And many people want to turn the pages two at a time - like a book. In this exercise, you will create a startup file that will setup BOLD Browser to display and turn the pages two at a time.

Invoke Design Manager from a Shell

1. If you haven't already done so, enter the following command in a shell:

   ```
   $ $MGC_HOME/bin/dmgr
   ```

2. Click on the Design Manager Maximize button.



   (Note: some window environments may have a menu choice that performs this function.)

Make a New $HOME/mgc/startup Directory

1. Click on the Navigator window and execute the pulldown menu **Add > Directory:**

2. Fill in the entry box with the pathname **$HOME/mgc** and press Return.

3. Execute the pulldown menu **Add > Directory:** again.

4. Fill in the entry box with the pathname **$HOME/mgc/startup** and press Return.

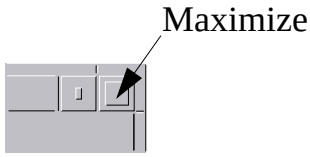
Invoke BOLD Browser and Open an Online Document

1. Invoke BOLD Browser from the Design Manager by double clicking the **bold_browser** icon.

bold_browser

2. Type the manual title **Customizing the Common User Interface** in the entry box and execute the form with a → stroke (press middle mouse button and draw a horizontal line).

3. Click on the BOLD Browser Maximize button.



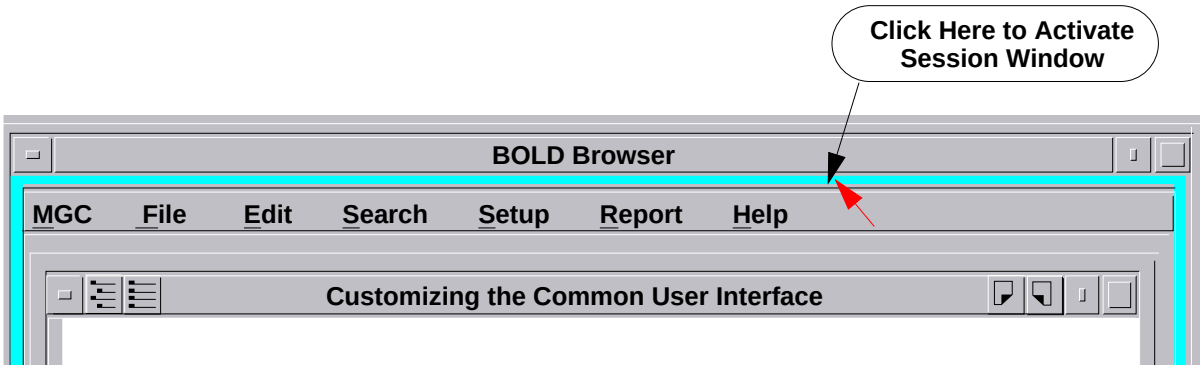
(Note: some window environments may have a menu choice that performs this function.)

Open a Transcript Window

1. Execute the pulldown menu **MGC > Transcript > Show Transcript**. The function **$show_transcript();** should appear as the last entry in the window.

Setup the Session Window for Up Down Tiling

1. Click on the session window border, as shown in the following illustratioin, to activate the session window:



2. Execute the pulldown menu **MGC > Setup > Session...**

3. Click the ◈ **Up Down Tiling** radio button, then execute the form with a → stroke.

Execute the $setup_page Function in BOLD

1. Choose the pulldown menu **Setup > Page Layout...**

2. Click the following radio buttons:
   Number of pages to view ◈ **2 page**
   Rate to turn pages ◈ **2**

3. Execute the form with a → stroke.

4. Observe the **$setup_page** function now appears at the bottom of the transcript.

Copy the Transcript to the System Clipboard

1. Activate the Transcript Window and highlight the last three lines as follows:

   a. Click on the Transcript Window.

b. Place the mouse cursor at the beginning of the **$set_active_window** line, press the left mouse button and drag the cursor down and across the **$set_active_window** line, the **$form_setup_session()** line and the entire **$setup_page** line, then release the button.

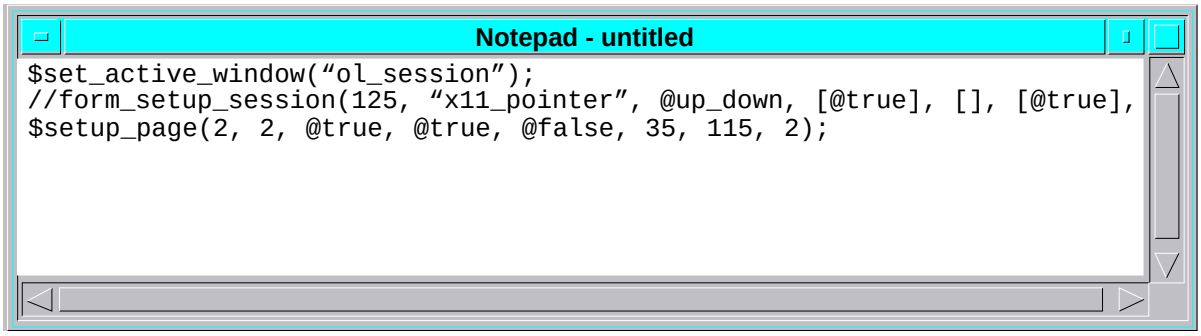
2. Press the right mouse button and execute **Copy to Clipboard> System**.

Open a New File and Paste the Transcript from the Clipboard

1. Execute the pulldown menu **MGC > Notepad > New.** A new (untitled) Notepad window appears.

2. Place the mouse cursor in the Notepad window, press the right mouse button and execute **paste**.

3. Click the mouse cursor at the beginning of the second line and type //. This turns this line into a comment line (non-executable). The Notepad window should now look like the following



Save the New File as bold_browser.startup

1. Close the Notepad window with a → stroke.

2. Answer **Yes** to the Query form.

3. Type the pathname **$HOME/mgc/startup/bold_browser.startup** in the entry box and press Return.

Test the New bold_browser.startup File

1. Close the BOLD Browser window.

2. Click the bold_browser icon again in the Design Manager Tools window.

3. Type the manual title **Customizing the Common User Interface** in the entry box and execute the form with a → stroke.

4. Click on the BOLD Browser Maximize button. Notice that the manual came up with two pages up.

5. Click the page icons and notice that the pages turn two at a time.

6. Close the BOLD Browser window when you are finished browsing the customizing manual.

Exercise 2: Creating a .startup file for da_session

Introduction

It is often hard to remember to set your working directory after an application comes up. In the following exercise, you will create a startup file that executes the **$set_working_directory** function immediately after the Design Architect application is invoked.

Open a New Notepad File and Enter the $set_working_directory() Function Name

1. From any application window such as Design Manager, Design Architect, or BOLD Browser, activate the session area and execute the pulldown menu **MGC > Notepad > New.** A new (untitled) Notepad window appears.

2. Type **$set_working_directory();** in the blank window.

Save the New File as da_session.startup

1. Close the Notepad window with a → stroke.

2. Answer **Yes** to the Query form.

3. Type the pathname **$HOME/mgc/startup/da_session.startup** in the entry box and press Return.

Test the New da_session.startup File

1. Click the **design_arch** icon in the Design Manager Tools window. Observe that the Set Working Directory Form appears after the window comes up.

2. Verify the working directory is set to **$HOME/training/da_n** and press Return.

3. Close the Design Architect window when you are finished.

Exercise 3: Add a Navigator Button to the Set Working Directory Form

Introduction

You have been using the **MGC > Location Map > Set Working Directory** prompt bar to set your working directory. In the following exercise, you will "overload" the default **$set_working_directory()** function with new code that will add a Navigator button and make the entry box longer to accommodate longer pathnames.

Open a Define Userware Window

1. From any application window such as Design Manager, Design Architect, or BOLD Browser, activate the session area and execute the pulldown menu **MGC > Userware > Define.** A new (untitled) AMPLE Userware window appears.

2. From the pulldown menu bar execute **File > Import**.

3. Navigate to the **$HOME/training/da_n/ample_source** directory and click on **set_working_directory.ample**.

4. Execute the Navigator form with a → stroke. The AMPLE code from the file is imported to the Define Userware window.

5. Place the mouse cursor in the AMPLE Userware window, press the right mouse button and execute **Compile**. A message stating that "**All text compiled successfully**" appears in the message window.

6. Test the new form by activating the session area and executing the pulldown menu **MGC > Location Map > Set Working Directory:**

7. **OK** the form.

Save the New File as session_area.ample

You are going to save the new $set_working_directory() function in a scope common to all applications. Do the following:

1. Close the Define Userware window with a → stroke.

2. Answer **Yes** to the Query form.

3. Type the pathname **$HOME/mgc/userware/base/session_area.ample** in the entry box and press Return.

   If a message appears stating that the pathname doesn't exist, you probably haven't yet created a **base** directory under **userware**. Do the following.

4. In any window type **$system("mkdir $HOME/mgc/userware/base")** and press Return. This **$system()** function issues the make directory command to the shell from which the application was invoked. The shell executes the command and creates the **base** directory.

5. Repeat steps 1 through 3 to save the file.

This new Set Working Directory form will now appear in every application from which you call it.

Exercise 4: Customizing the “Modify Property” Stroke

Introduction

Using strokes is an effective method to speed the task of creating and modifying a schematic. A stroke that you will want to use often is the “Modify Property” stroke  . With this stroke, you can click on a property value, execute the stroke to bring up the Modify Property form, fill in the new property value, then execute the form with a stroke. This method is quick and easy, but some people find this stroke difficult to draw, especially with an optical mouse.

In this exercise, your will change the Modify Property stroke from  to  , which is much easier to draw. You will then save this customization in you personal Design Architect userware file, so it will always be there whenever you invoke the Schematic or Symbol Editor.

Invoke Design Architect and Open the my_dff Schematic

1. Invoke Design Architect from the Design Manager and set the working directory to **$HOME/training/da_n**, if you haven't already done so.

2. Open the schematic for the **my_dff** component.

   a. Click on the **FIND COMP** icon.

   The Navigator comes up.

   b. Select the **my_dff** component and execute the form. The Schematic Editor is invoked on the **my_dff** component.

   c. Click the Maximize button to fill the session area with the schematic.

   d. Execute the  stroke to position all the elements in the view area.

Look on the Stroke Chart to find “Modify Property”

1. Draw a ? stroke to bring up the Stroke Help Chart.
2. Look for the Modify Property stroke.

   The stroke shape is _____.

   The stroke number sequence is _ _ _ _ _.
3. Draw the → stroke to close the form.

Try Using the Default “Modify Property” Stroke

1. Select a piece of property text.
2. Draw the Modify Property stroke to bring up the Modify Property form.

   Was the stroke easy to draw? _____

   Did you get the right result? _____
3. Enter a new property value and execute the form with the → stroke.

Redefine the Shape of the “Modify Property” Stroke

1. Again, draw a ? stroke to bring up the Quick Help on Strokes form.

   Look for a stroke definition that you might not want to use.

   The “**Select Area**” stroke is good choice because this can be accomplished by simply drawing a bounding box with the Select mouse key.

   The stroke number sequence for Select Area is _ _ _ _ _.
2. Close the Quick Help on Strokes form with a → stroke.
3. Execute the pulldown menu **MGC > Userware > Edit Source:**
4. Enter **$stroke_95123** in the entry box and press Return.

The source text for the Modify Property stroke function comes up in an AMPLE Userware window.

5. Change the number in the first line from 95123 to 74123.

6. Press the Right Mouse button and choose **Compile.** The message "**All text compiled successfully**" should appear in the message window.

7. Activate the Schematic Window and select a piece of property text.

8. Draw a  stroke and observe the Modify Property form come up.

9. Fill in a new value and execute the form (or click Cancel).

10. Reactivate the AMPLE Userware window and double click the Close button.

11. Answer **Yes** to the Query form.

12. Save the modified code to a file named as follows:

    $HOME/mgc/userware/des_arch/da_window.ample

    NOTE: If you haven't yet created the directory **$HOME/mgc/userware/des_arch**, create it using the **$system()** function. Otherwise use the Design Manager "**Add > Directory**" pulldown menu item to make the directory before you save the file.

Exercise 5: Add a “Zoom-to-Previous” Function Key

Introduction

Many times when you are working with a large dense schematic, you want to zoom into an area of the schematic, zoom in again, then zoom back to the previous zoom. In this exercise you will create a new function key definition called “Zoom-to-Previous”. After you zoom into an area on a schematic with a ↘ stroke, then zoom in again, you will be able to return to the previous zoom by pressing this key.

Open a Define Userware Window in DA

1. From Design Architect, invoke the Schematic Editor on the **add_convert** schematic you just created. Make sure the Schematic Window is active(highlighted in blue).

2. Execute the pulldown menu **MGC > Userware > Load...**

3. Navigate to the **$HOME/training/da_n/ample_source** directory and click on **zoom_to_previous.ample**.

4. Execute the Navigator form with a → stroke. The AMPLE code from the file is loaded into the schematic scope.

5. While observing the **F4s** label area in the softkey area, click on the DA Session window, then on the Schematic window. Notice the label “Zoom-to-Previous” is added to the SHIFT-F4 position.

6. Execute a ↘ stroke in the Schematic Window to include all elements of the schematic.

7. Zoom into the **add_convert** circuit by executing a ↘ stroke, across the circuit portion (leaving out the border).

8. Zoom in again on the 74161A instance with a ↘ stroke.

9. Press the **SHIFT-F4** function key and notice that the zoom changes back to the previous zoom.

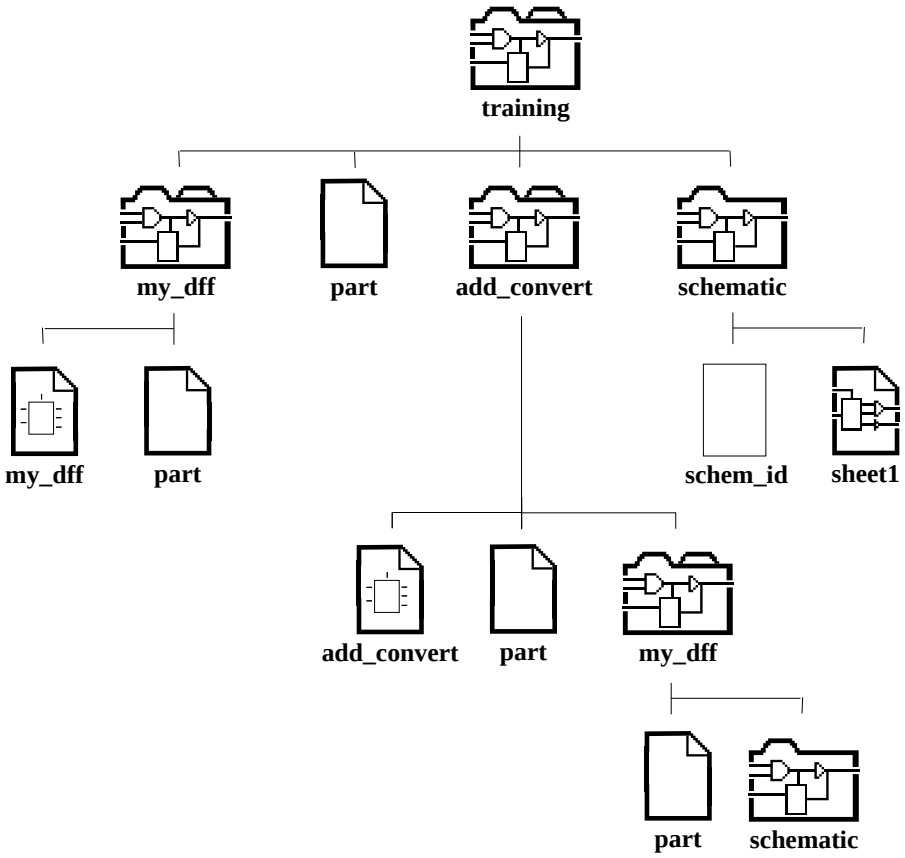
Browsing the “Zoom to Previous” Code

Zoom-to-Previous Function

```
// Declare two variables to allow you to save view area coordinates
 extern last_upper = VOID;extern last_lower = VOID;

// function to save current view coordinates's before viewing a new area
// this is original source with new code added to capture the window extents

function $stroke_159(),INDIRECT
{
   if (end_loc != undefined)
     if (end_loc != void)
        if (end_loc[2] == start_loc[2]) {
          // modification to save current view area
             local extents = $get_view_area();  // get the two coordinates
             last_upper = extents[0];    // save each coordinate separately
                                         // in extern var
             last_lower = extents[1];    // to allow other functions to see values
           // end of modification
          $view_area([start_loc, end_loc]);
          }
           else {
 $message("Stroke started and ended in different windows.  Could not view
area.");
         }
 }

//  "Zoom to Previous" - add new key definition to restore previous view
 extern $key_label_f4s = "Zoom to Previous";
//$update_softkey_labels();
 function $key_f4s(), INDIRECT
 {   if ((last_upper != VOID) && (last_lower != VOID) )  // make sure initial
            //view area stroke is done
    $view_area([last_upper, last_lower]);
  else
   $message("You must first view an area using the 159 stroke");
 }
```

Exercise 6: Fix this Broken Design Database

Situation: After you complete this training course, you go back to your desk and a co-worker tells you that he did the training exercises on his own. This person shows you the following design data and asks you to fix it. What is wrong with this picture? You will find a copy of this design in your **$HOME/training/da_n/com** directory.



Objective: Repair the design data above. Make it look like the design data you just created in this course. Before you start, examine the broken data with your instructor and discuss several strategies on how to fix it.