Design Architect User's Manual

Software Version 8.5_1

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About This Manual

Design Architect manuals provide information about the Schematic Editor, the Symbol Editor, and the VHDL Editor.

The *Design Architect User's Manual* consists of the following:

- "Overview" - Provides an overview of the editing environment and functionality.
- "Design Capture Concepts" - Describes concepts necessary for creating and editing a design.
- "Property Concepts" - Describes concepts related to properties associated with design capture.
- "Editing in the Context of a Design" - Describes the concepts for editing a schematic in the context of a design viewpoint.
- "Design Error Checking" - Discusses design checking.
- "Operating Procedures" - Provides operating procedures for various editing tasks.
- "DA Design Checks" - Lists required and optional checks performed in Design Architect.

For information about the documentation conventions used in this manual, refer to the manual titled *Mentor Graphics Documentation Conventions*.

Related Publications

The following list provides a brief overview of each of the Mentor Graphics manuals that contain information on related topics.

Getting Started with Design Architect is for new users of Design Architect who have some knowledge about schematic drawing and electronic design and are familiar with the UNIX environment. This training workbook provides basic instructions for using Design Architect to create schematics and symbols. This document provides about 4 hours of instructions including hands-on lab exercises.

Design Architect Training Workbook provides you with a more complete coverage of 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. This workbook features in-depth lab exercises that will give you confidence in working with Design Architect. Some instruction on customizing the Design Architect user interface is also include.

Design Viewpoint Editor User's and Reference Manual (DVE) contains information about defining and modifying design configuration rules for design viewpoints, along with latching the design. You can also add, modify and manage back annotation data for the design from within DVE.

Design Architect Reference Manual contains information about the functions used to create and modify schematic designs, logic symbols, and VHDL source files.

Design Viewing and Analysis Support Manual (DVAS) contains information about functions and commands for selecting viewing, highlighting, analyzing, reporting, protecting, grouping, syntax checking, naming, and window manipulating capabilities. DVAS functions and commands operate within applications such as QuickSim, QuickPath, AccuSim, QuickGrade and DVE.

Design Architect Reference Manual contains information about the functions used to create and modify schematic designs, logic symbols, and VHDL source files.

Component Interface Browser User's and Reference Manual describes the shell-level utility that allows you to view and edit component interfaces.

AMPLE User's Manual provides overview information, flow-diagram descriptions, explanations of important concepts, and task-oriented procedures for customizing the common user interface and writing AMPLE functions.

AMPLE Reference Manual contains information about AMPLE statements and functions that are common to all applications.

Common User Interface Manual describes the user interface features that are common to all Mentor Graphics products. This manual tells how to manage and use windows, popup command line, function keys, strokes, menus, prompt bars, and dialog boxes.

Common User Interface Reference Manual contains information about all of the Common User Interface functions.

DFI User's and Reference Manual contains information about the Design File Interface, a procedural interface that allows netlist read, back annotation, and write access to a Mentor Graphics design database.

Getting Started with QuickVHDL and VHDLwrite contains tutorials for creating, modeling, and debugging hardware designs with Mentor Graphics QuickVHDL and creating VHDL code from schematics using VHDLwrite. QuickVHDL is based on IEEE Std 1076-1992, *IEEE Standard VHDL Language Reference Manual*.

Design Dataport User's and Reference Manual contains information about Design Dataport (DDP), a procedural interface that can read, write, and modify schematic sheets and symbols.

Design Manager User's Manual provides information about the concepts and use of the Design Manager. This manual contains a basic overview of design management and of the Design Manager, key concepts to help you use the Design Manager, and many design management procedures.

Design Manager Reference Manual describes the AMPLE functions that are available in the Design Manager. This manual also describes Design Manager shell commands.

Digital Modeling Guide contains basic information for designers and modelers using the Mentor Graphics digital analysis environment. This manual can help you make some rudimentary decisions in model or design development.

Logical Cable User's Manual provides an overview of the Logical Cable application, introduces key concepts, and describes procedures for performing specific tasks. This manual also describes the relationship between Logical Cable and Physical Cable.

Logical Cable Reference Manual contains information about the functions used to create and modify logical cabling designs.

Properties Reference Manual contains information describing all properties created and/or used by Mentor Graphics applications for associating textual design data with circuit elements.

Chapter 1 Overview

Design Architect is more than a computer-aided schematic capture application. It is a multi-level design environment that includes: a Schematic Editor, a Symbol Editor, and the VHDL Editor. In a multi-level design environment you can:

- Implement top-down and bottom-up design methodology
- Specify a design at different levels of abstraction, from high-level specifications to gate-level implementation
- Specify a design with different modeling techniques
- Configure and manage different design descriptions to explore alternate design implementations

As Figure 1-1 indicates, Design Architect is the center of activity for most Mentor Graphics design processes. Design Architect lets you create and edit logical designs that are used by downstream processes such as: board design, IC and PCB layout, and analog and digital simulation. Many applications return design information to Design Architect in the form of back annotation values. These values can then be edited in the context of the design viewpoint (a description of design viewpoints begins on page 4-1) by Design Architect and, optionally, merged into the original source design. This cycle of creating a logical design, passing it to a downstream application for processing, and then passing new updated property values back to Design Architect for editing is a common design process.

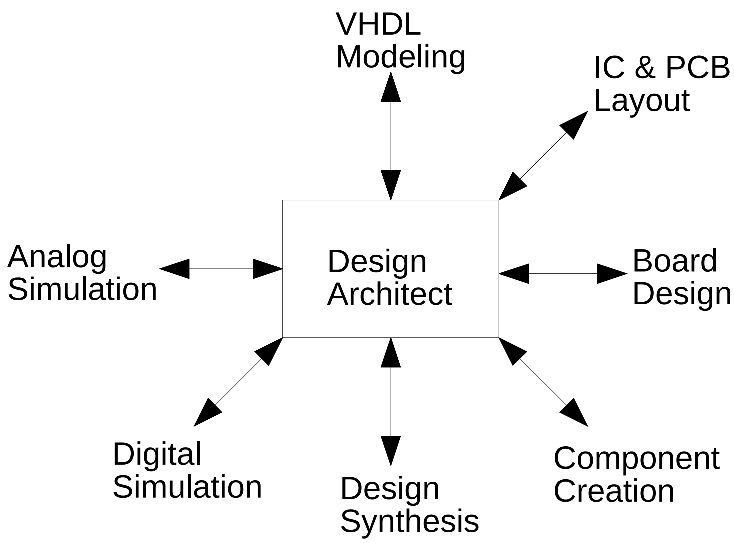


Figure 1-1. Design Architect Environment

To support not only the creation of logical designs, but the editing of a design with respect to a design viewpoint, Design Architect offers a collection of functionality which is summarized in the following list:

- Schematic capture
- Symbol creation
- Digital and analog component library access
- Property annotation
- Back annotation
- VHDL creation

Schematic Capture

Schematic capture is the process of drawing a schematic with a computer and storing it so that it can be used in other processes. In its simplest form, you can think of your workstation, shown in Figure 1-2, as a computerized drafting table.

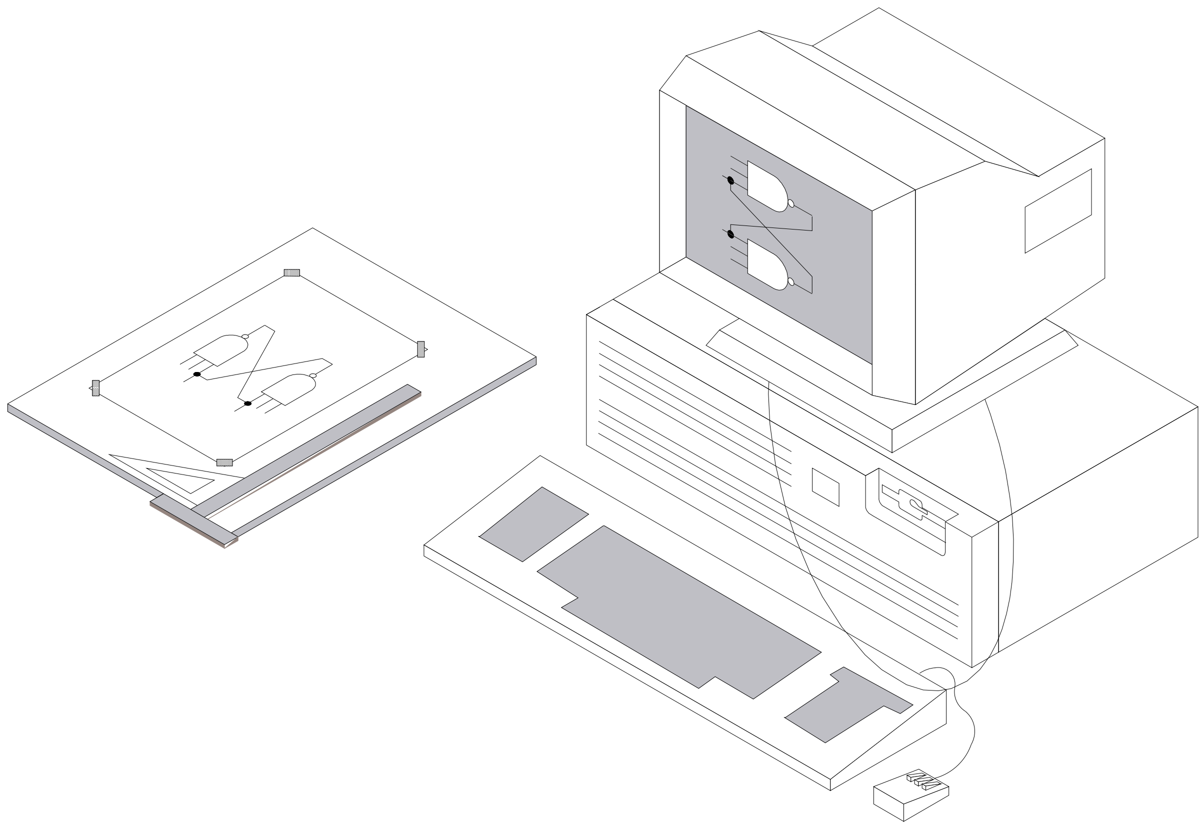


Figure 1-2. Workstation Acts as a Computerized Drafting Table

Schematics drawn by Design Architect can include more than simple wiring diagrams. They can contain detailed schematic information about instances, wires, connectors, test points, timing, engineering notes, and many other important properties and values needed by downstream applications.

The Design Architect Schematic Editor is used to capture schematic information, and is shown in Figure 1-3. Refer to "Design Capture Concepts" starting on page 2-1 for a detailed discussion of the concepts related to capturing a schematic.

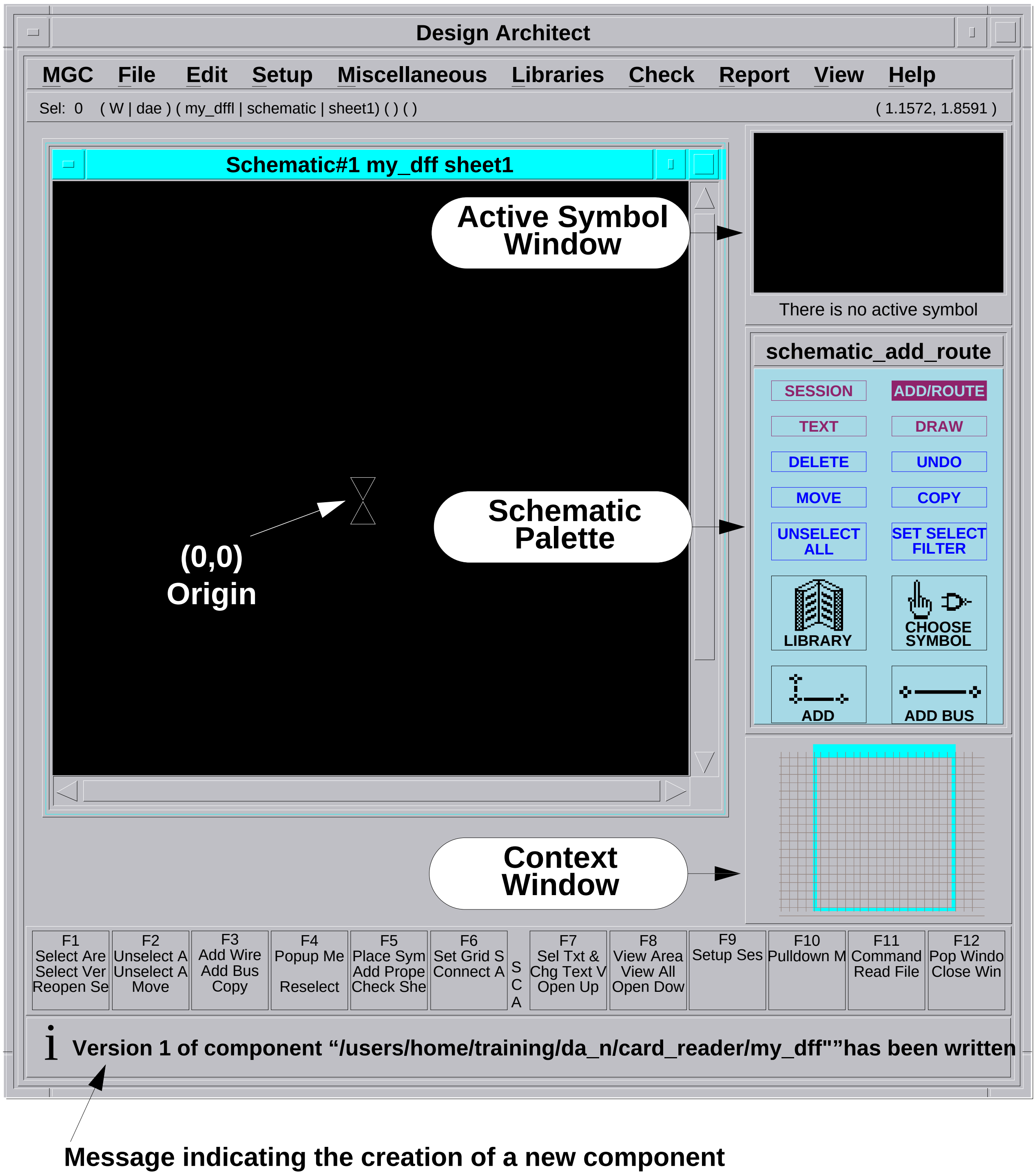


Figure 1-3. Schematic Editor

Symbol Creation

Design Architect allows you to create and modify analog and digital logic symbols that can be used in other Design Architect schematic designs. Symbols can represent basic design elements such as logic gates, transistors, off-the-shelf components, custom ICs, or a complete board design that represents a portion of the total design effort. The Design Architect Symbol Editor is used to create symbols, and is shown in Figure 1-4. For more information about symbol creation, refer to "Elements of a Symbol", starting on page 2-52 in this manual.

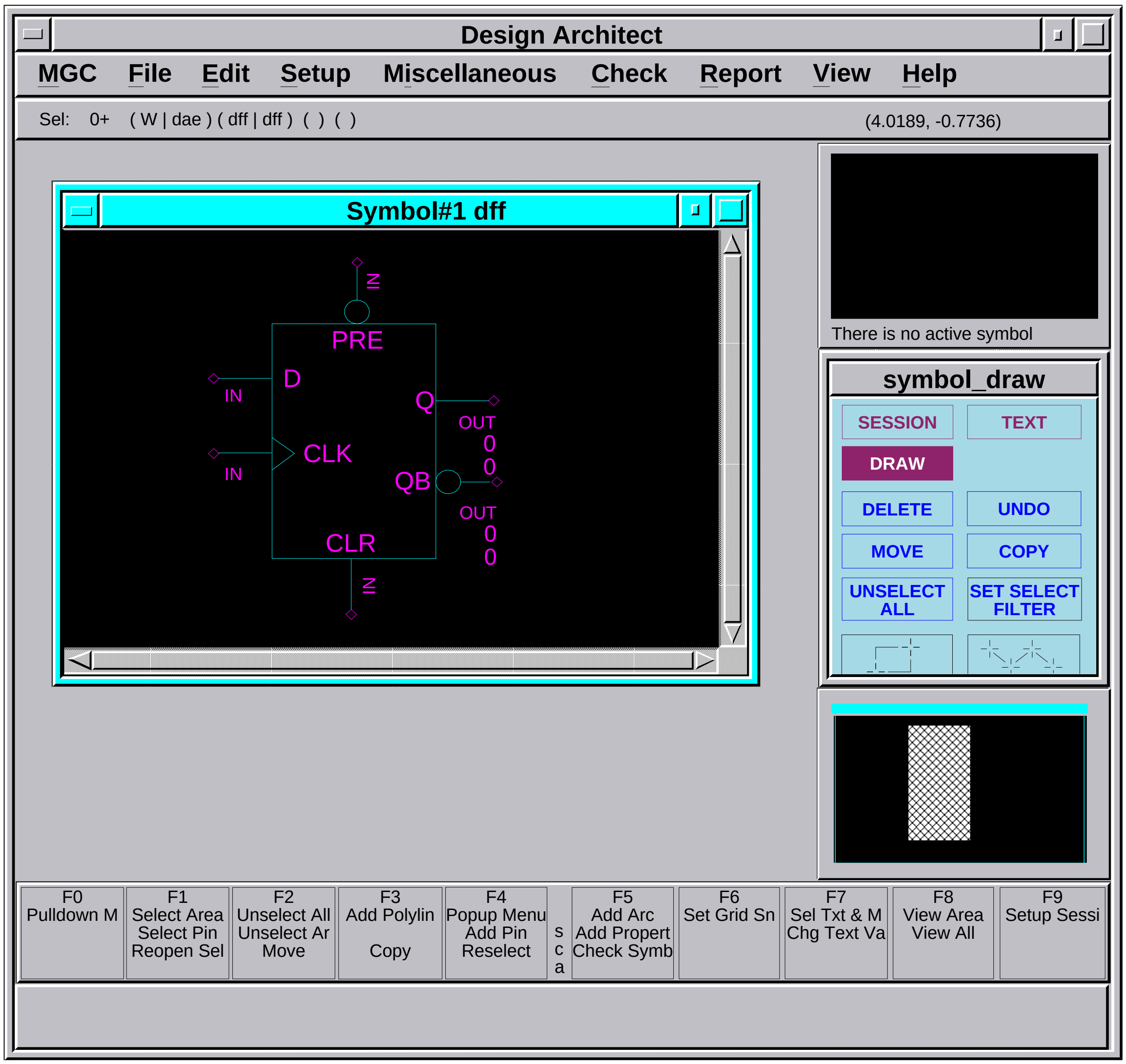


Figure 1-4. Symbol Editor

Digital and Analog Component Library Access

Mentor Graphics component libraries contain a variety of model types, used to describe the behavior of a circuit. The behavioral description of a circuit is necessary to simulate and analyze the circuit's functionality. The behavioral description of a circuit is defined with a functional model. Some examples of functional models are: schematic models, hardware models, Behavioral Language Models (BLMs), and VHDL models. The models are illustrated in Figure 1-5.

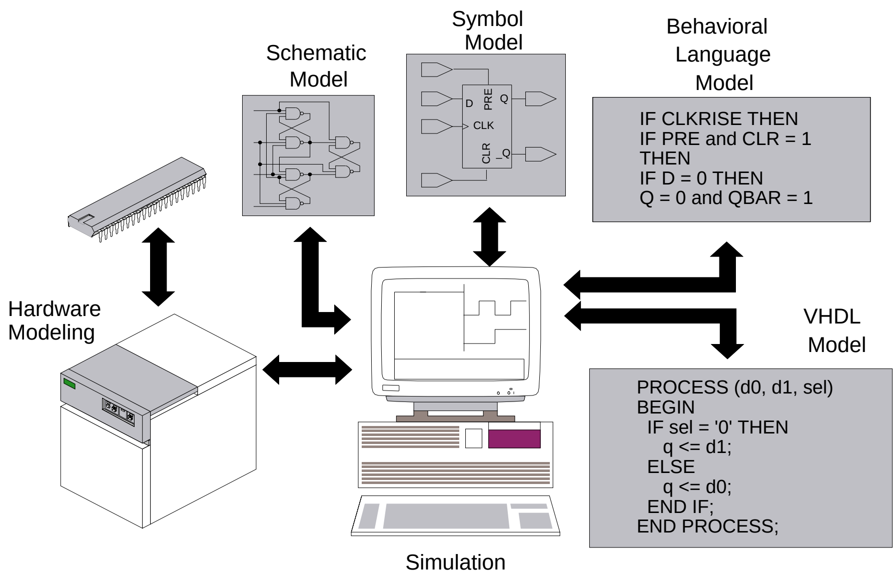


Figure 1-5. Example of Modeling Types

In Design Architect, you can select component models from a wide variety of component libraries, and then place and connect these components together to form schematics and simulation models. Mentor Graphics component libraries are named after the family of software models that they contain. For example, the library of 74-series low-power Schottky component models is named *ls_lib*. You use a location map or environment variables to access component libraries. The environment variable for *ls_lib* is MGC_LSLIB; the environment variables for other component libraries are named similarly. Your system administrator should tell you where to find a location map and how to set your environment variables.

Location maps are discussed in "Design Management with Location Maps" in the *Design Manager User's Manual*.

Component Models

The logical component libraries contain models which are created through various modeling techniques. The models describe the logical functionality of the circuit. The following list briefly describes the different types of models available.

- **gen_lib Primitives.** A set of primitive components, such as simple logic gates, is provided in the generic library *gen_lib*. Generic components are non-technology specific, and are used to create other library components. A generic component has delay and other property values preset to zero.

- **Sheet-Based Models.** Sheet-based models (schematics) are built with Design Architect and contain instances of primitive parts and other sheet-based models. Sheet-based models use timing information (properties) added directly to the schematic sheet, instead of technology files.

- **QuickPart Schematics.** QuickPart schematic models are compiled from a Design Architect schematic. A QuickPart contains the schematic, a description of the circuit's functionality, and a technology file that describes the timing information. QuickPart schematic models occupy less disk space and simulate faster than sheet-based models.

- **QuickPart Tables.** QuickPart tables are truth tables representing the functionality of a device. You can use Mentor Graphics applications to compile the table into a binary form usable by other downstream applications. A device modeled with a QuickPart table can be used as a primitive on a sheet-based model or on a QuickPart schematic model. See the *QuickPart Model Development Manual* for more information about QuickPart Tables.

- **Behavioral Language Models.** Behavioral Language Models (BLMs) are Pascal or C programs that simulate the function of complex devices. A BLM can be used as a primitive, and can also be used to model at a high level of abstraction. The program that describes the device can contain timing information for the device, as well as a functional description. If timing information for the device is not embedded within the BLM, a technology file must supply the timing information. Refer to the *Behavioral Language Model (BLM) Development Manual* for detailed information about BLMs.

- **VHDL Models.** VHDL models describe highly complex circuits or systems at high levels of abstraction. Typically, you would use a VHDL model to define an ASIC system, or board whose function is too complex to model using an alternative modeling technique. VHDL models are written using System-1076 or QuickVHDL. Refer to the *System-1076 Design and Model Development Manual* or the *QuickVHDL User's and Reference Manual* for detailed information about developing VHDL models.

- **Hardware Models.** Hardware models supply the functionality of a device by way of a Mentor Graphics Hardware Modeler, such as LM-family models. A hardware modeler is a network resource that applies stimulus to an actual IC to determine its behavior, and then feeds this information back to the digital simulation. Refer to the *LM-family User's Manual* for information about hardware models.

Property Annotation

Property annotation is the process of adding design information called "properties" to schematics and symbols. Most design applications, including analysis and layout, have certain design requirements that must be met before the design can be implemented. Downstream applications require that correct property values be added to the design for processing. These properties describe characteristics of the design which are not identifiable from the schematic alone. It is very important to know which properties must be assigned in Design Architect so that the proper information is transferred to a particular down-stream application. For more information about properties refer to "Property Concepts", starting on page 3-1, and to the *Properties Reference Manual*.

Back Annotation

Back annotation is the process of attaching new or changed property values, created in a downstream application, to the original schematic sheet. For example, after a circuit is physically placed on a PCB or IC, new time delay property information is made available. The new property values pertaining to this new time delay information are associated with the design viewpoint, and a more accurate simulation of the circuit can then be done using these updated values. More information about design viewpoints and the concepts related to editing back annotation data in the context of a design begins on page 4-1.

VHDL Creation

Design Architect creates VHDL models using the VHDL Editor and System-1076 or Quick VHDL compiler. The VHDL Editor lets you create and edit VHDL text files by inserting and expanding VHDL language constructs. The compiler built into the VHDL Editor allows instant compilation of models.

For further information about creating VHDL models, refer to the *System-1076 Design and Model Development Manual* or the *QuickVHDL User's and Reference Manual*.

Chapter 2
Design Capture Concepts

The following topics introduce you to the Design Architect environment and define important concepts necessary to create designs with Design Architect.

Design Architect Environment

You have access to three editors within the Design Architect environment: (1) the Schematic Editor to create schematics, (2) the Symbol Editor to create user-defined symbols, and (3) the VHDL Editor to create VHDL models. The three editors are accessible from a common Design Architect Session window. Each editor operates in its own window within the Session window. Multiple windows for each editor can be open at the same time.

Design Architect Session Window

The Design Architect Session window can be invoked from the Design Manager Tool window by double-clicking on the Design Architect icon. After the Design Architect Session window is activated, Design Architect editing windows can be opened using the Design Architect Session popup menu items, function keys, or palette icons. The softkey labels near the bottom of the window show the Session function key descriptions.

The Design Architect Session window menu bar is illustrated in Figure 2-1. The menu bar always contains the names of the pulldown menus for the current active window. You access pulldown menus by pressing and holding the Select (left) mouse button on the menu name.

Figure 2-1. Session Window Pulldown Menu Bar

The Session window pulldown menus include items that let you open and position windows, change window attributes, save and restore userware configurations, print text and graphics, find components, open a Notepad window, and access online help.

Items in the Session window popup menu let you open edit windows to view, create, and modify symbols, schematic sheets, schematic sheets in the context of a design viewpoint, and VHDL text files. You display this popup menu by moving the location cursor inside the desired window and pressing and holding the Menu (right) mouse button. To choose an item from the menu, move the mouse (with the Menu button still depressed) to slide the cursor down the menu; when the desired item is highlighted, release the mouse button. These items, except for **MGC**, are also available in the Session **File** pulldown menu, and in the Session palette.

The Session popup menu and palette are shown in Figure 2-2.

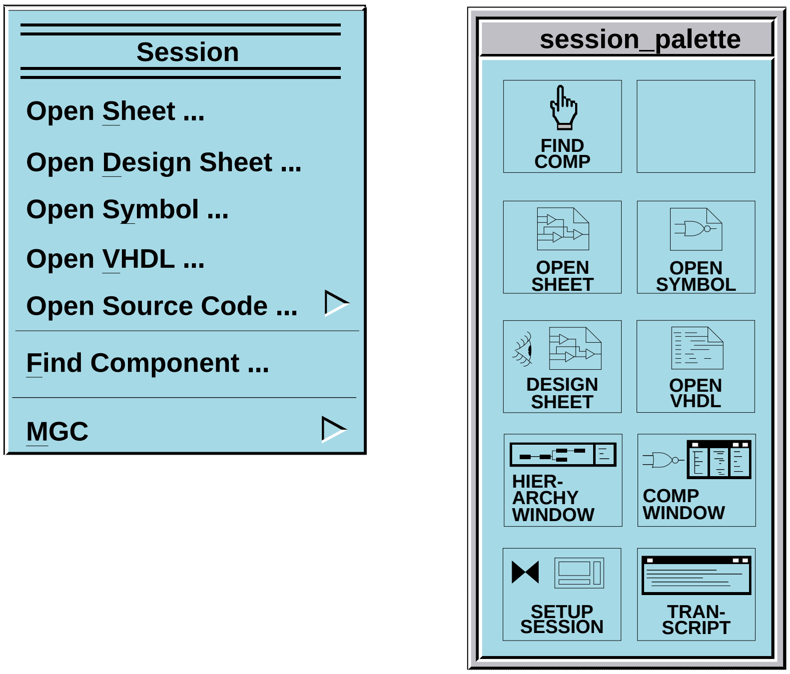


Figure 2-2. Session Popup Menu and Palette

Schematic Editor Window

A Schematic Editor window can be opened from the Design Architect Session window by executing the **Session > Open Sheet** popup menu item, the **File > Open > Sheet** pulldown menu item, or clicking on the Open Sheet icon in the Session palette menu, or pressing the F1 (Open Sheet) function key, or typing the command or function in the popup command line. All of these methods display the Open Sheet dialog box, prompting you for a component name. If the component does not exist, a new component is created with the name you supply. You can also invoke the Schematic Editor on an existing schematic sheet by double-clicking the Select (left) mouse button on a schematic or sheet icon in the Design Manager window. See the *Design Manager User's Manual* for more information about invoking a Mentor Graphics application from within the Design Manager.

When you open a schematic window, the softkeys show the Schematic Editor function key definitions, the Session palette and popup menu are replaced by the schematic palettes and popup menus, the menu bar displays the names of the schematic pulldown menus, and a status line is displayed beneath the menu bar. The Schematic Editor menu bar and status line are shown in Figure 2-3. The status line provides information about the design object in the window and current editing status.

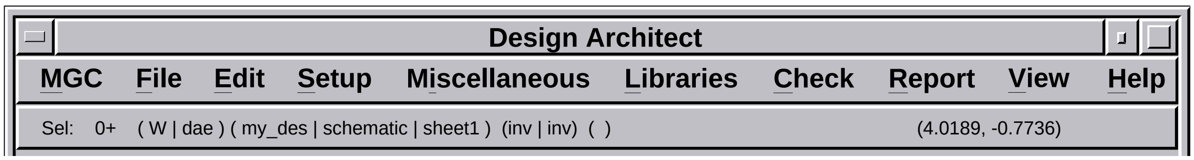


Figure 2-3. Schematic Window Pulldown Menu Bar

The palettes, popup, and pulldown menus supply you with the commands necessary to create a schematic. The more commonly used Schematic Editor window palettes and menus include commands to:

- Instantiate components
- Create and modify properties
- Create and modify nets
- Create and edit comment graphics and text
- Set up templates for creating nets, comments, property text, grids, pages
- Edit objects (moving, copying, deleting, connecting)
- Report on sheet objects' status
- View a sheet
- Check schematic sheets for errors
- Save and register schematics
- Access online help

The Schematic Editor has added functional capabilities when editing a schematic sheet in the context of a design viewpoint. This mode of editing is described starting on page 4-1.

Symbol Editor Window

The Symbol Editor window can be opened from the Design Architect Session window by executing the **Session > Open Symbol** popup menu item or the **File > Open > Symbol** pulldown menu item, or by clicking on the Open Symbol icon in the Session palette menu, or pressing the F5 (Open Symbol) function key, or typing the command or function in the popup command line. All of these methods display the Open Symbol dialog box which prompts you for a component name and a symbol name. If the component does not exist, a new component and symbol are created. If the symbol name is not specified, the symbol name defaults to the leaf name of the component. If the symbol does not exist within the component, a new symbol is created.

You can also open an existing symbol by double-clicking the Select mouse button on a symbol icon in the Design Manager window. See the *Design Manager User's Manual* for more information about how to invoke a Mentor Graphics application from within the Design Manager.

When you open a Symbol Editor window, a set of symbol palettes, popup and pulldown menus are available from the window, and the softkeys display the Symbol Editor function key definitions. The Symbol Editor menu bar and status line are shown in Figure 2-4. The palettes, popup and pulldown menus, and function keys supply you with the commands necessary to create and edit a symbol.

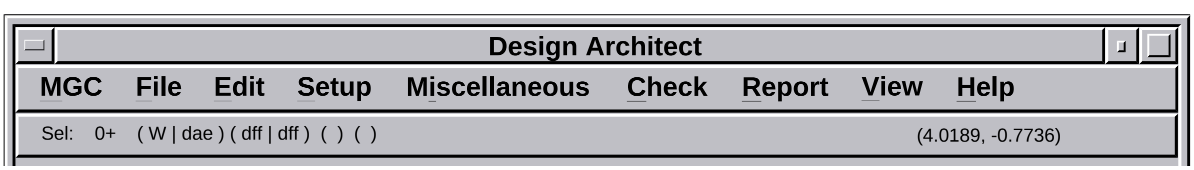


Figure 2-4. Symbol Window Pulldown Menu Bar

The Symbol Editor window palettes, menus and functions are similar to those in the Schematic Editor.

The more commonly used Symbol Editor commands let you:

- Create symbol body graphics
- Set up templates for creating comments, property text, grids, pages
- Edit objects (moving, copying, deleting)
- Report on symbol objects' status
- View a symbol
- Add pins and properties to the symbol
- Create and edit non-instantiable comments
- Check a symbol for errors
- Save and register a symbol
- Access online help

VHDL Editor Window

The VHDL Editor window can be opened from the Design Architect Session window by executing the **Session** > **Open VHDL** popup menu item, the **File** > **Open** > **Symbol** pulldown menu item, or by clicking on the Open VHDL icon in the Session palette menu, or pressing the F6 (Open VHDL) function key. All of these methods display the Open VHDL dialog box prompting you for a VHDL filename. If the VHDL filename does not exist, a new VHDL file is created with the filename you supply.

The VHDL Editor can also be invoked on an existing VHDL file by double-clicking the Select mouse button on a VHDL text icon in the Design Manager window. See the *Design Manager User's Manual* for more information about invoking a Mentor Graphics application from within the Design Manager.

When you open a VHDL window, a set of VHDL editing popup menus and pulldown menus are available from the VHDL editing window, and a new list of items is displayed in the menu bar. The VHDL menu bar is shown in Figure 2-5.

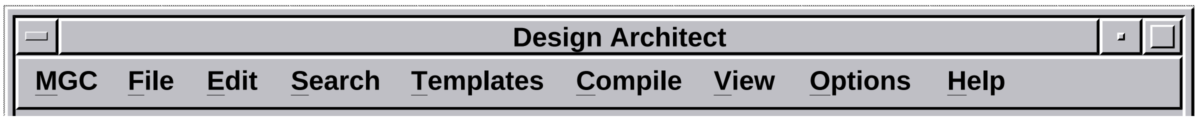


Figure 2-5. VHDL Window Pulldown Menu Bar

These popup and pulldown menus supply you with the commands necessary to create and compile VHDL models.

The VHDL editor window includes commands to:

- Create and modify VHDL text
- Expand and insert VHDL templates
- Compile VHDL text
- Access online help

The VHDL Editor palette and function keys also have some of the more common commands for editing VHDL models.

Design Sheet Window

A Design Sheet window can be opened from the Design Architect Session window by executing the **Session** > **Open Design Sheet** popup menu item, the **File** > **Open** > **Design Sheet** pulldown menu item, or by clicking on the Open Design Sheet icon in the Session palette menu, or by pressing the F3 (Open Design Sheet) function key, or by typing the command or function in the popup command line. All of these methods display the Open Design Sheet dialog box prompting you for a component name and a viewpoint name.

A component and a schematic sheet must exist to invoke on a design sheet. If you do not specify a viewpoint name, a new viewpoint is created with the name "pcb_design_vpt". The Design Sheet can also be invoked on an existing design by double-clicking with the Select mouse button on a design viewpoint icon in the Design Manager window.

When you open a design sheet window, you get the same set of popup and pulldown menus as in the Schematic Editor window; while editing in the context of a design viewpoint, an additional set of functions become accessible. The title area of the window shows the name of the schematic sheet, as in the Schematic Editor, with "(Design Context)" appended to the name. The Schematic Editor pulldown menus, the status line, and the title area of the edit window are shown in Figure 2-6. The status line includes the name of the viewpoint.

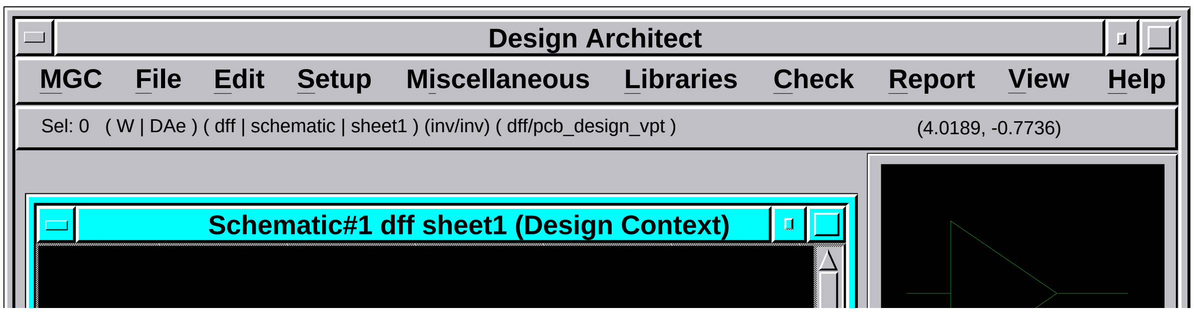


Figure 2-6. Design Sheet Window Pulldown Menu Bar

These palettes, function keys, popup, and pulldown menus supply you with the commands necessary to edit a schematic, plus commands to edit the schematic in the context of a design viewpoint.

The Design Sheet window includes all the schematic editing commands, plus commands to:

- View and edit back annotations
- Create back annotations
- View evaluated and unevaluated properties
- Merge back annotations to schematic sheet

Component Window

The Component Window allows you to view or edit detailed information about a component. Some of the things you can do in the Component Window are:

- List the Part Interfaces for Models, Labels, Pins, Pin Properties, and Body Properties for a given component
- Register and unregister component models
- Add/delete or edit labels for a component.
- Show all objects contained by the component, and optionally filter out objects depending on type.

You invoke the Component Window using the MGC pull down menu or from the session window palette. A window appears that is divided into four distinct information list areas. Each list area has a separate popup menu. The four list areas are:

- Component Information

  Displays an indented list of the component and its contents. Icons next to items indicate the object type. Multiple components can be shown at one time. Use the setup form to filter the types you wish to view.

- Models

  Displays all registered models for each part interface selected in the component list area. Labels are shown indented underneath the model name. Models are distinguished for a given component by the gray header bar.

- Pins

  Displays Pin names and properties for each selected part interface.

- Body Properties

  Displays the Body Property name and value for each selected part interface.

Figure illustrates the initial display of the Component window. For more information on the Component window, refer to the *Design Manager User's Manual*.

The following restrictions apply to the Component Window in Design Architect:

- If you are editing a symbol in a Symbol Editor window, you cannot make model registration or label changes to the component that contains the symbol in the Component Window.
- You cannot select a symbol or schematic model listed in the Component Window to open the symbol or sheet.
- You cannot change the component displayed in the Component Window from the Design Architect Active Symbol window.
- If you modify a component in the Component Window, sheets in the component are not automatically updated to display the change.

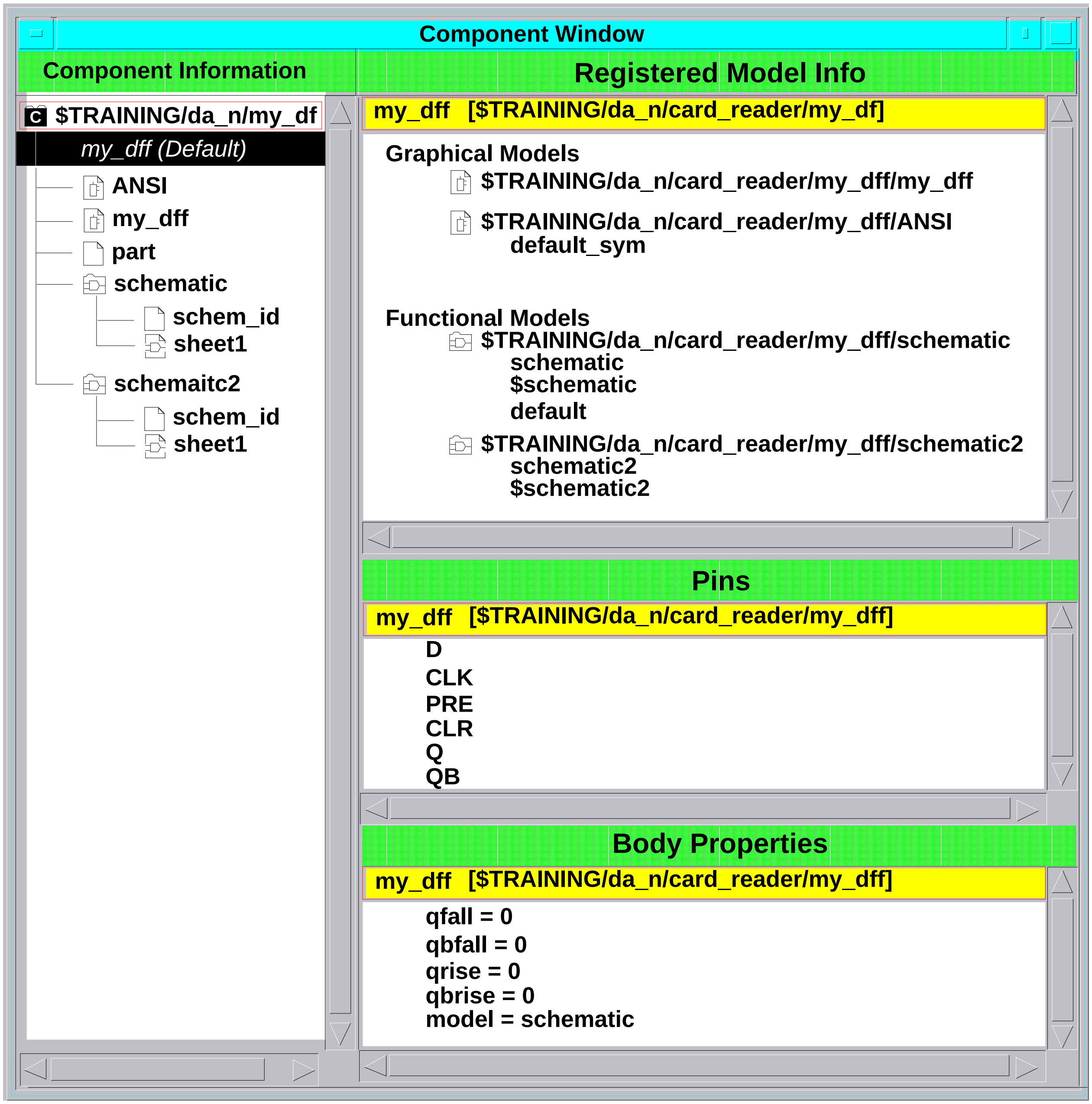


Figure 2-7. Component Window

Component Window

The Component Window allows you to view your design's configuration and component information without having to exit the application. It also allows you to:

- Display a component hierarchy in the context of a specific viewpoint
- Display design hierarchies that are not dependent on viewpoints
- Display instance information for a given component
- Display the path to a single instance
- Display the hierarchy as an indented list or a graphical tree
- Probe other applications.
- Display the value of a specified property rather than the instance name next to component in the hierarchy listing.

Because you look at a physical or logical hierarchy listing rather then looking at a file system, you get information concerning the instances names, property values, object designations and model information.

You access this Hierarchy Window using the MGC Pulldown menu or the session window palette.

The Hierarchy Window uses the mgc_component as the standard starting point for showing design hierarchy. Figure 2-8 shows the Hierarchy window. For more information on the Hierarchy window, refer to the *Design Manager User's Manual*.

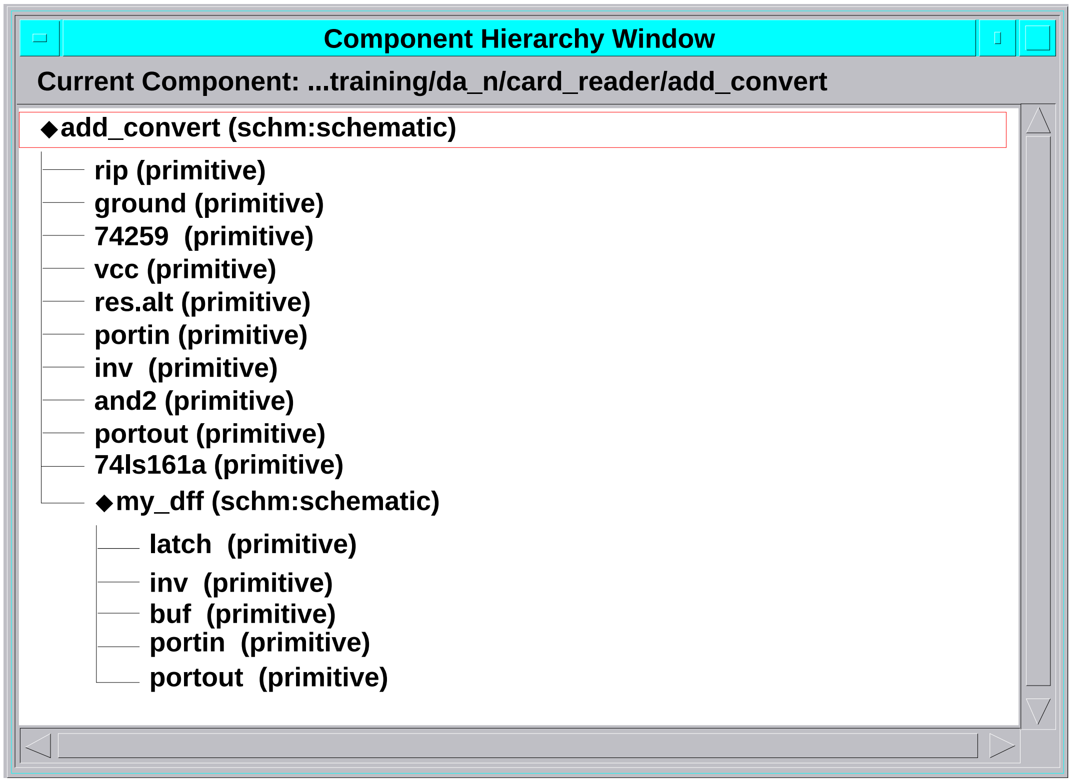


Figure 2-8. Hierarchy Window

The following restrictions apply to the Hierarchy Window in Design Architect:

- Cross-highlighting between open Schematic Editor Windows and the Hierarchy Window is not supported.
- When instances are added or deleted in a Schematic Editor Window, the changes are not reflected in an Hierarchy window until you reopen the design.

Integrated Editing Environment

Design Architect provides an integrated schematic and symbol editing environment, which includes an integrated command set, multiple window viewing and editing, and the capability of editing a symbol in-place on a schematic sheet.

Integrated Command Set

The Design Architect editors share a common, integrated command set. Within an integrated command set, commands performing the same function are used by all the editors. For example, the Add Circle command is used in both the Schematic and Symbol Editors, and calls the same function, $add_circle(). In either application, a graphic circle is drawn. Within the Symbol Editor, the circle is interpreted as symbol graphics, and within the Schematic Editor, it is interpreted as comment graphics. Refer to the *Design Architect Reference Manual* for descriptions of all commands and functions used within both Schematic and Symbol Editors.

Multiple Window Viewing and Editing

In Design Architect you can operate in a multi-window environment, giving you the capability of having multiple edit or view windows displayed on the same design. Each window must be opened in either edit or view mode. Having multiple views of the same sheet or symbol allows changes made in one window view to be displayed concurrently in the other window views.

Only one window may be open in edit mode for any one sheet or symbol. However, different sheets in a schematic can be open for concurrent editing.

Also, in a multi-window environment, graphics can be copied back and forth between windows. For example, graphics generated in a schematic or symbol window can be moved to other schematic or symbol windows. Refer to "Inter-Window Copy and Move" on page 2-72 for more information about inter-window copy and move.

Editing a Symbol In-Place on a Schematic

In addition to editing a symbol in a separate window environment, you can edit symbols directly on a schematic sheet. This is called *symbol edit in-place*. This methodology is useful for top-down design when creating and modifying functional blocks.

When you edit a symbol directly in the context of its instance on the schematic, the schematic sheet circuitry is still visible (grayed out) while you edit the symbol contents. Errors, such as mismatching the symbol pins with the connecting nets or using incorrect pin spacing, are avoided because the symbol can be modified in the position of its instance-to-be on the schematic. Refer to page 2-60 for more information about editing a symbol in place.

DA Startup Files

When you are familiar with your DA environment, you can use startup files to define your own menus, keys, strokes, or any functions used to initialize your working environment. Startup files are written in the AMPLE language, and have access to the full capability of DA functions within a specific window scope.

Before you begin writing DA startup files, refer to the *AMPLE User's Manual* for information about how to write AMPLE macros and additional startup file examples. Refer to the *Customizing the User's Interface Manual* for instructions for customizing your user interface.

For information about scopes and additional methods of introducing custom userware such as libraries to Design Architect, refer to Appendix A in the *Design Architect Reference Manual*.

In DA, a startup file can be specified for the initial opening of a DA Session window, Schematic Editor window, Symbol Editor window, and VHDL Editor window.

DA supports four levels of startup files:

- Site-specific: *$MGC_HOME/shared/etc/cust/startup/*name.*startup*
- Workstation-specific: *$MGC_HOME/etc/cust/startup/*name.*startup*
- User-specific: *$HOME/mgc/startup/*name.*startup*
- Component-specific: pathname to startup file specified in the Open Sheet, Open Symbol, and Open VHDL dialog boxes.

In DA, "name" can represent "da_session", "schematic", "symbol", and "vhdl" for each respective DA environment. $HOME is the value of the HOME environment variable for your shell, typically your login directory. $MGC_HOME is the value of the MGC_HOME environment variable that specifies the location of your Mentor Graphics software. $MGC_WD is the value of the MGC_WD environment variable that specifies the current working directory.

All applications search for startup files and execute them in the following order:

1. Site-specific startup files, if they exist.
2. Workstation-specific startup files, if they exist.
3. User-specific startup files, if they exist.

Component-specific startup files are executed when a pathname is specified in the Startup File Path text box for the dialog box that opens a symbol, sheet, or a VHDL document. A default value for this pathname can be specified with the $set_environment_dofile_pathname() function.

When debugging a startup file, be aware that function calls within the startup file are not, by default, transcribed when executed from a startup location. To transcribe the lower-level functions in the startup file, first set the transcript mode to "bottom". For example, to test a new startup file, type in the active session window:

$set_transcript_mode(@bottom)

Type in an active schematic window:

$dofile(your_home**/mgc/startup/schematic.startup)**

The previous commands set the transcript mode to "bottom" and execute the startup file "schematic.startup" in an active schematic window.

The sample startup files in following code blocks could be placed in any of the supported startup file locations. Refer to the *Design Architect Reference Manual* and the *AMPLE Reference Manual* for descriptions of the functions used in these files.

```
// This startup file sets up the DA Session environment
// and sets the selection model to individual selection
// rather than additive selection. The following Session
// setup options are specified:
//
// Mouse button click speed = average
// Input device = mouse
// Window layout = quadrant tiling
// Visible: menu bar, window title, message area, palette,
//          status line, softkey area, Active Symbol window.
// Not visible: Context window.
   $form_setup_session(125, "mouse", @quad, [@true], [@true],
           [@true], [@true], [@true], [@true], [@true], []);
   $set_selection_model(@individual);
```

The next example, sets up the editing environment in the Schematic Editor, then sets the default sheet checks.

```
//  This startup file sets net, property text, and comment
//  attributes, then sets default sheet checks.
//
//  Net attributes:
//   width = p1, dotted line, orthogonal mode = off,
//   snap angle = 44.9, snap = on, dotsize = 0.025,
//   dotstyle = square, junction dots at rippers,
//   closedots displayed, bus_width = p3, autoroute = on,
//   autoripper = on, ripper_symbol = "$MGC_GENLIB/rip", "1X1"
//
//  Property Text attributes:
//    font = "stroke",  ht=0.1875, left-bottom justification,
//    horizontal, transparent, visible
//
//  Comment attributes:
//    style = shortdash, width = p3, fill = clear,
//    font = "stroke", height = 0.1875,
//    left-bottom justification, horizontal, transparent
   $setup_net(@p1, @dot, @off, 44.9, @on, 0.025, @square, @on,
            @on, @p3, @on, @on, "$MGC_GENLIB/rip", "1X1");
   $setup_property_text("stroke", 0.1875, @left, @bottom, 0,
                     @on, @on);
   $setup_comment(@shortdash, @p3, @clear, "stroke", 0.1875,
               @left, @bottom, 0, @on);
//  The following list shows the default sheet checks set by
//  the next function:
//    checkfile not saved, report in window and transcript
//    no user-defined checks
//    errors and warnings reported for: instances,
//        special symbols, nets, frames, expressions, pins,
//        notdots, closedots, dangling nets and pins
//    errors only reported for: parameters, property owners,
//        overlapping instances,
   $setup_check_sheet("da_check_file", @nofile, @window,
        @transcript, "", void, @all, @all, @all, @all,
        @errorsonly, @all, @all, @errorsonly, @errorsonly,
        @all, @all, @all, @nocheck);
```

Elements of a Schematic

Schematics are created in the Design Architect Schematic Editor window. A schematic is more than a simple schematic drawing. It contains additional schematic capture information about components, wiring, connectors, test points, timing, and engineering notes, which can be used by downstream applications.

A schematic is a graphical and behavioral description of a circuit. Schematics are built by combining and connecting electrical objects together. Schematic sheets can also be annotated with comment graphics and text which have no electrical meaning.

A schematic can contain the following elements:

- **Instances of Logical Symbols.** Instances of logical symbols can represent anything from a simple logic function to a complete integrated circuit. Instances of logical symbols, as illustrated in Figure 2-9, are labeled as U11 and U30. Refer to page 2-52 for a more detailed discussion of how to create logical symbols.

- **Nets.** A graphical net is a pin-to-pin wiring connection between instances on a schematic sheet. In Figure 2-9, the instances of logical symbols U11 and U38 are connected to each other by a *net*. Refer to page 2-22 for more information about nets.

- **Property Name/Value.** A *property name* is the label for a property, much like a variable name is a label for a variable in a programming language. The *property value* is the value associated with the name. The combination property name/value is attached to different objects in a schematic to supply more information about the object. For example, the rise time for a pin is specified by a value (for example, "10, 20, 30") of a property name "Rise", attached to that pin.

  Some property values are displayed on the sheet. Net property values FINISH and COMPARE are displayed in Figure 2-9. Other properties attached to objects on a schematic sheet are not visible on the screen. You control the visibility of the property value. There are several important concepts to understand about properties; they are discussed in detail starting on page 3-1.

- **Comment Text and Graphics**. Comment text and graphics, also called *comments*, have no electrical meaning, but add other information to the schematic sheet.

  For example, in Figure 2-9, the border of the schematic sheet is created with comment text and graphics. Many other forms of comments can be added to the sheet. Refer to page 2-38 for a detailed discussion about comment text and graphics.

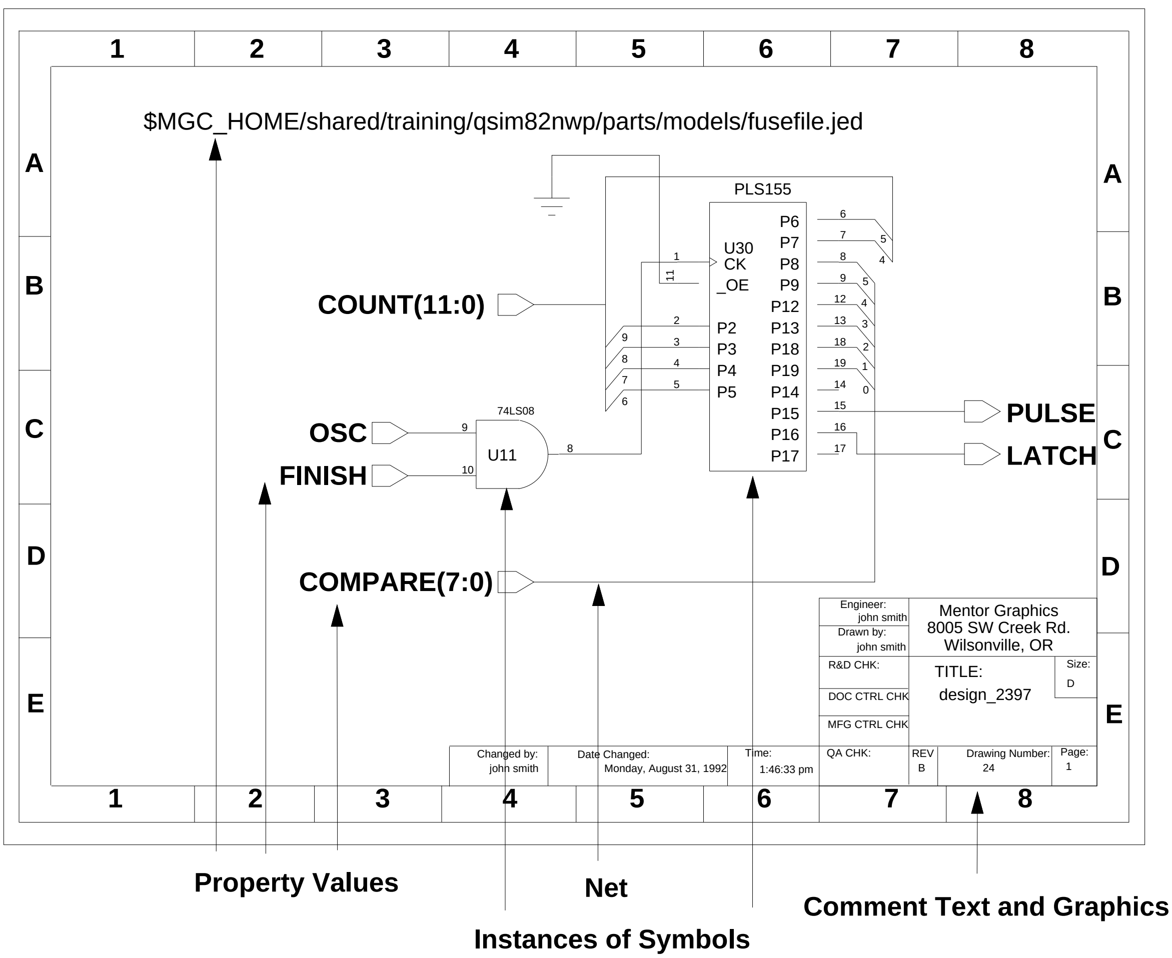


Figure 2-9. Example of a Schematic Sheet

Electrical Connectivity

Electrical objects are graphically placed and annotated on a schematic sheet to form an electrical connectivity model. The proper connection of nets, pins, instances, and special instance connectors creates the functional implementation of the circuit.

Electrical connectivity for a design is further defined by adding properties to these objects. For example, the addition of a "Rise" or "Fall" property owned by a pin further defines the electrical quality of the pin connection. This is also the case when a "Net" property defines whether the net is a bus or a wire. Properties are discussed in detail starting on page 3-1.

Electrical Objects Represented on a Schematic

Many types of electrical objects make up a schematic. The objects in the following list are used to build the schematic. When placed properly on the sheet, each electrical object forms a connection to another electrical object.

- Pins and pin bundles
- Nets, buses, and net bundles
- Instances
- Frames (specify conditional or repeated inclusion of electrical objects; not electrical, itself)
- Special Instances
    - Net connectors
    - Bus rippers
    - Implicit rippers
    - Ports
    - Off-page connectors

- Globals
- Null instances

Pins and Pin Bundles

A *pin* is an electrical connection between a net and a symbol instance, and is part of the symbol body. When a symbol is placed on a sheet, its pins become the locations on the symbol instance at which a net connection can be made.

A pin bundle is an ordered collection of individual pins and/or wide pins. A pin bundle must contain unique pins that occur only once on a symbol. Thus, if a pin occurs in a pin bundle, it cannot occur as an individual pin elsewhere on the pin or in a different pin bundle.

The syntax of pin names and pin bundle names are discussed on page 2-24. Proper pin connectivity is defined by a set of checks, described in Appendix A, "DA Design Checks".

Nets and Buses and Net Bundles

Nets, buses, and net bundles are used to connect the different parts of a circuit. A *net* is the fundamental unit of connection. A net is a single connection (called a wire), a set of connections (called a bus), or a group of wires and buses (called a bundle), that binds instances of symbols together at their pin locations through multiple hierarchies of the design. Nets on the same sheet, and different sheets in the same schematic, having the same name are automatically tied together. Proper net connectivity is defined by a set of checks, described in Appendix A, "DA Design Checks".

A bus has the same electrical meaning as a set of individual nets bound together. Buses have a defined width, derived from the number of elements in the bus. The expression A(0:15) defines a bus with a width of 16 nets. Each net is referenced sequentially: A(0), A(1), ..., A(15) through the array. The expression B(0:2;5:7) defines a two-dimensional bus of nets B(0;5), B(0;6), B(0;7), B(1;5), ..., B(2;7). In Design Architect, a net name is defined by selecting the net vertex and adding the net name as the Net property value. Net and bus names are discussed in more detail beginning on page 2-24. A discussion about property name/value restrictions begins on page 3-7.

Caution Board layout applications may not be able to recognize and utilize multi-dimensional buses, such as A(0:7;0:7), since they consider a multi-dimensional bus to be a single net joining all attached pins.

A net bundle is an ordered collection of nets, buses, and other net bundles. Each item within a net bundle represents a separate signal, whereas the net bundle represents a grouping of multiple signals which are often interrelated in some way. Net bundles cannot span design hierarchy, since they are simply a means of collecting a set of signals into a logical unit in a single schematic. Proper net bundle connectivity is defined by a set of checks, described in Appendix A, "DA Design Checks".

Global connections can be referenced by nets, rather than creating a net route to a global symbol component such as Vcc. Global components have a Global property and a Class property. The Global property value is the name of the net (for example, Vcc), and the Class property value is "G", which defines it as global. In order to establish connectivity to these global instances, you need to assign the Global property to the desired net; the property value is the net name (for example, Vcc). Global components available in *gen_lib* include Ground, Vcc, Vcc.n, and Vee.

When a design has global nets, they are listed as "//net_name" when the design is evaluated in the Design Viewpoint Editor (DVE). All other nets (not global) are listed as "/net_name".

Bundle Syntax

Net and pin bundles are named using the following syntax:

explicit_name=base_name[left_delimiter[dimension;...]right_delimiter...,[] ...]

left_delimiter = '{'

right_delimiter = '}'

dimension = range...[,range]

The enclosed left and right brackets denote an optional block. The "..." characters denote an optional repeating block.

- **explicit_name** is the base_name of the bundle, plus a collection description. The base_name can be any legal name allowed in Design Architect. Delimiters (braces) are required. No space is allowed between the base_name and the delimiters.
- **base_name** is a text string.
- **dimension** defines the collection of nets, buses, and nested bundles delimited by braces. Multiple dimensions can be defined inside a set of delimiters and separated by commas.

  The following are examples of dimensions within bundle delimiters:

  - {a,b,c,d} -- Defines a bundle of pins or nets labeled "a", "b", "c", and "d".
  - {w,x,y(0:1),bund{l,m,n}} -- Defines a bundle of pins or nets that consists of single bits "w" and "x", an array of "0" and "1", and a bundle of "l", "m", and "n".

Pin and Net Naming Syntax

In Design Architect, pins, nets and buses are named using the following syntax:

name = AMPLE_expression or explicit_name

explicit_name=base_name[left_delimiter[dimension;...]right_delimiter...,[] ...]

base_name = string with no delimiters, or slashes

left_delimiter = '[', '(', or '<'

right_delimiter = ']', ')', or '>'

dimension = range...[,range]

range = field or field:field

field = AMPLE_expression or number

The enclosed left and right brackets denote an optional block. The "..." characters denote an optional repeating block.

- **AMPLE_expression** must comply with AMPLE syntax and evaluate to a valid explicit_name.
- **explicit_name** is the base_name of the pin or net (bus), plus an optional array description. The base_name can be any legal name allowed in Design Architect. No space is allowed between the base_name and the delimiters. Delimiters (square brackets or parentheses) are required if an array is specified.
- **base_name** is a text string with no delimiters or slash characters.
- **dimension** defines an array of nets delimited by either brackets, parentheses, or angle brackets. Multiple dimensions can be defined inside a set of delimiters and separated by a semicolon.

  The following list describes some array descriptions for single and multiple dimensional arrays:

  - (2) -- Defines a single pin or net labeled "2".
  - (0:15) -- Defines an array of pins or nets labeled "0", "1", and so on, up to "15".
  - (1,3,5,7) -- Defines an array of pins or nets labeled "1", "3", "5", and "7".
  - (0:2; 0:2) -- Defines a two-dimensional matrix with array elements labeled "0,0", "1,0", "2,0", "0,1", "1,1", "2,1", "0,2", "1,2", and "2,2". For information on ripping bits from a two-dimensional bus, refer to "Special Instances" beginning on page 2-33.

Table 2-1 lists a variety of net, bus, and bundle naming examples.

Table 2-1. Net, Bus, and Net Bundle Naming Examples

Net Name	Description
A	A single net name
A(0:15)	A bus whose range is 16 bits (0 through 15)
A(2) or A[2]	The number 2 net of the bus named "A"
a_bus(1,3,5,7)	A reference for the four bits "1,3,5,7" in a_bus
B(0:2;0:2)	A matrix of nets, sized 3 nets by 3 nets
B(1:n)	A parameterized net range "n" bits wide
Bundle{a,b,c}	A bundle containing nets "a", "b", and "c"
Cable{Clk, Data(0:3)}	A bundle containing a net "Clk" and a four-bit-wide data bus.
($strcat("A(0:", n,")"))	The AMPLE function $strcat concatenates the string "A(0:" with net range variable "n" and the final right parenthesis ")" to build a net name from an expression.

For detailed information on pin and bus name character restrictions, refer to "Special Case Restrictions" beginning on page 3-8.

Net Bundle and Pin Bundle Connection

You can connect a net bundle to either a pin bundle with the same width or a bus pin of the same width. The connections of nets to pins are determined by position; that is, the first item listed in the pin bundle is connected to the first item listed in the net bundle, and so on.

You can connect a bus to a pin bundle of the same width. The connection between bus bits and pins are determined by position; that is, the MSB (most significant bit -- left----most index in the subscript) of the bus is connected to the first element in the pin bundle, and so on.

An example of net bundle and pin bundle connections is illustrated in Figure 2-10.

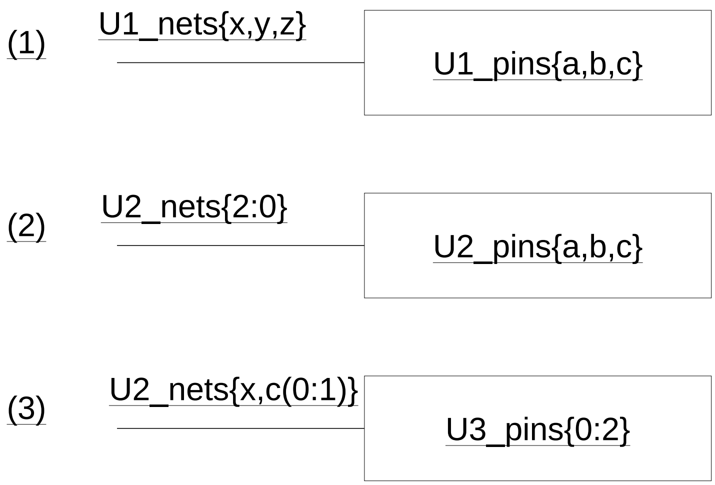


Figure 2-10. Net Bundle/Bus and Pin Bundle Connections

The connections made by mapping positions within the bundles and buses are:

1. Net "x" of U1_nets connects to pin "a" of U1_pins, net "y" of U1_nets connects to pin "b" of U1_pins, and net "z" of U1_nets connects to pin "c" of U1_pins.

2. Bit "2" of U2_nets connects to pin "a" of U2_pins, bit "1" of U2_nets connects to pin "b" of U2_pins, and bit "0" of U2_nets connects to pin "c" of U2_pins.

3. Net "x" of U3_nets connects to U3_pins bit "0", net "c(0)" connects to U3_pins bit "1", and net "c(1)" connects to U3_pins bit "2". This particular example shows that wide signals in a net bundle are flattened to individual signals before connections are made.

Unnamed Nets Connected to Pin Bundles

When an unnamed net connects either two pin bundles of equal width, or a pin bundle and a wide pin of equal width, the system creates an unnamed bus. The enumeration for the unnamed bus is in descending order, such as (1:0) and connections are made by mapping positions in each pin object. Figure 2-11 illustrates the connectivity generated when using unnamed buses to connect pin bundles.

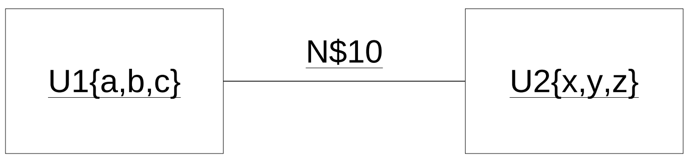


Figure 2-11. Unnamed Net Connections to Pin Bundles

The system creates a bus named N$10(2:0), which has the following connectivities:

- N$10(2:0) connects pin bundles U1{a,b,c} and U2{x,y,z}.
- N$10(2) connects pins "a" and "x".
- N$10(1) connects pins "b" and "y".
- N$10(0) connects pins "c" and "z".

Nets Ripped by Name from a Net Bundle

You can separate, or rip, individual nets from a net bundle, just as you can rip bits from a bus. Figure 2-12 illustrates acceptable ways in which you can rip nets and buses from net bundles:

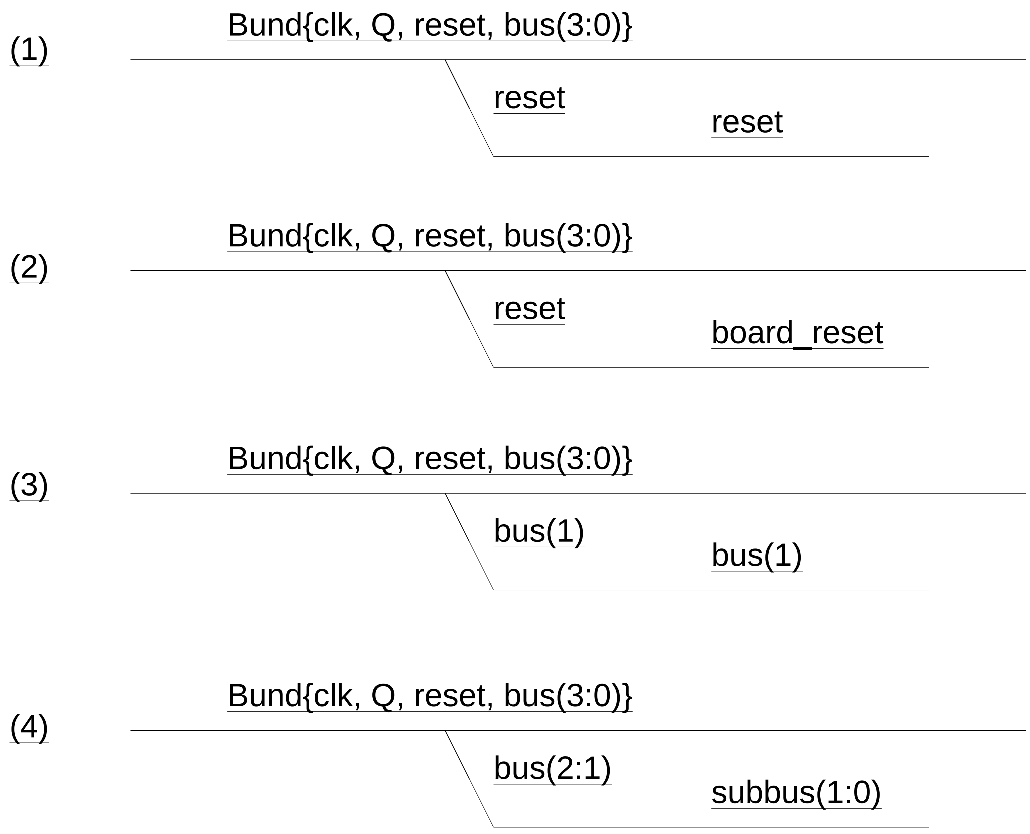


Figure 2-12. Ripping from a Net Bundle

1. A bundle item can be ripped by name from a net bundle and connected to a net with the same name as the bundle item; this is the typical case.

2. A bundle item can be ripped from the net bundle and connected to any other net, which essentially shorts the two nets together. In this example, "reset" and "board_reset" are electrically equivalent.

3. An individual bit of a bus that is a member of a net bundle can be ripped from the bundle and attached to any net. If the attached net has a different name than the bus bit, the bit and net are shorted.

4. Any sub-range of a bus that is an item in a bundle can be ripped and connected to another bus of matching width. Also, the entire bus can be ripped from the bundle.

Caution If you rip a bit from a bus and connect it to a net and then rip the same bit from the bus and connect it to another net, the system considers the two nets as shorted together.

For an operating procedure on ripping nets from net bundles, refer to "Ripping Members from Net Bundles" on page 6-65.

Unnamed Nets Ripped from Net Bundles

When an unnamed net is connected to a ripper from a bundle, the net is one of two types:

- A single-bit net. Ripper rule must list one item.
- An unnamed bus. Ripper rule must list multiple items.

If an unnamed bus results, it has a width that matches the ripper rule, is in descending order, and is connected by position. Figure 2-13 illustrates the two possible cases:

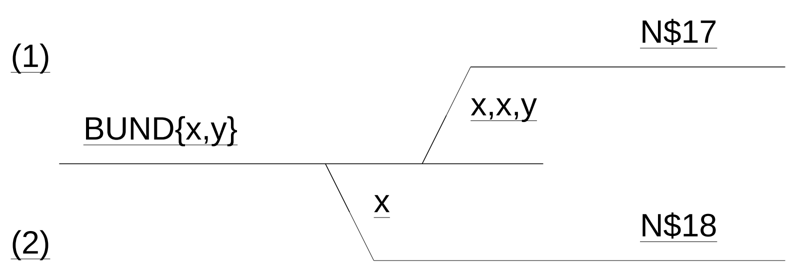


Figure 2-13. Unnamed Nets Ripped from Net Bundles

The following objects are defined:

1. A bus named N$17(2:0). Net N$17(2) connects to net "x", net N$17(1) connects to net "x", and net N$17(0) connects to the net "y".

2. The unnamed net N$18 connects to net "x".

Design-Wide Net Naming Rules

A net representing a set of connected nets in a fully evaluated design is called a *design-wide net*. If a design has more than one level of hierarchy, a design-wide net spans the design hierarchy. Each segment of the design-wide net can have a different net name. When the design is evaluated, the set of nets that make up the design-wide net name evaluates to only one name.

The following rules determine which design-wide net is chosen as the representative from a set of equivalent design-wide nets.

1. If one or more of the nets is Global, the global net defined in the highest level in the design hierarchy is chosen. If there is more than one global net at that level, a net is chosen according to the following ranking system:

    a. If any of the nets are bus bits, choose the net with the widest bus parent.

    b. If a representative net has not been determined (either no bus bits, or parent buses have the same width), then choose by alphabetical order.

2. If no nets are Global, use the following criteria, in order, until all nets except one have been eliminated:

    a. Highest level in the hierarchy

    b. EXTERNAL net (connected to a port) state

    c. Net with a user-given name

    d. Bus bit with widest bus parent

    e. Alphabetical order

Frames

A *frame* is a graphical box which encloses some circuitry that is repeated or conditionally included in a final netlist by a frame expression. FOR, IF, and CASE frame expression types are described starting on page 3-30. Frames are used on schematic sheets only.

In order for the contents of a frame to be evaluated correctly, certain connectivity rules must be followed. A full set of checks that define the proper frame connectivity is described in Appendix A, "DA Design Checks".

Repeating Instances

A repeating instance is a short-hand way to specify a simple FOR Frame. A repeating instance enables you to repeat a single instance by entering a one-dimensional range in the “INST” property; for example, INST = XINST(3:0). Using this optional range in the INST property value defines the number of times the instance is repeated and how the nets are 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.

The system creates a FOR frame to match the expression and connectivity of the repeated instance when the sheet is written to the EDDM database. Because a FOR frame is created for a repeating instance, downstream tools are not able to tell the difference between a real FOR Frame and the short-hand FOR Frame of a repeating instance.

Repeating instances should be used only in very simple cases. For more robust purposes, you should use standard FOR frames. FOR frame expression types for repeating instance are described on page 3-33.

Instances

An *instance* is a reference to a component symbol, and reflects the connectivity defined by that component symbol. An instance is graphically represented by a symbol and can be updated by updating the original symbol. Placing the representative symbol on a schematic sheet is called *instantiation*.

In order for an instance to be evaluated correctly, it must follow a set of connectivity rules. A full set of checks that define the proper instance connectivity is described in Appendix A, "DA Design Checks".

Special Instances

Special instance connectors are not part of the final evaluated design, and are not translated into physical components. They are used to pass connectivity information to the Design Viewpoint Editor (DVE), QuickSim II, and other downstream applications that define or use an evaluated design. They are created by adding specific Class property values to an instance. Refer to page 3-27 for more information about Class properties.

You may define your own special instance symbols, or use Mentor Graphics supplied components. The following list defines Mentor Graphics-supplied special instances located in *gen_lib* (access *gen_lib* through the $MGC_GENLIB environment variable):

- **Net Connector.** The net connector is used to connect two nets that have different net names. The net name is assigned by adding the Net property to a net vertex. It is not possible to attach more than one name to a net because conflicting property values are not allowed. Two nets with different net names can be connected by attaching the first net to the pin on one side of the net connector, and the second net to the pin on the other side of the net connector. If two nets with the same name are attached to a net connector, or if a net attached to a net connector is unnamed, when the sheet is checked, the Check command issues a warning.

  A net connector has a Class property value "C" and at least two pins. The netcon component is a Mentor Graphics-supplied net connector, and is located in the gen_lib library. Refer to page 6-61 for information about how to use the netcon component.

- **Off-Page Connector.** The off-page connector is used to connect nets with the same name across different sheets in a schematic. Nets with the same name, which are not graphically connected in the schematic, are automatically connected. To identify a net as connected by name across sheet boundaries of the schematic, attach each such net to a pin of an off-page connector.

  Table 2-2 summarizes the checking for off-page connectors during a Check -Schematic.

Table 2-2. Checking for Offpage Connectors

Connectors/Matching Names	Check -Schematic Results
No connectors in design	No checking for offpage connectors.
1 connector / matching net name	Warning: Add connector to net with same name.
1 connector / no matching net name	Warning: Unneeded connector; no matching net name found on other sheets.
connectors on mismatched names / matching names have no connectors	Warning: Add connectors to matching names.
Connectors on nets of different names	All three of the above warnings are possible.

  An off-page connector has a Class property value "O", and at least one pin. The offpag.out and offpag.in components are Mentor Graphics-supplied off-page connectors, and are located in the gen_lib library.

- **Port.** The port component is used to indicate a net making a connection external to the schematic. The number and net names of the ports on a schematic should match the pins on the interface of the symbol representing that schematic. Refer to page 2-75 for a definition of a component interface, and page 2-78 for a discussion about symbol registration. If the net name attached to a port in the schematic does not match the name of a pin on its representative symbol when the schematic is checked, the Check command issues an error.

A port has a Class property value "P", and must have exactly one pin. The portin and portout components are Mentor Graphics-supplied port components, located in the gen_lib library.

- **Bus Ripper.** A bus ripper is similar to a net connector. It connects two nets of possibly different names, and provides a way to rip off a single-bit or sub-bus of a bus for connection to a different net. For example, it permits connecting net N(1) to B(1) of bus B(0:7).

  The bus must be attached to the ripper pin named "Bundle". The ripped nets must be attached to the corresponding ripper pins. In addition, the value of the Rule property attached to the ripper must have a valid bus range syntax to identify the bits to be ripped from the main bus; for example, a value bit "1" of range "0:3". The net must be named so that its width matches the width specified by the Rule property.

  When ripping bits from a two-dimensional bus, the value of the Rule property must be set to rip one bit from the bus or to rip a range of bits from a row or column of the bus. The following list shows the syntax and a sample Rule property value for each possible type of rip. The sample values assume that the bus is named "data(0:2;0:2)" and that the width of the nets attached to the rip component match the width specified in the Rule property:

  x;y Rip one value from the matrix. For example:

  Rule = 0;0

  $x;y_1:y_2$ Rip a range of values from a row in the matrix. For example:

  Rule = 1;0:2

  $x_1:x_2;y$ Rip a range of values from a column in the matrix. For example:

  Rule = 0:2;1

A bus ripper instance has a Class property value "R". It must have at least two pins. One pin must have a Pin property with value "Bundle". A Rule property must be associated with the instance body or with each non-bundled pin. The value of the Rule property must have a valid bus range syntax.

The rip component is a Mentor Graphics-supplied component, located in the gen_lib library. The rip component provides a wide variety of ripper symbols capable of ripping varying numbers of bits from a bus. Refer to page 6-49 for an example of how to create a bus ripper.

- **Implicit Ripper.** An implicit ripper separates a named bit from a bus or a member from a net bundle. It differs from a standard ripper symbol in that:
    - o The implicit ripper is not an actual symbol in any library.
    - o Implicit rippers do not have a Rule property attached to them, since connection is established by name.

You can visually differentiate an implicit ripper from a standard ripper in that the implicit ripper instance is the same color as a net. The name of the net connected to the implicit ripper must exactly match the name of a bus bit or member of a net bundle. You can configure implicit rippers to connect at a 45-degree angle, much like standard rippers, or in a straight line.

Figure 2-37 illustrates some examples of implicit rippers.

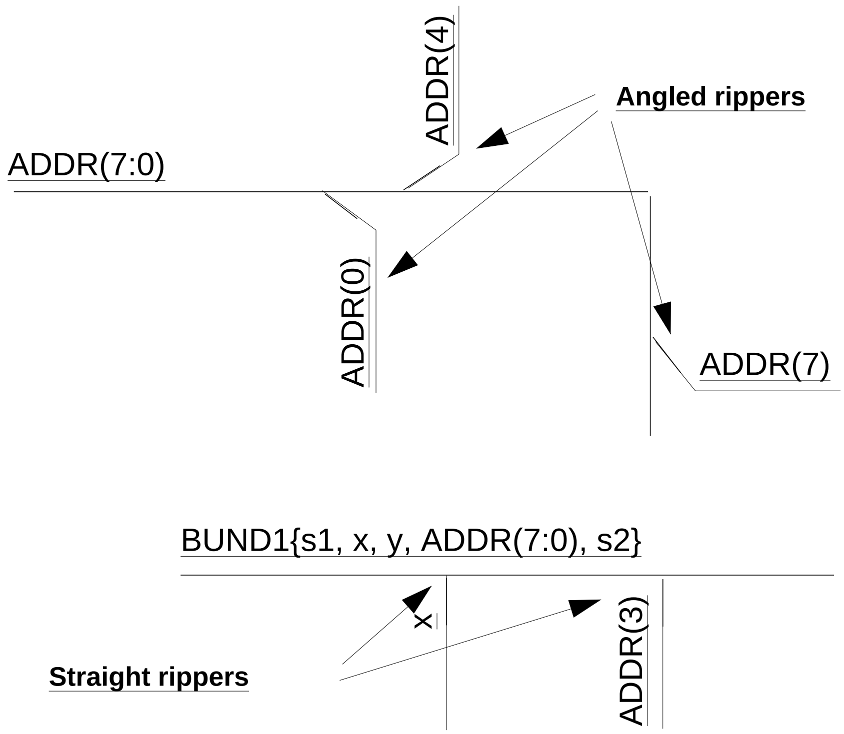


Figure 2-14. Implicit Ripper Examples

Implicit rippers are the default when you invoke Design Architect. Implicit rippers do not define any explicit connectivity; rather, electrical connectivity is established only by name.

You can set the ripper mode to "auto" using the $setup_ripper() function, which you can access through the **Setup** > **Ripper** pulldown menu. Auto rippers must be used if you need to pull off a bit in a bus and connect it to a wire with a different name, or if you want to pull off part of a bus and connect it to a smaller bus.

- **Globals.** A global instance is a component that has a Global property and a Class property assigned to the symbol body. The value of the Global property is the name of the net (for example, Ground and Vcc). The value of the Class property is "G". The global symbol must have at least one pin and a Global property. Examples from the Mentor Graphics-supplied *gen_lib* component library are Vcc and Ground.

A global instance can exist at any level of the design. Nets that connect to the global instance, without creating a physical net route, must have a Net property value that is the same as the Global property value on the global instance to establish electrical connectivity.

- **Null Instance.** A null instance is a component that carries the component's properties, but represents the component as electrically inert. In many cases the null function of a component can be provided using comments instead. A null instance has a Class property value "N" and no pins.

Comment Objects

Comment objects are graphical objects, such as lines, circles, rectangles, and text, combined together for descriptive purposes. Comment objects can be used as explanations, review notes, fabrication notes, or any purpose you have to comment the design. Comment objects have no electrical significance.

Types of Comment Objects

The following are comment objects:

- Arcs
- Circles
- Lines
- Polygons
- Dots
- Polylines
- Rectangles
- Text

Graphic Commands

Graphic commands create comment text and graphics on schematic sheets and symbol graphics on symbols. The term *symbol graphics* refers to the lines, rectangles, circles, and other graphical objects used to create symbol bodies. The same graphics-generating command set is used in both schematic editing and symbol editing.

The following commands generate comment text and graphics:

- Add Arc
- Add Circle
- Add Dot
- Add Line
- Add Polygon
- Add Polyline
- Add Rectangle
- Add Text
- Convert to Comment

Most comment-generating commands are self-explanatory; for example**,** the Add Rectangle and Add Circle commands add rectangles and circles to a schematic sheet. The Add Dot command adds a dot to a symbol body; the size and style of the dot drawn on the symbol instance are determined by the values of the dot_size and dot_style internal state variables (same size and style as the DA- generated net junction dots). Other comment object attributes control how lines, text, and other graphics are displayed, and are described starting on page 2-44. Refer to the *Design Architect Reference Manual* for more detailed information about these commands.

Convert Objects to Comments

The Convert To Comment command converts any selected electrical or graphical object, or group of objects, to comments. For example, selected:

- Nets become comment lines
- Symbol instances become comment text and graphics
- Visible properties become properties of the newly created comment object

Caution After an object has been converted to a comment, all hidden properties associated with that object are deleted. This process can be reversed using the Undo command.

Uses for Comments

Using comment text, graphic objects, and system functions that return standard information (such as date and version numbers of the design), you can create many useful structures that are distinct from the electrical elements of the schematic. For example, you can create:

- Title blocks (can be automatically created on a new sheet)
- Revision blocks
- Page borders (can be automatically created on a new sheet)
- Backplane, wire wrap, and other tentative design elements
- Explanations, review notes, and fabrication notes

Object Handles in Design Architect

In Design Architect, every graphical comment and electrical object has an associated *handle*. A handle is a unique, system-assigned identifier. You can also assign a name to an instance with the Inst property. The system recognizes the name you assign, but the instance handle is retained, not replaced. A handle consists of one of the key letters listed below, followed by the dollar sign character ($) and a system-assigned number.

- B = Bundle
- C = Comment
- F = Frame
- G = Group
- I = Instance
- N = Net
- P = Pin
- T = Property Text
- V = Vertex

An example of an instance handle is:

I$385

Handles, like this one, appear in various error messages and netlists. The handle can be specified as an argument in commands such as Select By Handle or Report Object, as in the following examples:

Select By Handle I$385 -View

Report Object I$385

The first command selects the object by its handle. The second command requests an extended status list associated with the object whose handle is I$385.

Methods exist to make the handle of an instance visible. Assign the Inst property to the instance with a value of I$0. When the Check or Save commands are issued, the I$0 value will be replaced by the unique handle for that instance. Similarly, assigning the Net property a value of N$0 makes the net handles visible after the Check or Save commands are executed.

Object Attributes

Text, lines, arcs, rectangles, nets, property values and many other objects associated with a schematic or a symbol have additional graphical attributes. A graphical attribute is a feature that affects the way the object is displayed.

Line Style Attributes

You can use different line styles and widths for lines created for symbol graphics or comment graphics, for example:

- Line style: solid, dotted, long dashed, short dashed
- Line width: 1 pixel, 3 pixels, 5 pixels, 7 pixels

A line and a net may have the same line style attributes, but only a net can have electrical connectivity. A net is created with the Add Wire or Add Bus command, and a line is created with the Add Line command.

Text Attributes

Design Architect supports a variety of text attributes for text objects. Figure 2-15 shows some of these styles. Comment text and property text attributes include: font type, text height, text horizontal justification, text vertical justification, text orientation, text visibility, and text transparency. Refer to the Setup Comment and Setup Property Text commands in the *Design Architect Reference Manual* for more information about these commands.

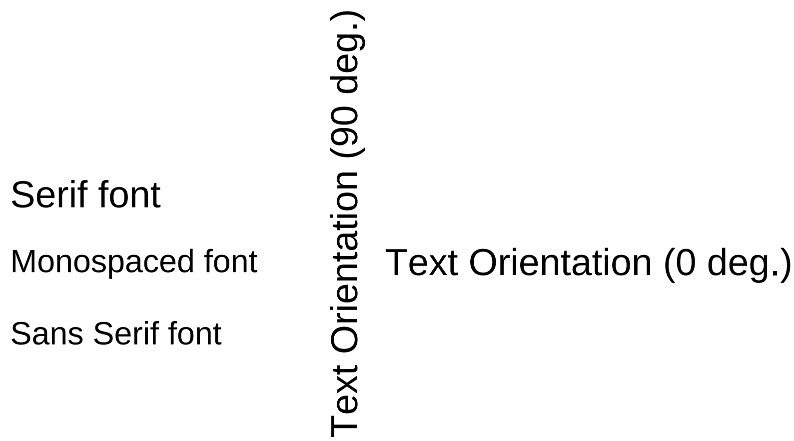


Figure 2-15. Text Attributes

Setting Up Attributes

There are three ways to set object attribute information:

- Execute the proper "setup" command
- Execute the proper "change" command
- Execute the individual "$set" function for each internal state variable

The Design Architect "Setup" commands are used to set all the object attributes for subsequently created objects of a particular type. For example, the Setup Comment command sets all the attributes for comment text and graphics. The Setup Net command sets all the attributes for nets, such as style, width, pin snap, and orthogonal routing. The Setup Property Text command sets all the attributes for property text display. The attributes set with the "Setup" commands remain unchanged for all subsequently created objects. A summary of attribute descriptions associated with each "Setup" command is displayed in Table 2-4.

The "Change" commands modify individual attributes of selected objects. For example, the Change Property Visibility command toggles the instance-specific selected property to a visible or invisible condition. The change commands do not affect the default internal state variables. Object attributes associated with each "Change" command are displayed in Table 2-4.

The "$set" functions work like the "Setup" commands except they set only one internal state variable at a time; refer to Table 2-4. Refer to the *Design Architect Reference Manual* for information concerning internal state functions.

Summary of Object Attributes and Associated Commands

Design Architect supports a variety of graphical attributes that can be used to customize the look of your schematic. Table 2-3 catalogs the attributes available for each object.

Table 2-3. Object Attributes

Object Types	**Object Attributes**
Comment Text and Graphics	line style, line width, fill type, text font, text height, horizontal text justification, vertical text justification, text orientation, transparency
Net	net style, net width, orthogonal, orthogonal angle
Property	name, value, type, visibility, text font, text height, text justification, text orientation
Symbol Graphics and Comments	line style, line width, fill pattern, text font, text height, horizontal text justification, vertical text justification, text orientation

Table 2-4 lists the object attributes with the associated commands and functions used to set and change these attributes. This table points you to the commands and functions necessary to set or change an individual object attribute, or to set or change the sheet/symbol default for a particular attribute.

Table 2-4. Command and Function Attribute Reference

Attribute Descriptions	Design Architect Commands/Functions
Line Style (solid, dot, shortdashed, longdashed)	Setup Comment Setup Symbol Body Change Line Style $set_line_style()
Line Width (1pixel, 3pixels, 5pixels, 7pixels)	Setup Comment Setup Symbol Body Change Line Width $set_line_width()
Polygon Fill (clear, solid, stipple)	Setup Comment Setup Symbol Body Change Polygon Fill $set_polygon_fill()
Net Style (solid, dot, shortdashed, longdashed)	Setup Net Change Net Style $set_net_style()
Net Width (1pixel, 3pixels, 5pixels, 7pixels)	Setup Net Change Net Width $set_net_width()
Orthogonal Routing of net (on, off)	Setup Net $set_orthogonal()
Orthogonal Routing Angle (angle)	Setup Net $set_orthogonal_angle()
Dot Size (dotsize)	Setup Symbol Body Setup Net $set_dot_size()

Table 2-4. Command and Function Attribute Reference [continued]

Attribute Descriptions	Design Architect Commands/Functions
Dot Style (square, circle)	Setup Symbol Body Setup Net $set_dot_style()
Ripper Dot Toggle (on, off)	Setup Net $set_ripper_dot()
Pin Snap to grid (on, off)	Setup Net $set_pin_snap()
Text Font for property and comment text	Setup Comment Setup Property Text Change Text Font Change Property Font $set_text_font() $set_property_font()
Text Height for property and comment text	Setup Comment Setup Property Text Change Text Height Change Property Height $set_text_height() $set_property_height()
Text Horizontal Justification (left, center, right) for property and comment text	Setup Comment Setup Property Text Change Text Justification Change Property Justification $set_text_hjustification() $set_property_hjustification()

Table 2-4. Command and Function Attribute Reference [continued]

Attribute Descriptions	Design Architect Commands/Functions
Text Vertical Justification (top, center, bottom) for property and comment text	Setup Comment Setup Property Text Change Text Justification Change Property Justification $set_text_vjustification() $set_property_vjustification()
Text Orientation (0,90) degrees	Setup Comment Setup Property Text Change Property Orientation $set_text_orientation() $set_property_orientation()
Visibility (on, off) for instance-specific property display	Setup Property Text Change Property Visibility $set_property_visibility()

Build a Schematic

A schematic may include many instances, wires and buses connecting the instances, comments to annotate the circuit, and special instances for special connections. Refer to "Creating a Schematic" in the *Getting Started with Design Architect Training Workbook* for a step-by-step tutorial on how to create a schematic.

To build a simple schematic involves the following steps:

1. Open a Schematic Editor window

2. Draw a schematic

3. Check schematic for errors

4. Register schematic with component

Open a Schematic Editor Window

The Open Sheet command opens a Schematic Editor window. You can activate this command from the Session menu or the palette menu in Design Architect. This command opens an existing schematic sheet if the schematic name exists, or creates a new schematic sheet, if a new name is given. When you open a new schematic sheet that does not have an existing symbol, you are also creating a new component which, in the future, will contain other relevant objects such as a symbol to represent the sheet, technology files, design viewpoints, and back annotation objects.

You can also invoke a Schematic Editor window from the Design Manager by double-clicking on a schematic sheet icon or its component icon. Refer to page 6-23 for the procedure to invoke the Schematic Editor from a Design Architect Session window.

Draw the Schematic

Here are five basic steps that allow you to draw a simple circuit:

- Choose and place component symbols
- Draw and route nets
- Terminate off-sheet nets
- Name nets
- Add comments

Choose and Place Component Symbols

Component symbols are selected and placed on a schematic sheet from a library palette or by typing the pathname to the component symbol. A library palette can be activated by selecting a library menu item under the **Libraries** menu in the Schematic Editor. A menu selection is available for every Mentor Graphics component library installed. When activated, the library palette includes a list of all library components available from that library. See "Choosing and Placing

Component Symbols on a Sheet" on page 6-29 for procedures describing how to select and place components on your schematic sheet.

Draw and Route Nets

After the component symbols have been placed, you can draw and route the nets necessary to properly connect the component symbols. You can set the net router to route automatically when a net is drawn, or you can manually route a set of nets by selecting the net vertices to route and executing the Route command. To activate automatic net routing, execute the **Setup > Set Autoroute On** menu item. When automatic routing is turned on, the Route command is automatically called after each net is drawn.

The net router defines an orthogonalized pathway for a connected net that avoids instance extents, comment objects, and other nets. The net router utilizes the pin snap grid as the routing grid. If net vertices are not on the grid, they are not routed. Routing performance is faster if the pin snap grid is set to a value larger than one pin interval during the route operation, and then set back for component instantiation.

Unconnected wires, buses, and pins will cause warning messages when you check the schematic sheet. If you want to indicate that an unconnected wire, bus or pin is valid, attach the Class property to it with a value of "dangle". You may first need to declare pins and nets as valid owners of the Class property.

To specify a property owner, choose the **Setup > Property Owner/Type > Property Owner** menu item. In the dialog box that appears, enter "class" in the **Property Name** text entry field, and click the **Pins** and **Nets** buttons.

See "Drawing and Routing Nets" on page 6-37 for procedures to draw and route nets.

Terminate Off-Sheet Nets

All input wires and buses should begin with a portin or offpag.in component from the *gen_lib* component library. Similarly, output nets and buses should be terminated with a portout or offpag.out component. Warnings may result if this is not done.

See "Choosing and Placing Component Symbols on a Sheet" on page 6-29 for procedures for placing these components on your schematic sheet.

See "Assigning Properties and Property Owners" on page 6-95 for details about how to add property values.

Modify Net Names

A net should always terminate at an instance's pin, or connect with another net at a junction. The Schematic Editor uses several components for terminating a net at an input or output point. The components portin, portout, offpag.in, and offpag.out provide net termination. By default, the portin and portout symbols assign the name NET to an unnamed net when attached. To prevent many different nets from being named NET (if two nets have the same name, downstream applications see them as being connected), you will need to change the name of the nets so they each have a unique name.

See "Modifying Net Names" on page 6-39 for a procedure for modifying a net name.

Add Comments to the Schematic Sheet

Comment objects are graphical objects, such as lines, circles, rectangles, and text, combined together for descriptive purposes. Comment objects can be used as explanations, review notes, fabrication notes or any purpose you have to comment the design.

To review commands used to add comment objects, refer to "Types of Comment Objects" on page 2-38.

Check the Schematic

You must pass a set of required Mentor Graphics schematic checks before a downstream application is invoked; if these checks fail, the downstream application will issue a warning, highlighting a problem that may be uncovered at a later time. These checks are set up for you by default, and are executed with the **Check > With Defaults** menu item.

To understand the additional capabilities of the Check command, refer to "Design Error Checking" starting on page 5-1. To find out how you can change your setup to include optional checks to be executed by default, refer to page 6-41.

Register Schematic with Component

You must register your schematic with a component before you can use the schematic with a downstream tool. When you save your schematic, for example, by executing the **File > Save Sheet** menu item, by default, you register your schematic with the component specified when you opened the schematic sheet. If you want to register your schematic with other components and component interfaces, you need to know more about how the component structure works.

Refer to "DA Model Registration" on page 2-73 for concepts related to the component structure and model registrations; for a procedure describing how to register a schematic, refer to "Saving a Sheet and Registering a Schematic" on page 6-44.

Elements of a Symbol

The following topics define the concepts and terminology related to the objects used to build a symbol.

Symbol Definition

The Symbol Editor creates symbol models. A symbol model is a graphical representation of a component, as shown in Figure 2-16. A symbol consists of five basic elements:

- **Body (Shape)**. The symbol body is the graphical image of the symbol. The graphics that display the symbol body are called *symbol graphics*.
- **Pin(s)**. Pins are points where an instance of the symbol electrically connects to the schematic sheet.
- **Origin.** The origin is the reference point used to place the symbol on the schematic sheet.
- **Properties.** Properties provide information describing the functionality of the symbol. Refer to page 3-1 for more information about properties.
- **Comments.** Comments placed on a symbol provide documentation about the symbol. Comments cannot be added directly to a symbol; symbol graphics can be converted to comment graphics with the Convert To Comment command, and back to symbol graphics with the Remove

Comment Status command. Comments on a symbol are non-instantiable and do not appear on an instance of the symbol.

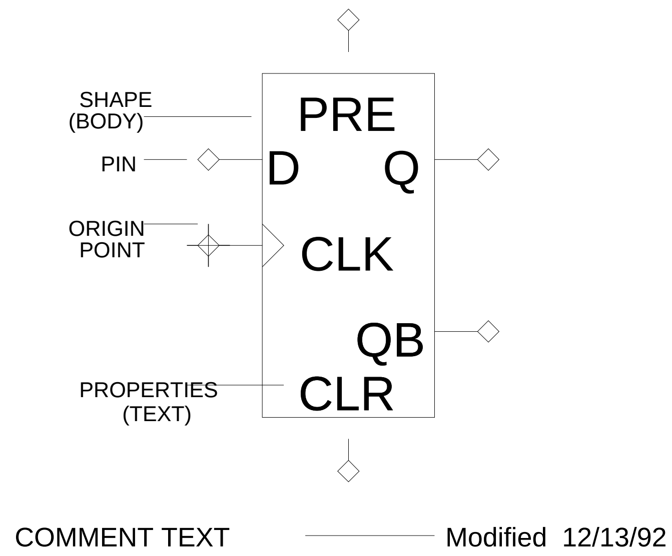


Figure 2-16. Symbol Structure

Symbol and Schematic Relationships

Instances of symbol models and schematics form a hierarchical bond. An instance, as illustrated on the right portion of Figure 2-17, represents a higher-level function to the sheet it references. The schematic below the instance of the flip-flop represents a more detailed level description of the function of the symbol model.

The flip-flop schematic sheet is said to be lower in the design hierarchy than the circuit schematic sheet. This is true because the flip-flop schematic is the functional representation for the flip-flop symbol model, which is one of the components using lower-level schematics. Sheets at the lowest level contain components that are usually simple gates.

For down-stream applications such as simulation, the functionality of some low-level components is already known by the simulator and does not require another underlying schematic sheet. Such a component is referred to as a *built-in primitive.*

This hierarchical bond between the symbol model and the schematic also allows the flexibility to represent that symbol with other functional models. Other more complex modeling methods can also be used to describe component functioning for primitives. Refer to the *Digital Modeling Guide* for more information about different modeling techniques.

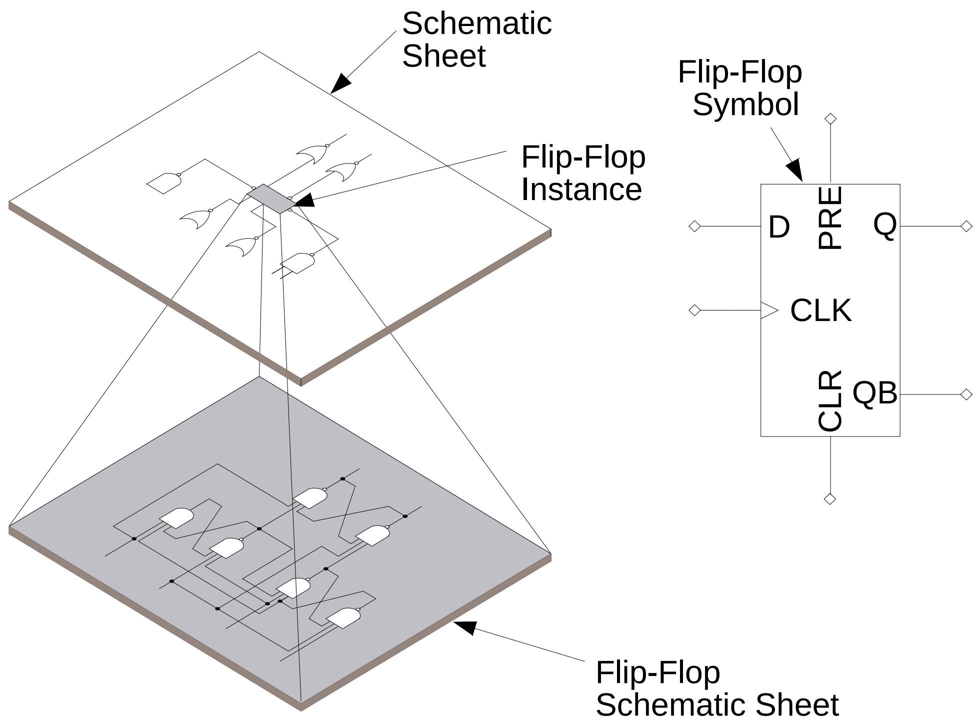


Figure 2-17. Symbol and Schematic Relationships

Build a Symbol

The following topics present some of the common procedures involved in building a symbol. Refer to "Creating a Symbol" in the *Getting Started with Design Architect Manual Training Workbook* for a step-by-step tutorial on how to create a symbol.

Creating a symbol involves the following steps:

1. Open a Symbol Editor window
2. Draw the symbol body
3. Add pins and pin properties
4. Add other symbol properties
5. Check a symbol for errors
6. Register the symbol with the component

Open a Symbol Editor Window

The Open Symbol command opens a Symbol Editor window. You can activate this command from the Session menu or the palette menu in Design Architect. This command opens an existing symbol, if the symbol name exists, or creates a new symbol, if a new symbol name is given.

You can also invoke the Symbol Editor from the Design Manager by double-clicking on a symbol icon. Refer to page 6-72 of this manual for more information about how to invoke the Symbol Editor on an existing symbol.

Draw the Symbol Body

A symbol body can be made up of lines, rectangles, circles, and arcs. A symbol body can also have "whiskers" which are short lines projecting from its body to indicate where the input and output pins will be connected. Whiskers are not a required part of the symbol, but rather a convention used in the Mentor Graphics component libraries.

The following list presents commands used to draw the symbol body:

- Add Arc
- Add Circle
- Add Dot
- Add Line
- Add Polygon
- Add Polyline
- Add Rectangle
- Add Text

Add Pins and Pin Properties

You add pins to a symbol with the Add Pin command. The pin name that you give as the Pin property is stored in the database as the *compiled pin name*. A compiled pin name is a non-volatile pin name on library symbols against which Hardware Model Language files and Behavioral Language Model files can be compiled.

When you make changes to the Pin property value (by changing the pin's user-defined name), with the Change Property Value command, the compiled pin name tracks the user pin name. If you change the compiled pin name with the Change Compiled Pin Name command, future changes to the user pin name will not affect the compiled pin name. If you wish to have the compiled pin name again track the user pin name, set the compiled pin name value to " " with the Change Compiled Pin Name command. The compiled pin name is not a property and cannot be viewed on the sheet. You can examine its value by executing the Report Object command. Compiled pin names are not used for connectivity of an instance on a schematic sheet.

Add Other Symbol Properties

In addition to adding pins and their associated names, you will also want to add and modify property values on pins, or on the symbol body itself.

Symbol properties attach data or characteristics about the symbol, and are subsequently used during design simulation and by layout and other downstream applications. The addition of properties allows accurate modeling of the real physical device. Symbol model properties are necessary for the component to operate correctly. A more detailed discussion of symbol properties starts on page 3-9.

Add Comments to a Symbol

When you add graphics to a symbol, for example, with the Add Rectangle command, by default, you create symbol graphics. Symbol graphics are included with the symbol and are displayed with the symbol at instantiation time. Comments are created by converting symbol graphics to comments with the Convert to Comment command. Comments created on a symbol sheet are not displayed on the sheet when the symbol is instantiated. They can only be viewed on the symbol while editing the symbol.

If you want to convert selected symbol comments back to symbol graphics you can execute the Remove Comment Status command.

To review commands used to add comment objects, refer to "Types of Comment Objects" on page 2-38.

Check a Symbol

You must pass a set of required Mentor Graphics symbol checks or the symbol will not be valid for instantiation. These checks are setup for you by default, and are executed with the **Check** > **With Defaults** menu item.

To understand the additional capabilities of the Check command refer to "Design Error Checking" starting on page 5-1. To learn how to include optional checks to be executed by default, refer to page 6-90.

Register Symbol with Component

You must register your symbol with a component before you can instantiate the symbol. When you save your symbol, for example, by executing the **File > Save Symbol > Default Registration** menu item, by default, you register your symbol with a component, and use the component's leaf name for the symbol name.

To understand more about symbol registration, refer to page 2-73. A procedure describing how to register a symbol with a component interface is on page 6-92.

Create a Symbol from a Schematic

Design Architect can create a symbol to represent a schematic sheet. When you choose the **Miscellaneous > Generate Symbol** menu item while in the Schematic Editor, a dialog box is displayed for you to specify the name of the symbol that will be created.

The symbol can be generated from the currently open schematic sheet, another sheet, or a pin list. Options include replacing an existing symbol, opening the newly created symbol for editing, and saving the new symbol.

Create a Symbol from a Pin List

While in the Schematic Editor, you can generate a symbol from a pin list. Choose the **Miscellaneous** > **Generate Symbol** menu item to display the Generate Symbol dialog box (This dialog box is also available in the session window with the **File** > **Generate** > **Symbol** menu item). When you click the **Pinlist File** button, a text entry field appears for you to enter the file pathname, as shown in Figure 2-18.

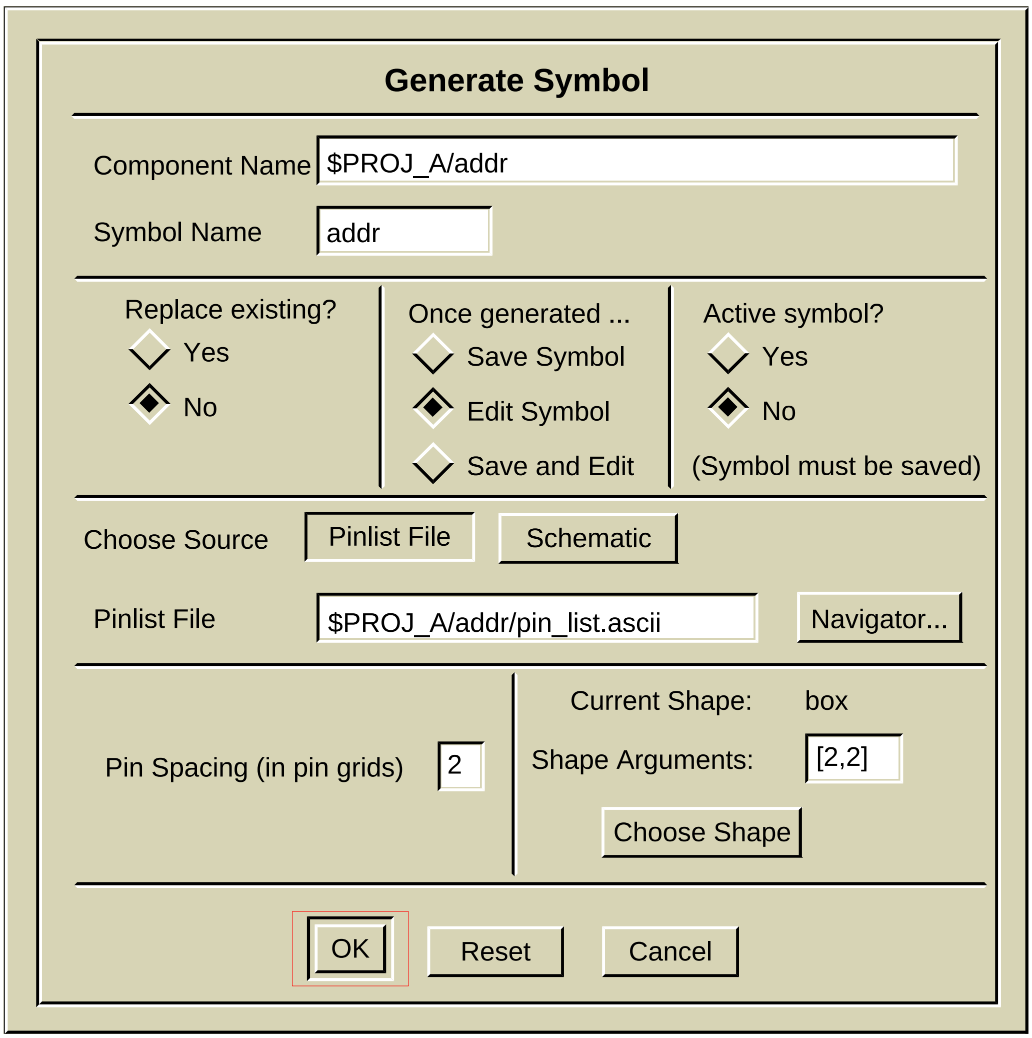


Figure 2-18. Generate Symbol Dialog Box

The following code block shows an example of a pin list file.

```
// Mentor Graphics pin list file for symbol generation.
// Created:  05/16/94 by Fred Jones

pins {          // Pin information
  "DIN(7:0)",   input, width 8, side 3, position_on_side 1,
                no_bubble, no_edgesense;
  "DIN(7:0)",   input, width 8, side 3, position_on_side 1,
                no_bubble, no_edgesense;
  "DOUT(7:0)",  output, width 8, side 1, position_on_side 0,
                no_bubble, no_edgesense;
  "CLK",        label "C", input, width 1, side 3,
                position_on_side 0, no_bubble, edgesense;
}

body_props {    // Property information
  name "W", text "W=", number, value "8", region 1;
  name "INST", string, value "I$0", region 3;
}

shape buf, 4;   // Shape information
```

For detailed information about the constructs used in the pin list file, refer to the "Pin List File Format" appendix in the *Design Architect Reference Manual*.

Edit Symbol In-Place

You can edit a symbol in-place on a schematic sheet. Errors such as mismatching the symbol pins with connecting nets, or using incorrect pin spacing, are avoided because you can modify the symbol model in the position of its instance on the schematic.

You open a selected instance in-place on a schematic sheet with the Begin Edit Symbol command. When the symbol is opened, the nets and instances on the sheet are grayed out, but are still visible while you are editing the symbol contents. All symbol editing commands are now accessible.

It is possible to have another window open on the symbol. This allows both a schematic context edit view, and a symbol window where the symbol can be viewed and edited by itself (out of context of the schematic). Edits made in the out-of-context window are visible on the symbol edited in-place.

You exit the symbol edit in-place mode and update the symbol instance on the schematic sheet with the End Edit Symbol command. If you do not specify the -Force switch and edits have been made but not written, you are prompted with a "Save changes?" request. Answering with a "yes" response writes edits to disk before closing the symbol. You can use the -Force command line switch to quit out of edit, with no changes saved.

Make a Symbol on a Schematic Sheet

Instead of having to open a Symbol Editor window to execute the graphic generating commands to create the symbol, you can make a symbol from comment objects and symbol pins on your schematic sheet. This methodology is useful for top-down design creation.

The Make Symbol command converts selected schematic comment objects and symbol pins to symbol graphics, and then checks the symbol. If errors in any required symbol checks are found, the command is aborted, and the selected objects remain on the schematic sheet. If no errors are found, the selected comment objects and symbol pins are deleted from the schematic sheet, and the symbol model just created is instantiated in-place on the schematic sheet. If you select objects other than comments and symbol pins, an error is reported.

NOTE: Symbol pins become part of a symbol when you issue the Make Symbol command. If the pins on a schematic sheet have not been made part of a symbol definition, an error will be reported with the required schematic sheet checks.

Elements of VHDL

The VHDL language has many constructs that are similar to objects used to create schematics and symbols. Both methods are capable of fully describing the structural and behavioral characteristics of a circuit. To learn about creating VHDL models, refer to the appropriate topics from the following list:

- VHDL language constructs

  IEEE Standard VHDL Language Reference Manual

  Mentor Graphics Introduction to VHDL

  Mentor Graphics VHDL Reference Manual

- VHDL text editing

  QuickVHDL User's and Reference Manual

  System-1076 Design and Model Development Manual

  Notepad User's and Reference Manual

- Compiling VHDL models

  QuickVHDL User's and Reference Manual

  System-1076 Design and Model Development Manual

- VHDL model registration

  "VHDL Registration" on page 2-83 (this manual)

Object Selection

To work with objects on the screen, you must first select them. You can move, copy, flip, rotate, or pivot a selected object (or group of objects), as well as perform a variety of other operations. For selection procedures, refer to "Selecting and Unselecting Objects" starting on page 6-6.

Topics related to object selection are as follows:

- General selection
- Specific selection
- Selection sets
- Reopen selection
- Reselection
- Selection filters
- Individual selection
- Text selection
- Selecting objects in multiple windows
- Unselecting objects

General Selection

There are four common ways to select object(s):

1. Move the cursor over the object and click the Select (left) mouse button. This action toggles the object between its selected and unselected state.

2. Put the cursor near the object(s) to select, hold the Select mouse button down, drag an expandable box, called the *dynamic rectangle*, until all the object(s) you want selected are in the rectangle, then release the Select mouse button.

3. Put the cursor near the object(s) you want selected, hold the F1 (Select Area Anything) function key down and drag the dynamic rectangle until all the object(s) you want selected are in the rectangle. Release the function key.

4. Execute the appropriate **Select** menu items. For examples of using the **Select** menu items, refer to "Selecting Objects" beginning on page 6-6.

Selection types 1 and 2 use the selection filter to define which type(s) of objects are selected. To set up the selection filter, click on the **Set Select Filter** palette button, or execute the Setup Select Filter command. Selection types 3 and 4 do not use a selection filter; they select all object types within the dynamic rectangle. Selection filters are described on page 2-68.

Specific Selection

You can specify what types of objects you want to select or unselect. Popup menu items **Select > All**, **Select > Area,** and **Select > Exterior** let you choose one of the following items:

- Comment graphics
- Comment text
- Frame
- Net

- Pin
- Property
- Segment
- Symbol pin
- Symbol body
- Vertex

Other **Select** popup menu items let you select:

- Attached (nets, pins, instances, branches)
- By object handle
- By property (owners, name, type, value)

Selection Sets

Selected objects are called a *selection set*. Items are added to the selection set by placing an object (instance, net) on the sheet or by selecting an existing object. Multiple Select commands can add more items to the open selection set. If an edit or report operation is performed, the selection set is closed, but the objects remain selected. A *closed selection set* means that no more selections can be added to the set. The next Select command or placement of a new object on the sheet creates and opens a new selection set, and unselects all objects within the closed selection set.

The Select Count in the status line shows whether the selection set is open or closed. If the number of selected items is followed by a plus (+) character, the selection set is open ("Sel. 2+"); otherwise, the selection set is closed ("Sel. 2 ").

Reopen Selection

You can reopen the previously closed selection set with the Reopen Selection command. This selection set remains open until another edit operation is performed. For example, if you select three instances and rotate them (closing the selection set), and then you want to move those three instances, plus four other instances, you execute the Reopen Selection command, then select the additional four instances, prior to performing the move.

Reselection

The previously closed selection set is called the *reselection set*. You can use the Reselect command to select the reselection set. If the current selection set is open, the Reselect command adds the contents of the reselection set to the current selection set, leaving the selection set open. If the current selection set is closed, it will become the new reselection set, and the current reselection set will be the new selection set. The following example shows how reselection operates with respect to selection sets.

For this example, you select some instances and nets, and identify this selection set as "Group A". If you perform a Move command on Group A, the selection set is closed, but the objects in Group A are still selected, as shown in Figure 2-19.

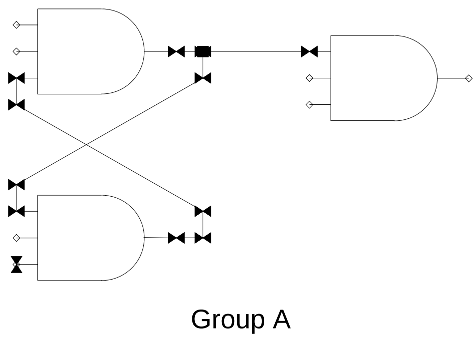


Figure 2-19. Group A Selected

Next, select another group of instances and nets. This action closes Group A, and creates another selection set identified as "Group B", as shown in Figure 2-20. Group A is now the reselection set.

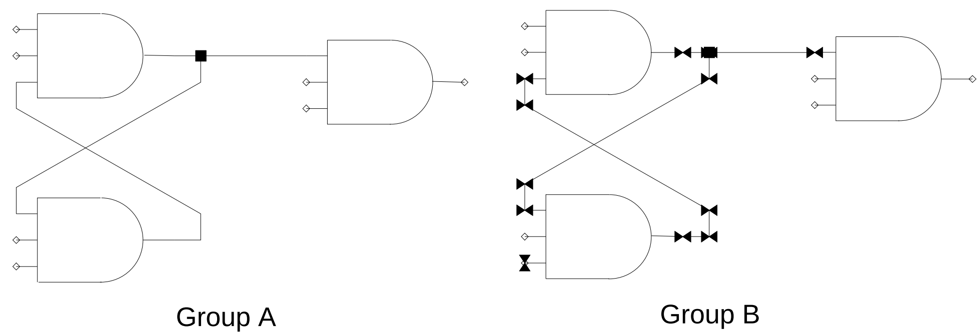


Figure 2-20. Group A Closed, Group B Selected

Perform a Move command on Group B, which closes this selection set. Next you issue the Reselect command. Because Group B is closed, it becomes the reselection set, and Group A is the new selection set, as shown in Figure 2-21.

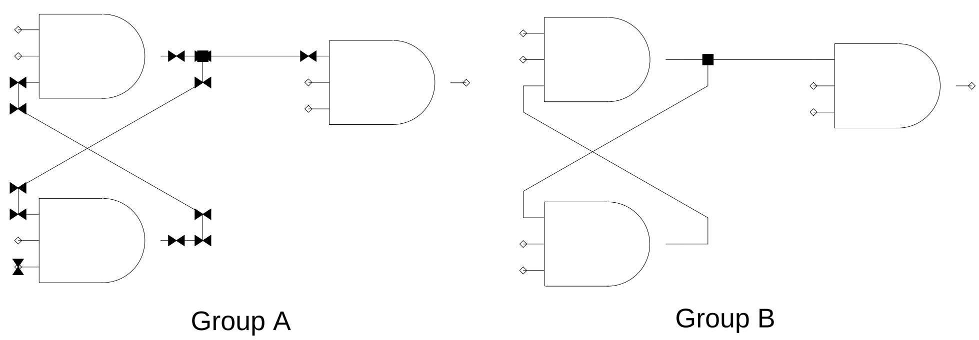


Figure 2-21. Group A Reselected, Group B Closed

Now Group A is current and open, able to accept additional selections. Issue the Reselect command again, which selects Group B. Because the current selection set (Group A) is open, Group B is added to Group A. Thus, the new open selection set is the sum of the selection set, Group A, and the reselection set, Group B, as shown in Figure 2-22.

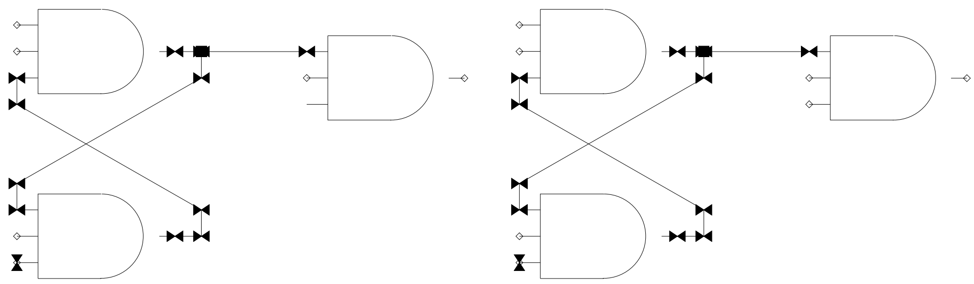


Figure 2-22. Selection Set (Sum of Groups A and B)

Selection Filters

A selection filter lets you specify a set of criteria used to select a defined subset of objects. You can define a selection filter for one selection by supplying arguments to a particular Select command, or by defining a selection filter to use until it is subsequently modified. Selection filters are extremely useful when trying to select a particular type of object in an area that contains many types of objects.

For example, you may want to select pins on an instance in a schematic sheet. Because this selection of "only pins" needs to occur once, you can use the Select Area command with the -Pin switch to select the pins. This command causes only pins in the specified area to be selected, and the selection filter is enabled again after the selection is complete.

Design Architect has three selection filters defined for the Schematic Editor. Each filter is designed to use with the palette of the same name. The Add/Route filter default setting selects instances, pins, net segments, and vertices. This is the default selection filter. The Text filter default setting only selects property text and comment text. The Draw filter default setting selects comments and symbol pins. The Symbol Editor selection filter default setting selects pins and symbol bodies by default.

You can change from one selection filter to another (in the Schematic Editor) or redefine a selection filter by clicking on the Set Select Filter button in the palette. Design Architect does not change the selection filter when you change to a different palette in the same scope.

You can also define unselection filters used in the unselection of objects. The $setup_unselect_filter() function is described in the *Design Architect Reference Manual*.

Individual Selection

By default, Design Architect uses the additive selection using open and closed selection sets. However, you can change this method of selection to an individual selection model, in which the Select mouse button is defined to unselect objects before doing a select using the selection filter. This means you never need to know the state of the selection set. This also lets you click the Select mouse button in an empty space in the edit window to unselect all objects. To get additive selection in this mode, press the Control key and Select mouse button simultaneously.

You can choose the selection model you want to use through the **Setup > Set > Additive Selection/Individual Selection** pulldown menu item in the Session window.

Text Selection

Generally, you do not mix the selection of text and graphics, so the select filter is rarely set to select text. To make text selection easier, the Shift key-Select mouse button sequence is defined to select only text. This method of selection honors the additive versus individual selection model discussed in "Individual Selection" on page 2-69.

In the Schematic Editor, you can select any type of text using this method. In the Symbol Editor, this key sequence selects property text and comment text (symbol text converted to comment text); it does not select symbol text.

Multiple Window Object Selection

When multiple windows are open on the same sheet, objects in the sheet which are selected in one window are highlighted in each of the windows and can be operated upon from any of the windows open into the sheet.

A selection set is created for each symbol or schematic sheet displayed in a Design Architect window. When you activate another window, you have changed the selection set you were working in to the new active window selection set. As an example, you cannot select an object from one window and select another object from another window and move both of these objects simultaneously with the same move command to another window.

Unselect Objects

When you finish performing an action on selected objects, you should unselect them, so you won't inadvertently perform any further actions on them.

There are several ways to unselect object(s):

1. Click the Select mouse button on the Unselect All icon in the palette.

2. Move the cursor over the object and click with the Select mouse button. This action toggles the object between its selected and unselected state.

3. Press the F2 (Unselect All) function key. This unselects all selected objects.

4. Press and hold the Alt key and Select mouse button simultaneously, and drag the dynamic rectangle to include the objects you want unselected, then release the Alt key and mouse button.

5. Put the cursor near the object(s) you want unselected, hold the Shift-F2 Unselect Area Anything function key down and drag the dynamic rectangle until all the object(s) you want unselected are included in the rectangle. Release the function key.

6. Execute the appropriate **Unselect** menu items. Refer to "Selecting and Unselecting Objects" in this manual for examples of using the **Unselect** menu items.

Manipulate Objects

After electrical, graphical, and comment objects have been placed on the screen, they can be moved, flipped, rotated, copied, deleted, grouped, and pivoted as required for the design. Refer to "Manipulating Graphical Objects", starting on page 6-11, for detailed information on how to use these commands. These operations are executed with the following commands:

- **Move** - moves selected objects
- **Flip** - flips selected objects
- **Rotate** - rotates selected objects around a single basepoint in multiples of 90 degrees.
- **Copy** - duplicates selected objects
- **Copy Multiple** - duplicates selected objects the specified number of times in a line in the direction indicated by the cursor
- **Copy to Array** - duplicates selected objects, placing them in the specified number of rows and columns
- **Group** - groups selected objects
- **Delete** - deletes selected objects
- **Pivot** - pivots selected objects individually about their own origins in multiples of 90 degrees.

Inter-Window Copy and Move

You can move objects to and from schematic and symbol windows. Any object selected and visible on the screen can be moved or copied with the Move and Copy commands. Refer to "Manipulating Graphical Objects" for inter-window move and copy procedures.

When objects are moved to another window, they are converted to the type of objects the other window's editor understands. For example, when you move selected schematic objects to another schematic window a one-to-one translation occurs. A net becomes a net, an instance becomes an instance, and so forth.

When you move or copy objects from a schematic window to a symbol window, or from a symbol window to a schematic window, an object conversion occurs. Refer to Table 2-5 for how schematic objects are converted to symbol objects.

Table 2-5. Schematic Objects to Symbol Objects

Schematic Objects	To Symbol Objects
Instances, nets, pins, visible comments, and visible properties	Symbol text and graphics, and properties
Invisible properties	No translation

Refer to Table 2-6 for information on how symbol objects are converted to schematic objects.

Table 2-6. Symbol Objects to Schematic Objects

Symbol Objects	To Schematic Objects
Symbol graphics, visible properties (not pin properties), symbol comments	Comment text and graphics, and properties
Pins	No change
Properties attached to the pins	No change
Invisible properties (not pin properties)	No translation

Undo and Redo

The Undo and Redo commands help you return your application to a previous state. They are usually used after a command has been executed by mistake. For example, if you have moved an instance to a mistaken location, you can then execute the Undo command to return to the state you were in before you moved the instance. If you execute an Undo command by mistake, you can execute a Redo command, and return to the state before you executed the last undo command.

The Undo command supports more than one level of undo; that is, you can execute the Undo command "n" number of times until you reach the specified undo level or you reach the top of the undo stack. You can set the undo level with the **Setup > Set > Undo Level** menu item or the $set_undo_level internal state function. The default number of undos is 5. The undo level also controls the redo level.

There is an Undo icon in each palette in the Symbol and Schematic Editors. Click the Select mouse button on the icon to undo an action. In the selection sensitive popup menus, choose **Undo > Undo**. To redo an unwanted undo, choose **Undo > Redo** from any of the selection sensitive popup menus.

DA Model Registration

When you create a schematic, VHDL, or symbol model in DA that you want to use in a design, you must register it with a component interface. The component interface is the mechanism that defines a set of models used by downstream applications. Registration occurs when you save the model (symbol, schematic) or compile a VHDL model. The model is, by default, registered to a component interface with the same name as the component. In most cases you will use the default registration set by the Save Sheet and Save Symbol commands.

Refer to pages 6-44 and 6-92 for information on how to save and register your schematic and symbol. Refer to "Creating and Compiling Source Code" in the *System-1076 Design and Model Development Manual* for information on how to compile a VHDL model.

For the more advanced user, you may want to take advantage of the flexibility of the component structure. For example, you may want to have more than one schematic or symbol defined for one component, link other models (for example, technology files) with a single schematic, share the same model with other component interfaces, or define other component structures that make sense for your design needs. In these cases, you need to understand the mechanisms behind the registration process.

The following concepts are necessary to understand the registration process:

- The structure and definition of component, component interface, and model
- The relationship between a component interface and a model
- How labels bind models together
- The relationship between evaluated instances and the component interface

Definition of a Component

The *component* is a container that includes a part and model(s). The component'*s* models describe a device. A "flip flop", "mux", and "AND" devices are examples of components. Figure 2-23 shows the pieces that comprise a component and the component's relationship to a library.

As shown in Figure 2-23, a component contains the following:

- One or more component interfaces (stored within the part)
- One or more models

Hierarchically, a component is at a directory level. The models which make up the component are files or file sets hierarchically below the component. The component is represented iconically within the Design Manager. Viewing "down" through the component reveals icons that represent the part, models, and other files.

The *component interface* is not iconically represented within the Design Manager. The component interface defines the group of models used in a design application (simulation, for example). The component interface is stored within the part object.

The *part* object appears as a icon in the Design Manager. One and only one part can map to a component. The part is at the same hierarchical level in the file system as the models, as illustrated in Figure 2-23.

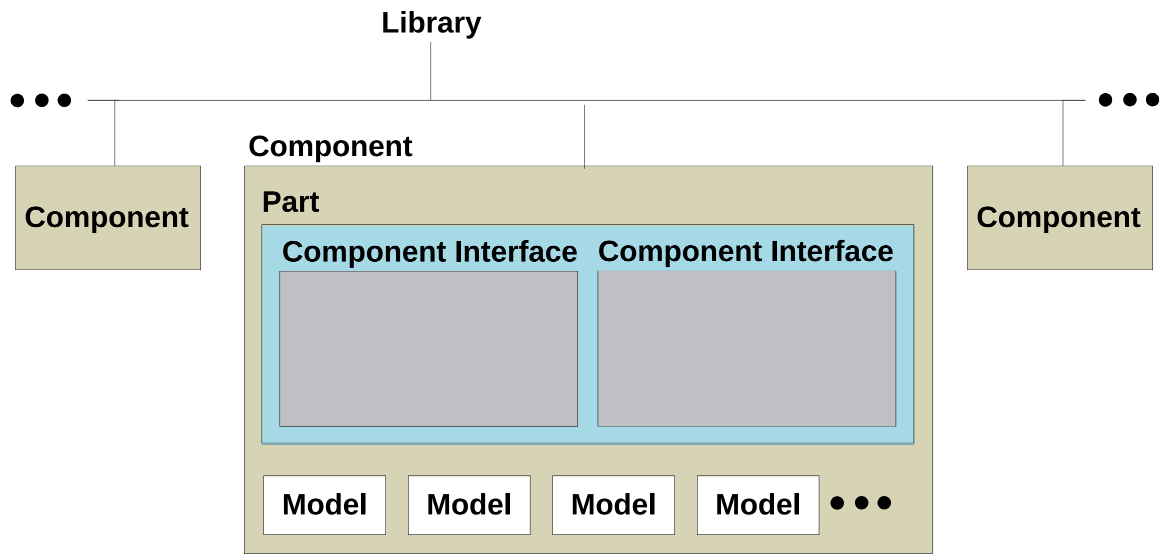


Figure 2-23. Composition of a Component

Component Interface

The *component interface* defines an electrical interface to a component, and a list of models that match that interface. One or more component interfaces can be logically contained within a part. Figure 2-23 shows the logical relationship between a component and its component interface(s).

You can think of the component interface as the "roadmap" to the models used. For more information on how models and component interfaces interact with each other, refer to "Instance Evaluation," beginning on page 2-86.

A component interface contains several pieces of information, including: the component interface name, pin list, property set, and model table, as illustrated in Figure 2-24 and described in the following list:

- A *component interface name* can be set by you. The default *component interface name* matches its associated component name.
- A *pin list* is a one-to-one mapping with the pins used by the symbol model. This list is created automatically when the component interface is created at the time you save and register the symbol.
- A *body property set* contains property name/value pairs for the body of the symbol model. This is also created automatically when the component interface is created when you save and register the symbol.
- A *model table* contains model entries which are links between the component interface and the models to which it has access.

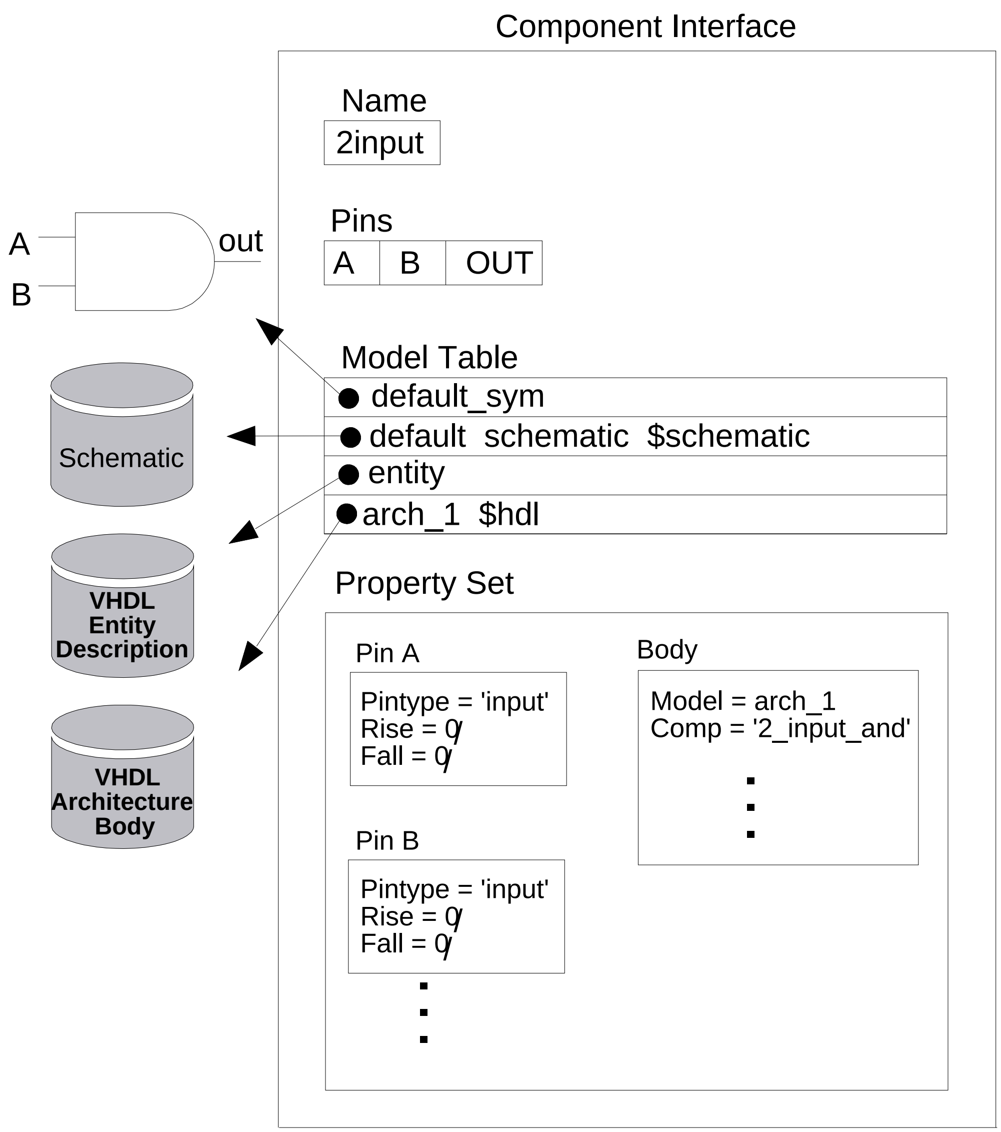


Figure 2-24. Component Interface

The elements of a component interface can be viewed and edited with the Component Window or the Component Interface Browser. For more information about the Component Window, refer to the *Design Manager User's Manual*. For information about the Component Interface Browser, refer to the *Component Interface Browser User's and Reference Manual*. In Design Architect, the Report Interfaces command also shows the elements of a component interface, but limits information to models created only by Design Architect.

Model

A *model* is defined as a functional or non-functional description of a device. Functional models are used by analysis applications, such as QuickSim II, to describe the function of a circuit. Examples of functional models are VHDL, schematic, QuickPart table, and Behavioral Language Model (BLM). Non-functional models are also used by applications, but do not describe the function of a circuit. They describe, for example, the timing of the circuit (technology file), or the graphical symbolic representation of the circuit (symbol). One or more functional and non-functional models can be logically associated with a component through a component interface. Figure 2-23 shows the logical relationship between models and components.

A model can be shared with other component interfaces, as shown in Figure 2-25. A model can be used by the component interface after it has been registered with the component interface. All models except symbol models and VHDL models can be registered with more than one component interface. Symbol models and VHDL models can only be registered with one component interface per component. To use a VHDL model with a different component, copy the VHDL source to reside under the new component and recompile. Use the **MGC > Design Management > Copy Object** menu item in either Design Architect or the Design Manager to copy design objects.

Figure 2-25 shows the symbol model represented hierarchically above the component interface. The one-to-one association of symbol and component interface allows you to think of the symbol as the entity that represents the specific pin property set of the component interface.

Registration and Labeling

Whenever you create a functional model that you wish to use in a component, you must register it with a component interface. Registration involves assigning a label to a model, and associating the model and its label with a component interface. Every model has at least one label associated with it.

NOTE: Models within the same type (such as symbols) registered to the same component interface must have unique user-defined labels.

Labels are assigned to model entries in the component interface model table. You can assign more than one label to a model, and register a single model with more than one component interface (except for symbol and VHDL models). Each time you register a model with a component interface, you effectively add an entry to the model table. This entry provides the link between the component interface and the model, and also provides the set of labels associated with the model used in model selection by downstream applications.

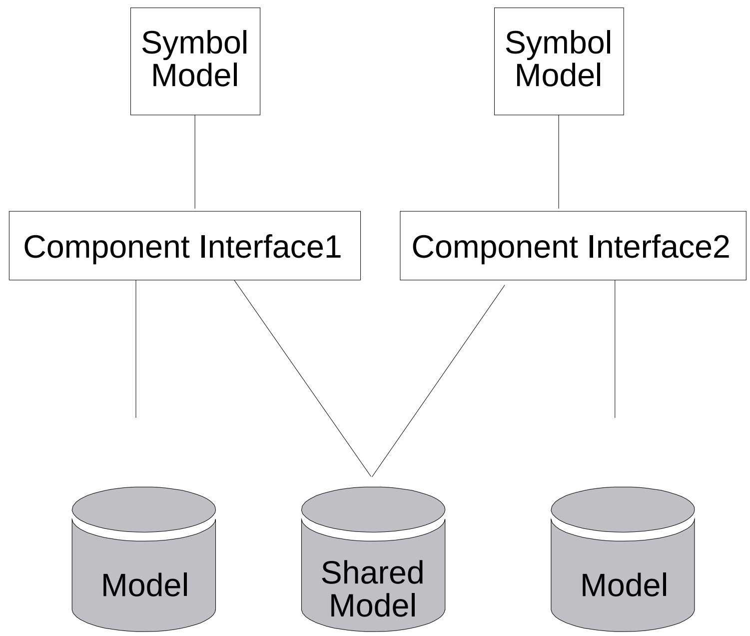


Figure 2-25. Shared Model

Symbol Registration

When you save a symbol using **File > Save Symbol > Default Registration**, your symbol is automatically registered. If the symbol is new, a component interface is created with a pin list, symbol body property list, and a component interface name that matches the component name. If you do not specify other options, the "default_sym" label is inserted in the model entry, as shown in Figure 2-26. This label identifies the symbol as the default symbol for the component interface. This default action also specifies the component interface as the default for this component.

If the symbol is already registered to the component interface when the symbol is saved, it checks to see if the symbol is still valid for this component interface. If the symbol is not valid for the component interface (for example, the number of pins on the symbol do not match the number of pins in the component interface), the Save Symbol command will query you as to whether you want to save the symbol and update the component interface. This action invalidates any other models registered to that component interface.

Refer to "Saving and Registering a Symbol" on page 6-92 for a procedure on how to save and register your symbol.

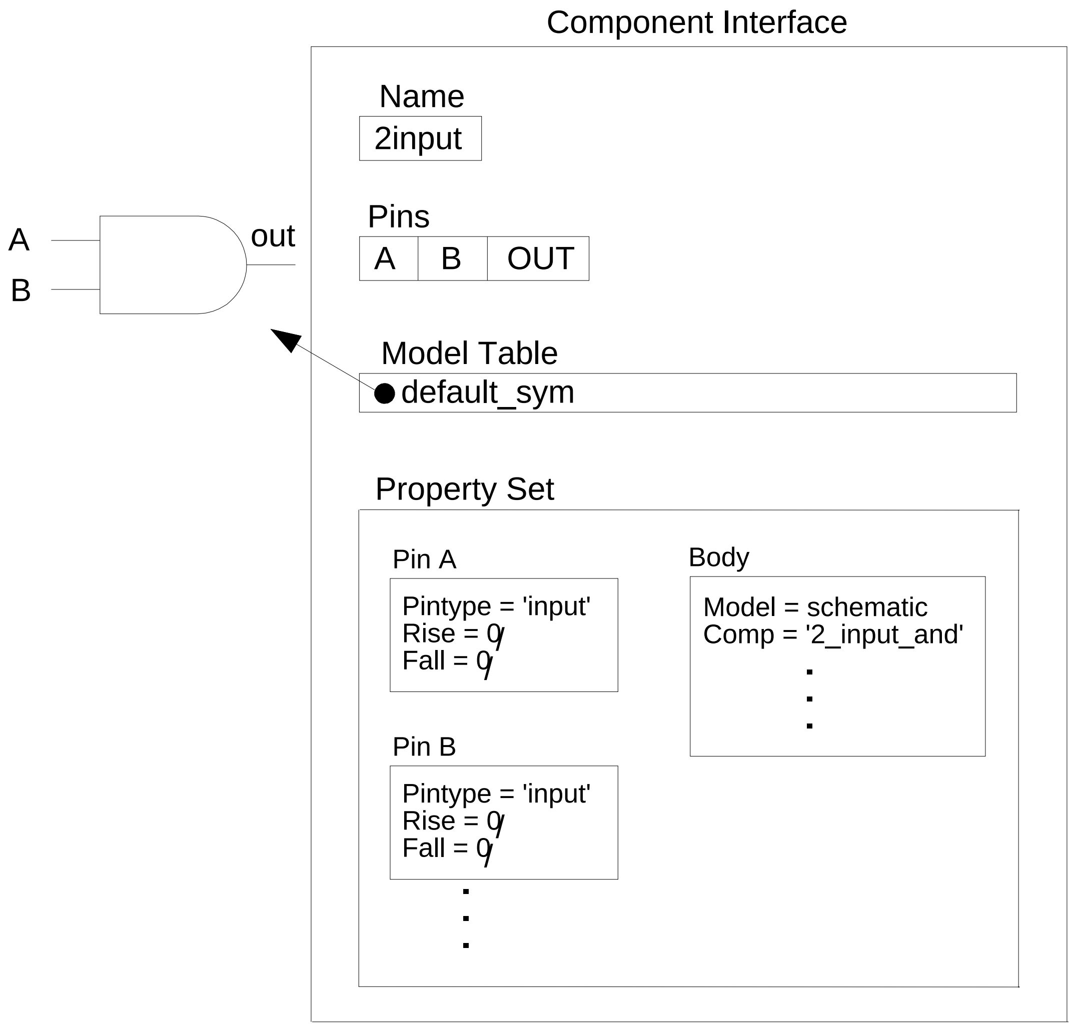


Figure 2-26. Symbol Registration

Multiple Symbols Registered to One Component Interface

A component may contain multiple symbols that are graphically different but share the same functionality of the component. For example, you may create a MG_STD positive logic, MG_STD negative logic, and an ANSI standard symbol for a specific component.

In the case where library parts have multiple symbols and each symbol has the same pins and properties, it is recommended that you register all symbols to one component interface. This can only be done if each of the symbols have the same pins and properties.

In cases where they do not, a separate component interface must be created for each symbol.

For a procedure on how to register multiple symbols to one component interface, see "Registering Multiple Symbols to One Component Interface" on page 6-93.

Schematic Registration

A schematic may be composed of multiple schematic sheets. Each sheet "knows" what schematic it belongs to. When you save the schematic sheet using the default save menu item **File > Save > Default Registration**, your schematic is automatically registered. If the schematic itself is new (this is the first schematic sheet saved in this schematic), and a component interface does not exist, a default component interface (with no pin and property information) is created, and is named the same name as the leaf of the component name.

If the schematic itself is new, but a default component interface already exists, the schematic is registered with that component interface. If you are saving an existing sheet, the schematic's registration does not change.

Every time you register a schematic, two labels are created and are inserted in the component interface model table. The first is the name of the schematic, in this case "schematic," as shown in Figure 2-27. The second label is $schematic. The model type can be used by downstream applications to select the model.

If the schematic is the first schematic model to be registered with this component interface, it is labeled "default," specifying it as the default schematic model for this component interface. Otherwise, to define the schematic as the default schematic registered to the component interface, the "default" label must be explicitly assigned with the Save Sheet command.

Refer to page 6-44 for the procedures used to save your sheet and register your schematic.

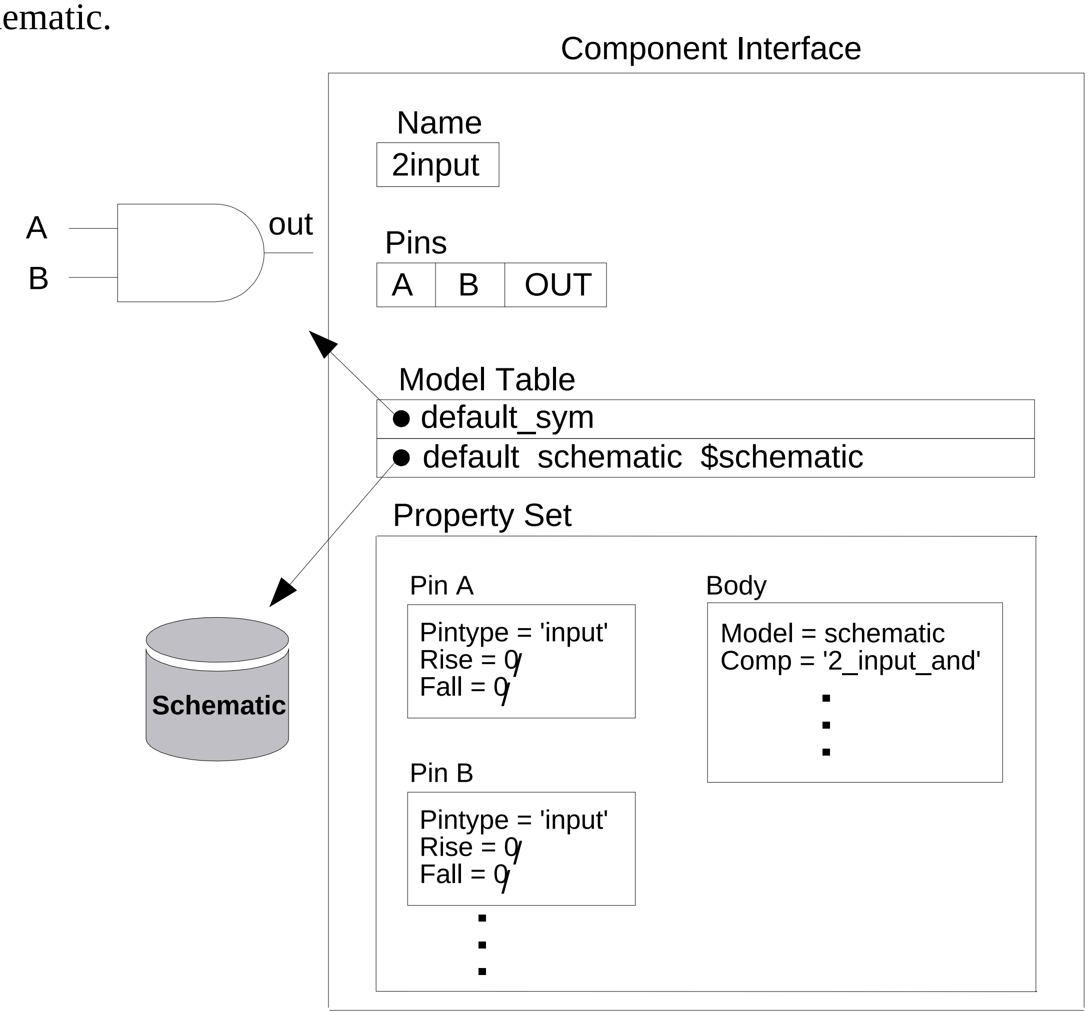


Figure 2-27. Schematic Registration

If the label "default" is used for a schematic, Design Architect scans the model table and removes the "default" label from any other schematic or VHDL model registered with that component interface.

VHDL Registration

A VHDL model consists of two pieces: a *primary design unit* and a *secondary design unit*. The primary design unit describes the electrical interface between the modeled device and the outside world. In VHDL terms, the primary design unit is also known as the *entity description*. The secondary design unit provides the functional description of the electrical device. This unit can describe the device behaviorally, in terms of data flow, or at the gate level.

You can have multiple secondary design units that are compatible with the same primary design unit. In VHDL terms a secondary design unit is known as an *architecture body*. You can include both the entity description and the architecture body(ies) in the same text file or within individual files.

You register a VHDL model to a specified component when you compile the model. In the VHDL Editor, the Compile command compiles the VHDL model (both entity and architecture body) using the options specified with the Set Compiler Options command. The entity description and the architecture body are registered as two separate entries into the model table as shown in Figure .

The first entry label is the entity description identifier, in this case "entity," as shown in Figure . The second entry has a label and a model type. The name represents the architectural body identifier, in this case "arch_1". The $hdl identifies the model type as a VHDL which can be used by downstream applications to select the model.

If the VHDL model is the first functional model to be registered with this component interface, it is labeled "default," specifying it as the default functional model for the component interface. Otherwise, to define the VHDL model as the default VHDL registered to the component, the "default" label must be explicitly assigned to the component interface with the Component Interface Browser.

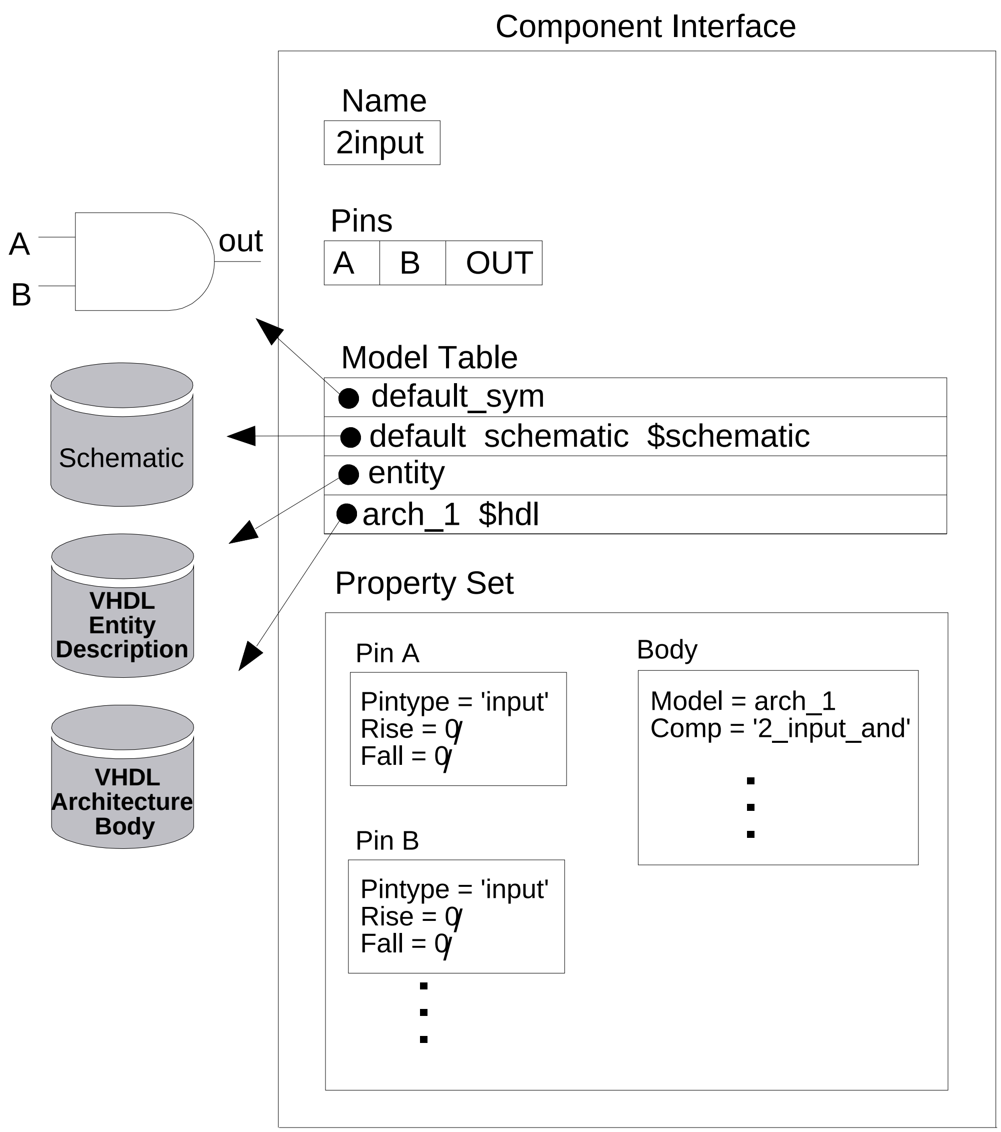


Figure 2-28. VHDL Registration

Registration of Multiple Models

If you register multiple model types to a component interface you should add a set of labels that identifies the combinations of models you wish to use. In Figure 2-29, a schematic model, symbol model, and two technology files are registered to one component interface. The label name "default_sym" is associated with the symbol model and is used by Mentor Graphics to identify the symbol as the default symbol for the component interface.

In this example, the other label names .8uS and 1uS were picked by you to identify combinations of models available for use. For example, in Figure 2-29, the label ".8uS" is entered in the model table for the .8-micron technology file and the schematic model. This binds the schematic to the .8-micron technology file, since both have the same label. The "1uS" label is entered for the 1-micron technology file and the schematic. This binds the schematic to the 1-micron technology file, since both have the same label.

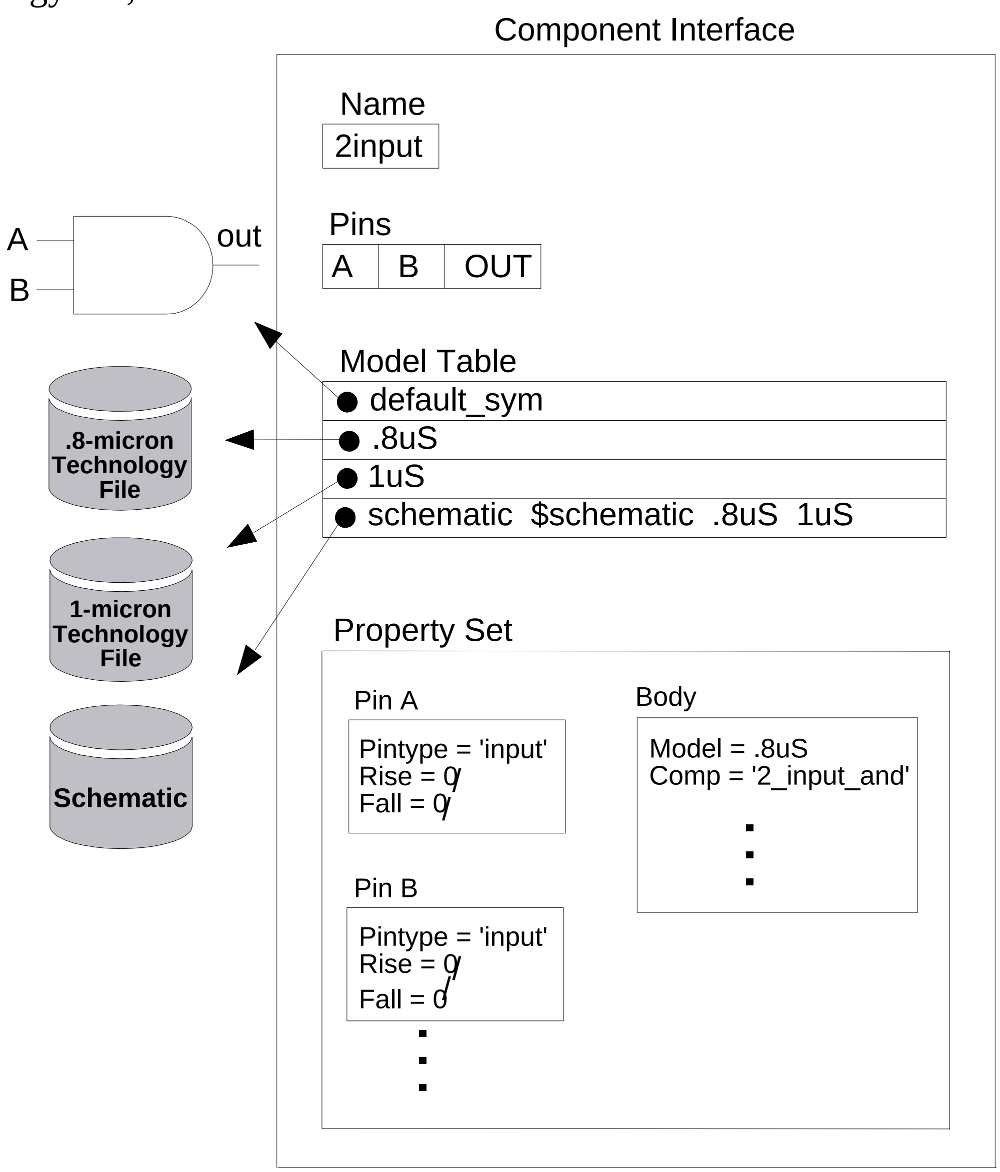


Figure 2-29. Registering Multiple Models

The different labels define all the workable combinations of models entered in the component interface. Labels are not restricted to these names. Any naming conventions appropriate for your design needs can be used as labels, although models of the same type must have unique labels. For example, if you have two schematic models registered with an interface, Design Architect will assign the "$schematic" label to them; you need to assign unique labels to each of them to identify the desired schematic model for a symbol instance.

To select the models appropriate to the .8-micron technology file, set the instance's Model property to ".8uS" to tell the simulators which models to choose. Refer to page 2-86 for more information about instance evaluation.

Labels are added to the component interface model table for schematics with the Save Sheet command. For more information about registration syntax for other models, see the V8 document that describes how to create a particular model.

Instance Evaluation

An instance is defined as a reference to a particular component interface. After you have registered a set of models to a component interface, and identified the group of models you want to use through the use of labels, the analysis application can then evaluate the instance. Whenever an application evaluates an instance, the application must understand how the device works. For example, when QuickSim II evaluates an instance, it needs to know how the device's timing works.

An instance can have many properties. Of all these properties, the Model property is key to instance evaluation. The evaluating application uses the value of the Model property on the instance to compare against the labels of its registered models. For example, consider the component interface and models shown in Figure 2-30.

This example shows a component interface with several models. Note that the models have been registered with several labels. This component interface and group of models could represent a library organization that revolves around different chip manufacturing technologies, or perhaps the need to have different types of models for various downstream applications or types of simulation. In any case, several models exist that can possibly provide a definition for the instance.

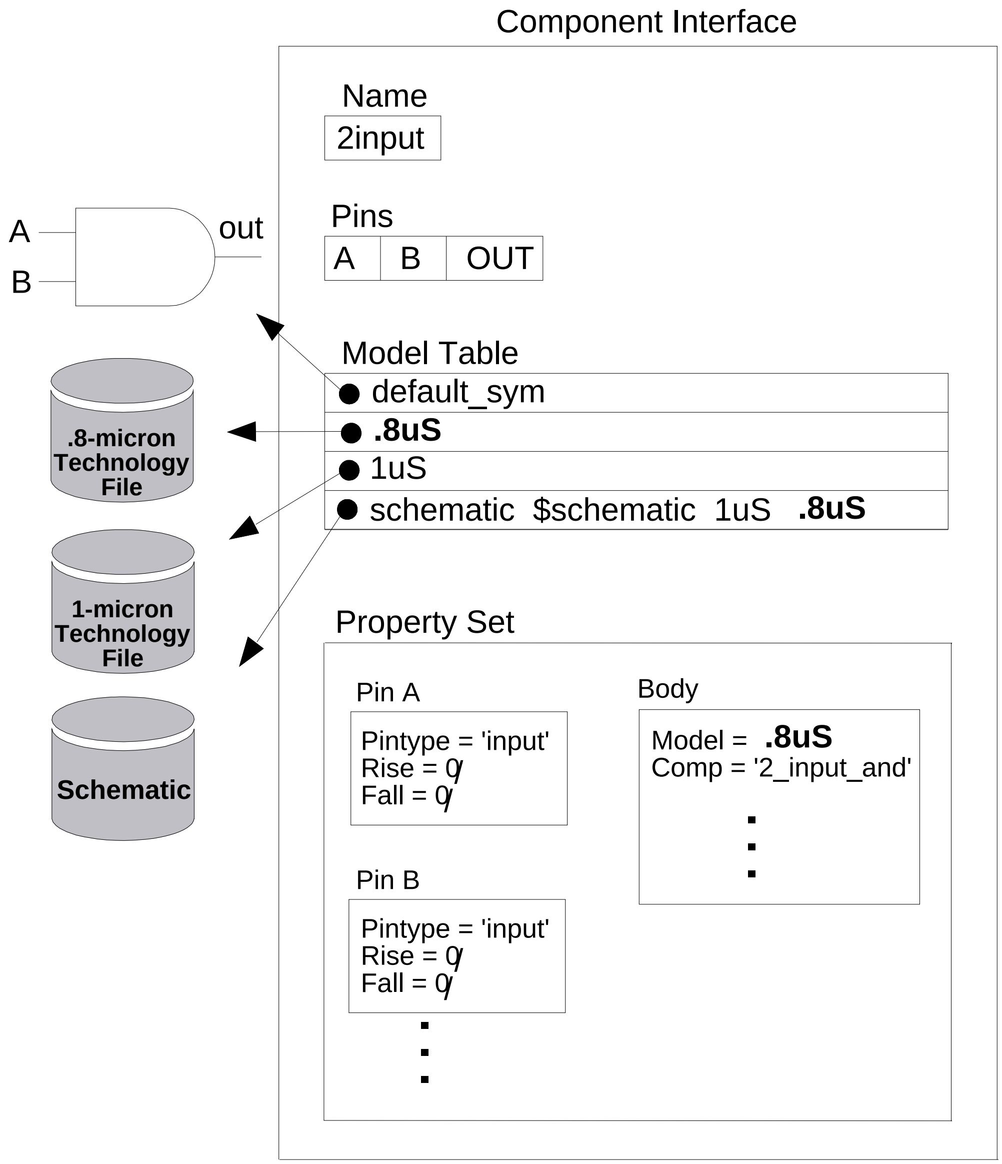


Figure 2-30. Instance Evaluation

Note also that the value of the Model property in the figure is ".8uS". When the instance is being defined, the group of labels for each model registered with the component interface is examined for a match against the Model property value. If a match is found, that model becomes part of the instance's definition. When all models have been examined, the instance is defined.

Figure 2-30 shows the selected models by highlighting the labels that match the Model property value of ".8uS". In this example, the .8-micron technology file and the schematic model both have labels that match the value of ".8uS". The symbol model is labeled as the default symbol, including this model in any model combination. None of the other registered models have the ".8uS" label or are labeled as default. Thus, the instance identified by the ".8uS" label has a symbolic, functional, and timing description.

Changing the value of the Model property on an instance allows you to easily select different models. Once a new definition for the instance exists, the application can re-evaluate the device again. This can all occur without rebuilding the design.

Manipulating Design Objects

You can copy, move, resize, group, delete, and release design objects in the Design Manager, or with very similar functionality, in the Integrated Design Manager (iDM) within Design Architect. For complete information about these topics, refer to the *Design Manager User's Manual*.

CAUTION: Attribute files are in ASCII format. As a result, they can be edited. **Do not edit these files.** If you edit an attribute file directly, you can corrupt the design object to which it belongs. Use the Design Manager or iDM to edit ALL design references; it will automatically update the attribute files for you.

In Design Architect, the iDM functions reside in the **MGC** pulldown menu, shown in Figure 2-31, or in the Session popup menu. These functions provide an easy way to copy, move, delete, and change references from within Design Architect. iDM also provides the ability to navigate through your designs, and to view and interact with your design hierarchy.

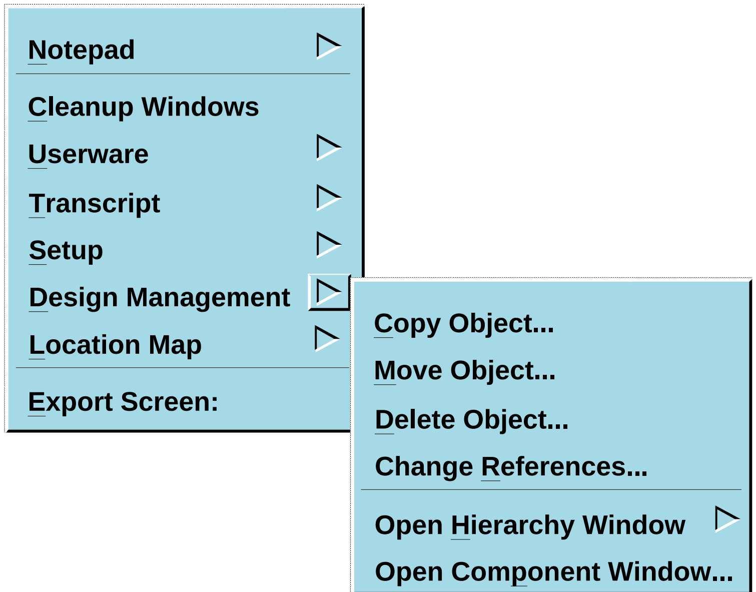


Figure 2-31. File > Design Management Menu

Creating a Configuration Object

In the Design Manager, a *configuration object* defines a collection of data objects that are interrelated by containment or by references. The reason for a configuration object is to give you the ability to treat design objects as a single unit for certain operations such as moving, copying, and releasing.

You specify which design objects (called primary objects) you want in the configuration, then specify build rules for each primary object. The Design Manager builds the configuration, according to the rules you set. Save the configuration; all the information needed to recreate the configuration instantly at a later time is stored in the configuration object.

Configuration objects are represented by icons in navigator windows. You can select the icon and perform operations on all objects in the configuration with a single command, or open the configuration object for editing or viewing.

Configuration objects are discussed in detail in the *Design Manager's User's Manual*.

Copying a Design/Library Component

The Design Manager copies objects in two modes: by reference or by containment. The copy by reference requires a configuration object to find all design objects associated with a design, and operates on them as a single unit.

Copying by containment is simpler and more common. All objects contained in the directory hierarchy below the specified object are copied. All resolved references are automatically updated. Any references that were unresolved before the copy operation remain unchanged. You can modify these references to point to existing objects within the Design Manager or the iDM environments. If you do not use the Design Manager or iDM to copy design objects, the original references remained unchanged.

When you copy a schematic or symbol model, the new copy is not registered with any interface. You must register the newly copied object using either Design Architect or the Component Interface Browser.

For general information about copying a design or library component, refer to "Copying a Design Object" in the *Design Manager User's Manual*.

Moving a Component

In general, design objects should be moved *after* you have made a backup copy. This is a reliability issue primarily for larger collections of objects because of the time required to complete the move and update the references. Network problems could cause the operation to fail before it completed, leaving no easy way to recover.

When you move an object within a component or design, all objects in the selected object's containment hierarchy 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 remain unchanged.) When moving objects that contain other objects such as components and schematics, all inter-object references between the contained objects are updated.

Any design object that references the moved object, but is not either contained by the moved object or in the selected set of objects to move, will not have the reference updated. Thus, the design object reference that points to a non-existent design object is broken. You must manually update this reference so that it points to the new location of the moved design object. This topic is covered on page 2-94.

Design Manager allows all types of objects to be moved. However, because schematic models are registered with their containing components, attempts to move symbols and schematics outside of their containing components will result in an error, and the move will not take place. You can move symbols and schematics within the component, that is, rename them. You can also copy symbols and schematics outside their containing components.

For general information about moving a component, refer to "Moving a Design Object" in the *Design Manager User's Manual*.

Renaming a Component

Renaming a component renames the file set (all objects that are of the same file set) that is selected, and then changes references within the file set (container) hierarchy to reflect the change. External design object references that point to objects in the renamed container are not updated. These references will need to be updated.

When you change the name of the component container, the Design Manager only changes the objects at this level in the hierarchy. Examine Figure 2-32.

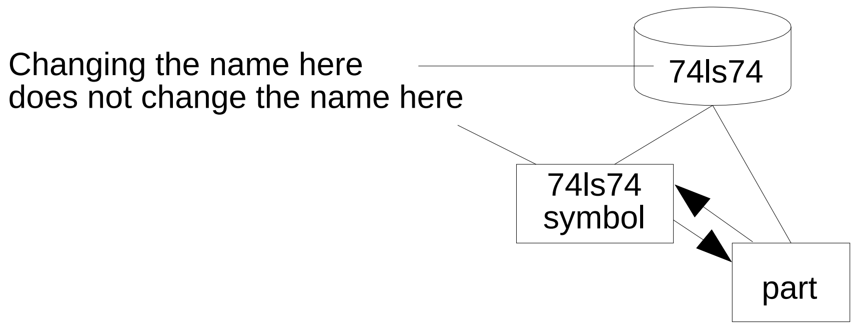


Figure 2-32. Renaming a Component Containing a Symbol

Note that for the typical component, the symbol name is the same as the component name. If you change the name of the component in the Design Manager, the symbol name remains the same. The Design Manager updates the component interface to reflect the new path so that when the component is requested in an application, the references are preserved.

For general information about renaming a component, refer to "Renaming a Design Object" in the *Design Manager User's Manual*.

Resizing an Instance

Normally when you place a symbol on a sheet, you have no choice as to what size it is; the size is determined in the Symbol Editor by how many pin grids it occupies and in the Schematic Editor by the pin spacing of the sheet. By default, Design Architect does not allow you to resize instances on a sheet, since many sites have stringent drafting standards and cannot use this functionality. However, you can change the default for a sheet to enable resizable instances.

Caution Changing the default on a sheet to allow resizable instances is irreversible.

You can use the $allow_resizable_instances() function to set up the sheet for resizing. To determine if resizable instances are already allowed on a sheet, you can use the $get_allow_resizable_instances() function; when you issue the command, "@true" in the transcript indicates that the sheet already allows resizing and "@false" indicates the sheet is still in default mode.

Since instances cannot shrink so they take up fewer pin grids than the original symbol, the pin spacing of the entire sheet is changed so that the size of the instance appears to have changed. The $allow_resizable_instances() function decreases the pinspacing of a sheet by a factor of four. New instances placed on that sheet automatically appear at the same relative size as other unscaled instances.

If your site decides it wants to use resizable instances, the $allow_resizable_instances() function should be issued from a schematic environment file so that it is executed for every sheet that is opened. This can be accomplished by placing the following function in a *da_session.startup* file:

```
$set_environment_dofile_pathname(@sheet,'dofile_pathname')
```

The dofile specified in the above function should contain "$allow_resizable_instances()" and any other sheet-specific startup commands. Using the method will ensure that every sheet that is opened at your site will include the ability to resize instances by default.

If the $allow_resizable_instances() function is executed on an existing sheet that already contains instances or comments, the pin spacing for those objects will be automatically adjusted so that they appear at normal scale, rather than smaller or larger. However, the preferred method is for a sheet to be set up for resizing when it is created.

Grouping Design Objects

You can group design objects in order to make other editing actions easier. For example, you can group objects together rather than repeatedly selecting the same items with time-consuming selection strokes. By giving the objects a group name, you can then select the group and move or copy it; the new objects do not retain the group name if they are copied.

You can append more objects to a group, which enables you to select and perform editing actions on more objects than the ones you originally had in the group. Additionally, you can report all the names of the groups in a design.

For operating procedures on grouping objects, refer to "Grouping Objects" on page 6-19 and "Ungrouping Objects" on page 6-20.

Deleting a Component

When you delete an object within a component, other objects in that component that might reference the deleted object are updated. However, if you delete an object (or an entire component), other objects that reference the deleted object (component) need updating. For example, if you delete *$MGC_GENLIB/and2*, then any designs that reference that component need updating.

Keep the following in mind when deleting design objects:

- Before deleting a model other than a symbol or schematic, unregister the model from the component interface using the Component Interface Browser.
- Deleting a symbol does not delete the pin and property information from the interface, unless it is the last pin-creating model. Check Schematic and other evaluations will continue to compare the pins and properties with the models registered with the interface. When the last pin-creating model is deleted or unregistered from an interface, the pins are removed from the interface. The models considered to be "pin-creating models" are symbols and VHDL entities.
- Always delete objects using iconic navigators. This method deletes file sets, not just files. Remember, external object references to the deleted object will always need to be changed.
- *Never* delete an object using operating system commands. These commands do not preserve design object and file set relationships, and can easily corrupt data beyond repair.

For general information about deleting a component, refer to "Deleting a Design Object" in the *Design Manager User's Manual*.

Changing Component References

In the iDM, you can change or delete the references that you previously created in the Design Manager or in an application. After you move or delete a design object, or if a design object has unresolved references, use the **MGC > Design Management > Change References** menu item to fix broken references. This displays a dialog box in which you specify a new reference target path. You can enter multiple reference changes at one time.

If the design was originally stored using soft pathnames, the references associated with the design should not have to be manually updated except to fix broken references. When using the Design Manager to manually edit references, use the soft pathname, if possible.

The Design Manager environment does support operating system relative pathnames, such as "." and "..". Although the Change Object References command allows you to change a reference to any string, you should always specify a path that begins with / or a "$" (such as *$MGC_GENLIB*) in order to provide soft pathname and location map compatibility. For general information about changing design or library component references, refer to "Working with References" in the *Design Manager User's Manual*.

Releasing Designs

A released design is a protected copy of a design object, or objects defined in a configuration object. When you release a design, you are only releasing a single version. If the original design object is at version number 8, the released design object becomes version number 1.

Containment relationships are preserved. References are automatically updated to reflect the new location. Important recordkeeping information is stored in the copied configuration object. The Protect property is added to these design objects; you are not allowed to modify a released design. If you need to edit released data, use one of the following options:

- Edit 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.

For general information about setting up a configuration object and releasing a design or library component, refer to "Managing Designs" in the *Design Manager User's Manual*.

For more information about releasing a design, refer to "Releasing a Configuration" in the *Design Manager User's Manual*.

Version Operations

Idea Station applications normally maintain two versions of a design object. Realize that for large designs, retaining two versions can consume large amounts of disk storage.

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 write that occurs will update versions using the version manager.

For general information about working with design or library component versions, refer to "Working with Versions" in the *Design Manager User's Manual*.

Chapter 3
Property Concepts

At the beginning of the design process you must know which properties are required by other Mentor Graphics applications you plan to use. If you do not assign the necessary properties, the downstream applications you want to use will not be able to process your design.

For information about specific properties, refer to the *Properties Reference Manual*.

Introduction to Properties

Properties are "name/value pairs" that are assigned to specific graphic objects within the design. The graphic object is called the property “owner”. Properties that are created without an owner are called “logical” properties. Properties contain design information that typically can’t be represented graphically.

Properties have many functions. They can define device timing characteristics, establish horizontal and vertical connectivity in multi-sheet and multi-level designs, define a variety of design characteristics that cannot be conveyed by the images of components and wires that make up a schematic diagram, and much more.

To show how properties provide information to a design, consider that schematic designs in Design Architect contain two types of information:

- Connectivity information, which is conveyed graphically by pin and net connection.
- Property information, which describes some characteristic of a component that is not identifiable from the schematic drawing alone.

The symbols and schematics created in Design Architect are the means by which you communicate this connectivity information. For example, a schematic diagram shows you graphically that part A is connected to part B. The diagram alone cannot tell you the propagation delay of a signal through parts A and B. That information comes from the values of the Rise and Fall properties attached to the pins of parts A and B.

If you only want to draw, store, and print schematics, you do not have to assign properties at all. However, if you want to perform a check of the design rules or process a circuit design with other downstream applications, such as one of the Mentor Graphics simulators or layout applications, you must assign certain properties. Properties have the following characteristics:

- A property has an owner type (optional), a name, a type, and a corresponding value. The value can be either a number, triplet, expression, or character string.
- A property can be assigned to the individual objects that compose the schematic sheet in a component library, for example, instance, net, and pin objects.
- Back-annotated properties are generally supplied to a design viewpoint by downstream applications such as IC and PCB layout. Back annotations can be merged back to the original source design.
- Some downstream applications require a specific set of properties in order to operate properly. Refer to "Required Properties per Application" in the *Properties Reference Manual* for information on these tools and the properties they require.
- Certain properties are assigned automatically by the downstream Mentor Graphics engineering applications when they are executed.

- Some components may not have all the properties required for them to be processed by other Mentor Graphics programs. If this is the case, you can assign the necessary properties to the components in your designs by using the various property commands.

- Structured Logic Design (SLD) properties are special properties that are built into Design Architect. When the source design is evaluated, SLDs are converted to connectivity information, and are not accessible as properties in the evaluated design. Refer to "Structured Logic Design Properties" on page 3-26 for more information about SLD properties.

Some of the fundamental properties assigned to components supplied in various libraries are described beginning on page 3-26. A comprehensive description of individual properties is available in the *Properties Reference Manual*.

Table 3-1 shows a few examples of properties, which may be helpful at this point in the discussion.

Table 3-1. Property Structure

Property Name	Property Value	Property Type	Property Owner
Model	nand	String	Instance or Symbol Body
Net	cl_line	String	Net
Rise	10, 15, 20	Triplet	Pin

Property Ownership

Ownership is a key element in understanding the concept of property use. When we say that certain kinds of objects "own" certain properties, we mean that those properties can only be attached to those objects. Selectable items can own properties, but certain classes of properties and certain classes of objects make sense together, while others do not.

By way of analogy, you could assign a value to a property called "number of years in school" for a person, and you could assign a value to another property called "number of cylinders" for a car. Thus, you could say that people own the property "number of years in school," and cars own the property "number of cylinders." However, it does not make sense to provide a value to a property called "number of cylinders" and assign that property to a person. People don't own the property "number of cylinders;" that is, "number of cylinders" has no semantic meaning in the context of people.

Here is another example. Pins own properties called Rise and Fall. You can assign a value to the Rise property and attach that value to a specific pin in the design. However, it would not make sense to attach that value to a net in the design; nets would not understand the "Rise" property.

To help you keep track of application property ownership, Design Architect provides "ownership" commands. These commands define property ownership, and list the valid property owners for named properties. The Set Property Owner command lets you restrict property ownership to a specific type of object. The Report Default Property Settings command lets you check the "ownership status" of properties, that is, to tell you which objects own which properties by default. The owners for a particular type of property can be changed. This does not affect previously-created objects with that property.

Once property ownership is defined, Design Architect does not allow a property to be assigned to owners that are not valid for the property name. In fact, Design Architect only knows about a few default owners (for example, Structured Logic Design properties). Other property owners could be defined before editing. In Design Architect, the following six classes of items can own properties:

- Comments
- Frames
- Instances
- Nets
- Pins
- Symbol bodies

Property ownership is not required prior to adding a property value to a object. You may establish specific "ownership" for all properties, although Structured Logic Design (SLD) properties are built into Design Architect and already have default owners. These owners can be changed with the Set Property Owner command. A full discussion of SLD properties begins on page 3-26.

Property Names Versus Property Values

Another important concept is the distinction between property *names* and property *values*. Properties always have a name and a value; the name describes the property, while the value is data that describes a characteristic of the design. Property names are entered and stored as strings of ASCII text. Property values can be represented as text strings, numbers, triplets, or expressions. Property types are discussed starting on page 3-6.

On page 3-4, the example of the "number of cylinders" property was used to illustrate the concept of *ownership*. Let's use this example again to illustrate the relationship between property names and property values. Cars have a property named "number of cylinders" with a value (typically) of 4, 6, or 8. The property name is "number of cylinders;" the property name does not vary from car-to-car. The property value can vary from car-to-car.

Similarly, in Design Architect the Rise property might have a value of "5, 10, 15" on one pin, and a value of "10, 20, 30" on another. The numbers represent minimum, typical, and maximum delays, respectively, in nanoseconds on the owning pin. The property name Rise does not vary from pin-to-pin; the property value can vary. Property name and value restrictions are discussed after property types.

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:

- Character string
- Number (integer, real, exponential)
- Expression (arithmetic or string expression)
- Triplet. The special property type "triplet" is a 3-valued property used to describe the best-case/typical/worst-case values used in timing analysis. The three values of a triplet may be separated by a comma or spaces. If you are entering triplet values in a command or function, enclose the values in quotes (for example, "5,7,10"). When entering triplet property values in a prompt bar or dialog box, do not enclose the values in quotes (5,7,10). The value, whether entered as a string, a number, or an expression type, will be evaluated as a number.

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

It is important for you to know what the property type is before entering a property value. For example, if the property type of property name "A" is a character string, and you enter the value of 95, this value will be interpreted as a character string "95" not the numerical value of 95.

When you add the property value, the Add Property command, by default, sets the property type to the value set by the previous Set Property Type command for that property name. If the -Type option is used with the Add Property command, the property type can be changed to any of the property values listed previously.

Once a property value has been attached to an object, its property type can only be modified through the Change Property Type command. After a property has been selected, the Change Property Type command can change the property type to string, number, expression, or triplet.

Property Name/Value Restrictions

Operating systems, AMPLE, and downstream applications all impose restrictions on property names and values. Design Architect does not check for violations of all these restrictions. The following topics summarize the known restrictions.

Property Name Restrictions

Any identifiers that are saved in the design database, such as property names, must begin with a letter (a-z, A-Z), or a dollar sign ($).

Subsequent characters can be any of the aforementioned characters, an underscore (_), or a digit (0-9).

Property names are case insensitive in Design Architect, and must have less than 512 characters. Property names and values are stored as C Language style null terminated strings and, therefore, cannot contain a null character.

Property Value Restriction

Property values of type "string" have no real character restrictions. However, if that property value is going to be used by a downstream application, that application must be able to recognize the string. Property values have no character length restriction. Property values are case insensitive, although you can change the case for display purposes.

Property values of type "number" can be integers, real numbers, or exponential decimal numbers. Downstream applications that use the design viewing and analysis package (for example, Design Viewpoint Editor) do not handle exponential notation and non-decimal radix notation.

Property values of type "expression" are evaluated as AMPLE expressions and, therefore, must follow AMPLE syntax.

Property values of type "triplet" include one, two, or three values. Each of these must evaluate to a number. If any of the three values is an expression, the expression must follow AMPLE syntax.

Special Case Restrictions

If a property value is the name of an object that must be recognized by the design database, the same property name restrictions apply. These include values of the Pin, Net, and Inst properties. For example, the Net property value is the name of the net, which is stored in the design database.

The following list describes additional restrictions for net and pin names:

- "_$", "_B$", "_b$", "N$", "n$", "I$", "i$", "P$", "p$", "G$", "g$", "B$", "b$", "R$", and "r$" are reserved for the leading characters for handles (such as net, instance, and pin handles) and for internal use.
- Even though a net/pin name is declared to be a "string" in Design Architect, if the value includes "( )", "[ ]", or "< >" the system will attempt to evaluate the string within the delimiters.
- Pin/Net/Inst property values cannot contain a slash (/), back slash (\), a space ( ), a period (.), an escape, or tab character.
- "[ ]", "( )", and "< >" are reserved to delimit bus subscript notation. The bus width is indicated between the delimiters. The numerical values for the bus width can be indicated in binary (prefix with "0b"), octal (prefix with "0o"), decimal (no prefix), or hexadecimal (prefix with "0x").
- A comma (,), colon (:), and semicolon (;) should only appear as part of a bus subscript syntax.

- A period (.) should only be used for separating parts of a record in VHDL.
- In any name that might be evaluated (names surrounded by parentheses), the entire string within the parentheses is considered an AMPLE expression and must follow the AMPLE expression syntax.

Mentor Graphics discourages the use of non-printing characters and special characters in net/pin names because of their meanings in different applications and operating systems.

Symbol Properties

Like other properties, symbol properties provide information about the object that owns the property. Symbol properties have additional characteristics and functions other properties do not. For example, a symbol property:

- Can be owned by a piece of symbol graphics or by the "logical symbol."
- Can be created either graphical or non-graphical, if owned by the logical symbol.
- Has a property stability and property visibility switch.
- Is brought forth to the instance when the symbol is instantiated on a schematic sheet. Refer to page 3-13 for information about how an instance of a symbol is updated.

Logical Symbol Properties

Regular symbol properties are attached to symbol body graphics and can be invisible, or displayed graphically on the symbol. They are created when you add a property (with the Add Property command) to a selected symbol graphic. This action attaches the property to a selected symbol object, for example, a symbol body or symbol pin.

A symbol property that has no graphic owner is called a *logical symbol property*. These are created by adding a property with nothing selected, and are not attached to symbol body graphics, but rather are owned by the "logical symbol." The *logical symbol* is the symbol entity, rather than the collective symbol graphics, and represents the function of the component.

Logical symbol properties can be either graphic or non-graphic. A graphic property has a location, which is displayed in gold to distinguish it from properties owned by the symbol body, and has a name, value, and property attributes.

A non-graphic property is not displayed, but has a name, value, and property attributes. Non-graphic properties are intended for program generated properties that do not need to be displayed or changed.

If you delete a symbol body that has properties attached, those properties become graphic logical symbol properties at their original locations.

If you add the property graphically, you must select the text itself (rather than owner graphics) to change the property through a change property command, or to move or copy the property. If you add a logical symbol property that already exists on a symbol, the value of that property (wherever it occurs on the symbol) changes to the value of the property being added. To list the logical symbol properties for the symbol, execute the Report Object command. Both graphical and non-graphical logical symbol properties are included in the component interface when the symbol is saved and registered.

Property Stability Switches

In the Symbol Editor, when you add properties to a symbol, a property stability switch is placed on the property. These switches control the changeability of the symbol property when an instance of the symbol is placed on a schematic sheet. The following switches define four levels of stability:

- **-Fixed** specifies that property value, type, and name cannot be altered or deleted on any instance on a schematic sheet, although property attributes can be changed.
- **-Protect** specifies that property value, type, and name can be altered on an instance at instantiation time on a schematic sheet. However, once instantiated, the instance-specific property value cannot be changed, only the property attributes can be changed.
- **-Variable** specifies that property value, type, name, and text attributes can be altered on an instance at instantiation time or any time after.
- **-Nonremovable** specifies that property value, type, name, and text attributes can be altered on an instance at instantiation time or after, but the property cannot be deleted from the instance.

The default property stability switch setting is -Variable (except for Pin properties), and can be changed with the Setup Property Text command and the $set_property_stability_switch() function. The Change Property Stability Switch command changes the property stability for selected property names without changing the default switch settings.

The default property stability switch setting for Pin properties is -Fixed.

Property Visibility Switches

In the Symbol Editor, when you add properties to a symbol with the Add Property command, a property visibility switch is placed on the property and is set to "Visible" or "Hidden". The Visibility Switch controls the visibility of the symbol property when an instance of the symbol is placed on a schematic sheet. Hidden properties are not selectable. When adding graphic-properties to a symbol, all properties are visible in the symbol window.

The default property protection switch setting is -Visible, and can be changed with the Setup Property Text command and the $set_property_visibility_switch() function. The Change Property Visibility Switch command changes the property visibility for selected property names without changing the default switch settings.

Property attributes listed in report windows may include "-Not Visible" and "-Hidden". If both of these are listed, the property was hidden when added, and the property visibility has not been changed. If "-Hidden" is listed without "-Not Visible", the property visibility was changed to visible on the sheet.

There is also a property visibility switch attached to the properties added to the instance of the symbol. This switch controls the visibility of properties added to the instance of the symbol, and is set in the Schematic Editor.

Updating Properties on an Instance of a Symbol

The following topics describe how properties are updated automatically and manually, as well as how modified property values and attributes are flagged and how those flags affect the update process.

Attribute-Modified Properties

A property on an instance becomes Attribute_Modified when the graphical attributes of the property are changed. When you change the appearance of property text, you are making attribute modifications, and the property is flagged as Attribute_Modified. Some examples of commands that change graphical attributes (assuming the operation is performed on a property, not the owner) include Move (of a property attached to the instance), Change Text Height, Change Property Justification, and Change Text Font.

The Attribute_Modified flag has no meaning in the Symbol Editor. A description of how Attribute_Modified properties affect the update process begins on page 3-14.

Value-Modified Properties

When you change the value of a property, the Value_Modified flag is attached to that property. A property becomes Value_Modified when one of the following actions occur:

- You change the property value with the Add Instance, Change Text Value, Change Property Value, or the Delete commands.
- You mark the property using the Mark Property Value command.

A Value_Modified property, by definition, is also Attribute_Modified. Properties on the symbol and the instance that are Value_Modified appear in report windows as "Value Modified". The Value_Modified flag has no meaning in the Symbol Editor. A description of how Value_Modified properties affect the update process begins on page 3-14.

Mark Property Value

The Mark Property Value command operates on selected property values, or on a specified property name. You can mark a property value as either "Modified" or "Not Modified", depending upon how you want those properties updated.

Caution If a property value was modified with the Change Property Value or Change Text Value command, then clearing the Value_Modified flag with the Mark Property Value -Notmodified command also causes the value to revert back to the original value on the symbol immediately.

You can also mark and unmark properties by choosing the **Miscellaneous >** **Mark Property Value** menu item; in the prompt bar, enter the property name and choose either "modified" or "notmodified" by clicking the stepper button.

Property Merge Options

The property update process is controlled by property merge options on the Update and Replace commands. The Open Sheet dialog box also has options to control how a sheet is updated when it is opened; this is discussed on page 3-15. The update process can change some or all of the properties you have placed on an instance, depending on which property merge option you use with the Update or Replace command and how the properties were modified before the update. How the properties are merged onto the instance of the symbol is based on the following four property merge settings:

- **-Clear**: Symbol body graphics are updated. All instance-specific properties are deleted. All other properties and property attributes are reset to the current symbol values. Any new properties on the current symbol are added to the instance. This is the default for the Replace command.

- **-Symbol**: Symbol body graphics are updated. The state of the Value_Modified flag is ignored. Instance-specific properties remain unchanged. All other property values are reset to the current symbol values. If the Attribute_Modified flag is not set on a property whose value is updated, then the attributes are also updated. Any new properties on the current symbol are added to the instance.

- **-Instance**: Symbol body graphics are updated. The state of the Value_Modified flag is ignored. All existing properties remain unchanged and the Value_Modified flag is set. Any new properties on the current symbol are added to the instance.

- **-Auto**: Symbol body graphics are updated. All instance-specific and Value_Modified properties remain unchanged. All other properties are reset to the current symbol values. Any new properties on the current symbol are added to the instance. If the Attribute_Modified flag is not set on a property whose value is updated, then the attributes are also updated. This is the default for the Update command.

Automatic Update Process

Properties on an instance of a symbol can be updated when a schematic sheet is opened, giving instances on the sheet new, updated versions of the symbol. When you open a sheet, you can specify an update option, or you can explicitly set the default auto_update_mode for the Session. You can set the default from a startup file, especially if you use the same update option whenever you open a sheet.

The Open Sheet and Open Design Sheet commands have an auto_update_mode switch. This switch has the same settings described on page 3-14, in addition to a -Noupdate setting, which means that no update should be performed when the sheet is opened. The default switch setting for these commands is -Noupdate, unless you explicitly change it.

If you open a sheet via a menu path and dialog box, you can change the switch setting by clicking on the Options? "YES" button, then clicking the Auto Update Mode stepper button until the desired setting appears. Changing the switch setting when opening a sheet only applies to that sheet; it does not change the default setting for the Session.

The $set_auto_update_mode() function lets you change the default setting for the auto_update_mode switch. Auto_update_mode controls only automatic updates when a sheet is read; it does not specify a default property merge for the Update and Replace commands.

The $get_auto_update_mode() function returns the default. The following example retrieves, then resets the auto_update_mode default.

```
$get_auto_update_mode() //   @noupdate $set_auto_update_mode(@auto)
$get_auto_update_mode() //   @auto
```

The $get_auto_update_inst_handles() function returns a vector of handles for all the instances that were out of date when the sheet was read. These instances will have been updated if the auto_update_mode option was not @noupdate. This system function only returns valid results immediately after the sheet is opened.

Property Update Examples

Table 3-2 shows examples of how the Value_Modified and property merge switches control which properties are merged onto the instance of the symbol.

The second column shows the properties on the symbol at the time of instantiation. The "Properties on Instance" show how the property values were changed at instantiation time.

Assume the original symbol was edited to have the property values shown in the "Properties on Edited Symbol" column. The "Merged Properties" column shows the results of updating the instance of the symbol.

In the "Properties on Instance" and "Merged Properties" columns, an asterisk (*) indicates the property is Value_Modified.

Table 3-2. Property Update Examples

Merge Switch	Properties on Symbol	Properties on Instance	Properties on Edited Symbol	Merged Properties
-Clear	Model=AND Ref=j1	Model=OR * Rise="10 20 30" My_property=16	Model=NAND Ref=j2	Model=NAND Ref=j2
-Symbol	Model=AND Ref=j1	Model=OR * Rise="10 20 30" My_property=16	Model=NAND Ref=j2	Model=NAND Rise="10 20 30" Ref=j2 My_property=16
-Instance	Model=AND Ref=j1	Model=OR * Rise="10 20 30" My_property=16	Model=NAND Ref=j2	Model=OR * Rise="10 20 30" Ref=j1 * My_property=16
-Auto	Model=AND Ref=j1	Model=OR * Rise="10 20 30" My_property=16	Model=NAND Ref=j2	Model=OR * Rise="10 20 30" Ref=j2 My_property=16

Parameters

A *parameter* is a variable that is resolved outside of the design through a temporary value in Design Architect or through a parameter rule in the design viewpoint. For example, the value of a property may be an arithmetic expression that contains one or more variables. The value of that property cannot be determined until the variables are resolved. The method the system uses to resolve variables is defined by a set of rules which dictates the position in the design tree where the system looks for the variables. Parameters are one of the rules used to evaluate property value variables.

Briefly stated, as each instance in a design is evaluated, the system looks at the instance properties in an attempt to resolve expressions that contain variables. For those variables which are unresolvable at the instance level, the search continues up through the design tree. The search for the variable's value continues until a match is found, or the root level of the design is reached. If the root level of the design is reached and the variable has not been resolved, the system looks through the parameter list in the design viewpoint. See "Rules for Resolving Property Value Variables" on page 3-19, for a detailed explanation of this process.

Given this method of evaluation for property value variables on schematic sheets, there are two commands that help you create and evaluate designs more efficiently. These commands are Set Parameter, used in the Schematic Editor within the Design Architect Session window, and Add Parameter, used in the Design Viewpoint Editor (DVE). The following two paragraphs briefly describe the purpose of these two commands.

The Set Parameter command supplies dummy parameter values for variables in property value expressions on a schematic sheet. Without these dummy values the Check command, when executed, reports warnings about expressions in which variables cannot be resolved. The ability to check syntax reduces the number of problems that otherwise would not be discovered until you create a design viewpoint. Basically, the Set Parameter command offers a method to flag forgotten variables entered on a schematic that need to be identified in DVE. These parameters are not known to the Design Viewpoint until you execute the Add Parameter command in DVE.

The Add Parameter command in DVE lets you specify a particular value for a variable. Issuing this command for a variable adds the definition of the parameter to the parameter list for the current design viewpoint. If the system cannot resolve the variable's value by the time the root of the design is reached, the parameter list is searched for the value, and the variable can be resolved.

Using Expressions as Property Values

A property value can have a property type defined as an *expression*. An expression is a combination of variable(s), constant value(s), and arithmetic or logical operator(s) defined by AMPLE expression syntax. For example, "x + 5" is a simple expression with a variable "x", and the constant value "5," added together with the arithmetic operator "+". A full discussion of arithmetic operators and expression syntax is included in the *AMPLE User's Manual*.

Expressions can be defined for any property values. 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 or schematic is checked, or when a design viewpoint is created with expressions defined. All expressions must follow AMPLE expression syntax as described in the *AMPLE User's Manual*.

Rules for Resolving Property Value Variables

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. Figure 3-1 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.

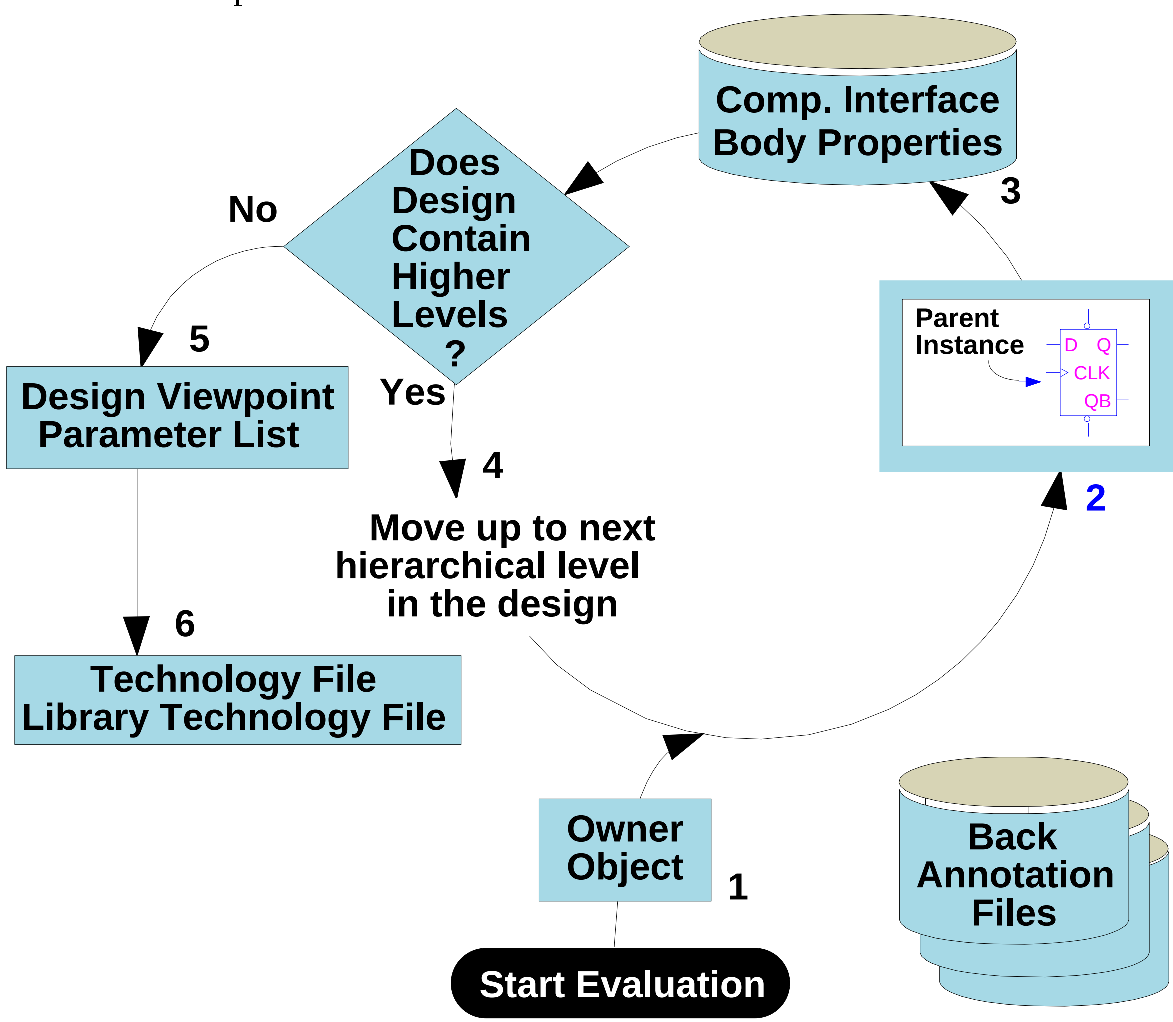


Figure 3-1. Parameter Evaluation Rules

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.

You must add a parameter prior to evaluation of the design, in order for the value of the variable to be used in evaluation.

You can declare variables for the width of a parameterized bus, the number of bits in a parameterized register, and many other types of expressions. These property value variables can be declared in Design Architect or through back annotations. When defining property value variables, remember to set the property value type to expression. Variables can also be set up in CASE, IF, and FOR frames, instance names, net names, pin names, and subscripts.

For example, suppose you design a generic register and declare a variable "bank_size". In DVE, you assign the bank size of this register to be 300 bits.

ADD PArameter "bank_size" 300 -Numeral

Whenever a downstream application encounters an unresolved property variable named "bank_size" during evaluation, it assigns it the value 300.

If a variable is not resolved anywhere in the design hierarchy, the design viewpoint, or technology file, an error message is generated.

Facts About Property Variable Resolution

The following list presents some facts and tips about property value resolution rules and their effect on property value evaluation:

- Property values assigned to primitives take precedence over property values assigned to objects which are higher up the design tree.

- A common mistake is to assign constant property values on a device's lower-most schematic sheet, expecting to be able to use a different property value when the design is evaluated. This is not a valid technique. The property values at the outer-most leaves of the design tree are the property values first found, according to the scoping rules.

If you want to pass a property's value down to a schematic sheet from higher up in the design tree, the property on the lower schematic sheet must consist of an expression containing variable(s) that are resolved further up in the hierarchy. The property value is retrieved when the expression is evaluated.

- Property variable values assigned as parameters with the Add Parameter command in DVE specify global values for those variables. To find out more about the Add Parameter command, see the *Design Viewpoint Editor User's and Reference Manual*.

- Property variable values originating with the symbol model (kept in the component interface) specify "local" values. That is, they specify the value of the property variable that is used on all underlying sheets of that symbol.

  This rule is important because it allows you to specify that certain portions of a design have a different value for a property variable than is specified by the Add Parameter command in DVE.

Example of Property Variable Resolution

As an example of property variable resolution, suppose you have created the design hierarchy shown in Figure 3-2. In this design, the top-most schematic contains an instance for device A (among other instances). The underlying schematic sheet for device A contains instances for three devices designated as B, C, and D. Instances B, C, and D also have their underlying sheets.

Figure 3-2 also shows the four symbol models to the right of the design. Each graphic represents the symbol model and component interface pair to which each device is associated. Note that some properties appear to the right of each graphic. Finally, the figure also shows the viewpoint of the design and its parameter list. This parameter list is created using the DVE Add Parameter command.

To show how the same parameter in different legs of the design can evaluate to different values, consider the following scenario. Suppose instance B in the design has a pin with a Rise property whose value is the triplet "5, 10, 15", while instances C and D have pins with "Rise" properties whose values are "delay".

Furthermore, these property values appear on the schematic sheet making them specific to the instance. Because the value for Rise on instance B is not an expression, the value will always be "5, 10, 15".

The value for Rise on instance C, on the other hand, is unresolved. Note, however, that the symbol model for device C has a property named "delay" and its value is the triplet "10, 20, 30". When the design is evaluated, the property value resolution rules in this case begin by looking at the instance of device C itself. Finding no definition for the parameter "delay", the system looks to the symbol model and its properties next. At this point, "delay" becomes defined for instance C and the search stops.

For instance D, notice that the value for Rise is identical on the schematic sheet. Here, though, the symbol model for D does not have a property that defines "delay". Note also that no definition for "delay" exists in the next higher level of the design. That is, "delay" is not defined in instance A or as part of the symbol model for device A. The design viewpoint's parameter list, however, does define "delay" as the triplet "15, 25, 35".

When the design is evaluated, the property variable resolution rules first look at the instance of D. Because no value for "delay" is found there, the system checks the properties associated with the symbol model for device D. Again, no definition for "delay" exists. Having exhausted its search on this level of the design, the system moves up one level of hierarchy and performs the same ordered search beginning with instance A and finally the symbol model for device A. Like the underlying sheet, no definition for "delay" is found. Finally, the design's viewpoint is searched and "delay" is determined to be the triplet "15, 25, 35" for instance D.

To summarize this example, even though both instance C and D use the same parameter for the property Rise because of property variable resolution rules, the system evaluates "delay" to different values.

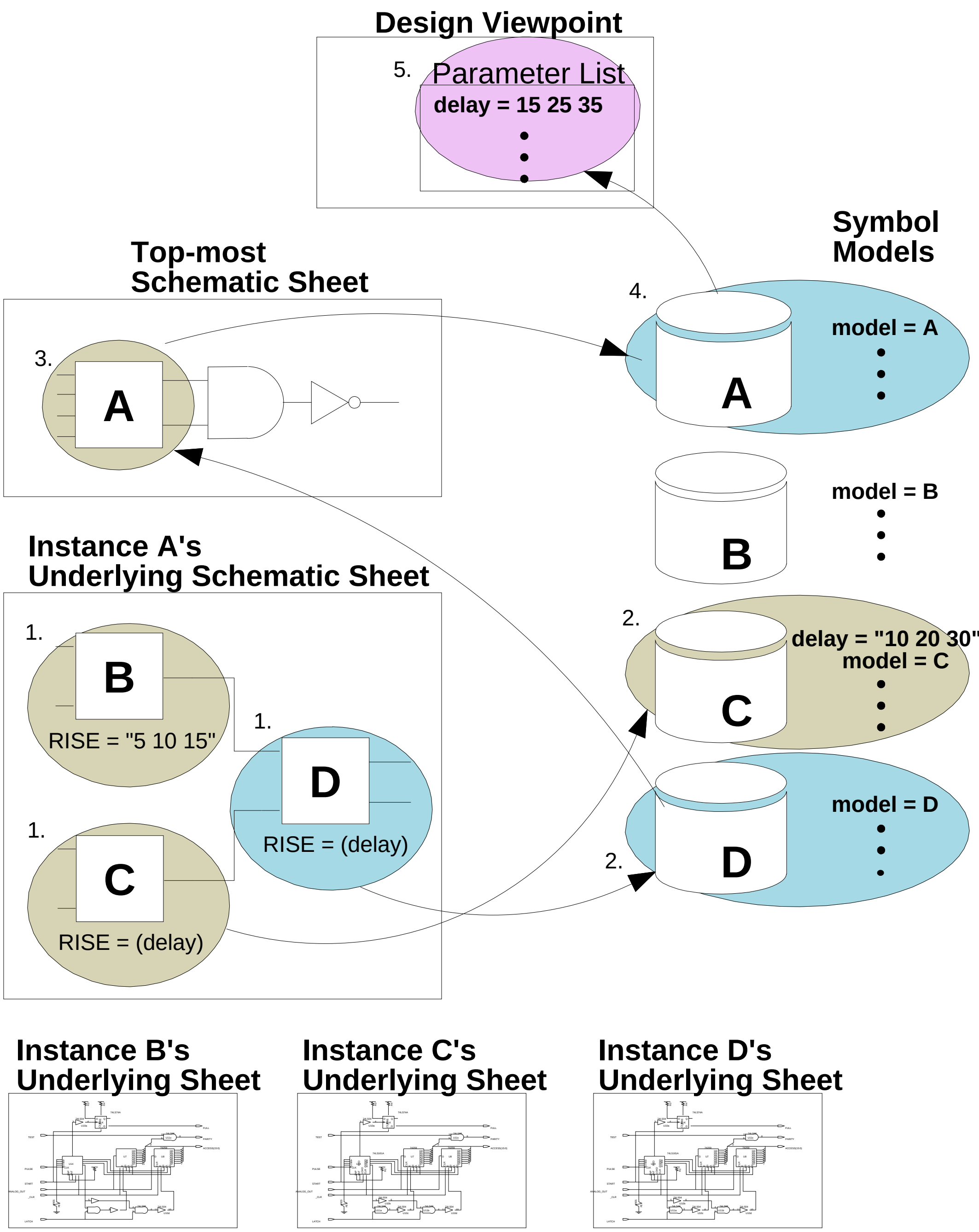


Figure 3-2. Property Variable Resolution Example

Structured Logic Design Properties

Structured Logic Design (SLD) properties are special properties that are built into Design Architect. They are used to pass connectivity information about the design to the routines in DVE that evaluate the design. These properties are not accessible from an evaluated design and can only be added to a schematic source design.

While in Design Architect and editing in design context, the "annotations" switch is turned on, by default. When this switch is ON, all property edits are stored with the viewpoint, except edits to SLD properties which are made directly on the source sheet. When you turn annotations OFF by choosing the **Setup > Annotations/Evaluations > Toggle Annotations** menu item, all property annotations are made directly on the sheet, and not recorded in the back annotation object. While in design context, you should have annotations ON to edit all properties except SLD properties. The state of the annotations switch is displayed in the Design Architect status line. The upper case "A" in the status line shown in Figure 3-3 indicates annotations are ON. A lower case "A" indicates annotations are OFF.

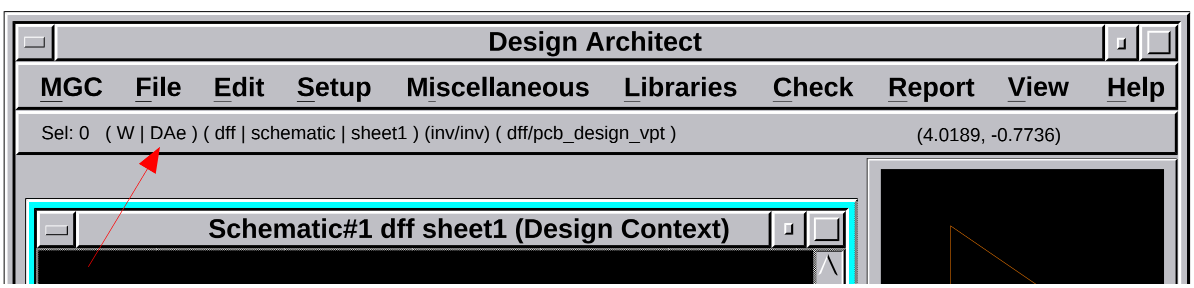


Figure 3-3. Status Line Showing Annotations ON

The Design Architect objects which have valid SLD properties are shown in Table 3-3:

Table 3-3. DA Objects Associated with Specific SLD Properties

DA Objects	SLD Properties			
Bodies/Instance	Class	Rule	Inst	Global
Pins/Vertices	Class	Rule	Net	Pin
Frames	Frexp			

Table 3-4, summarizes SLD properties. Note that the property values marked with an asterisk (*) can include special notation, described beginning on page 3-30. The following pages describe SLD properties in more detail.

Table 3-4. Structured Logic Design Properties

Property Name	Property Value	Description
Class	C	Connector: Connects differently named nets together.
Class	G	Global: Connects a net globally across the design. For example, Ground.
Class	P	Port: Establishes design I/O connectivity with a pin on the symbol above it in a hierarchical design.
Class	R	Ripper: Extracts a range of nets from a bus.
Class	O	Off-page connector: Identifies net connected to a net on another sheets of the schematic.
Class	N	Null: Defines object as electrically inert.

Table 3-4. Structured Logic Design Properties [continued]

Property Name	Property Value	Description
Class	dangle	Identifies a dangling instance pin or net vertex that should not cause a check warning.
Inst	<instance_name>	Instance name on a schematic sheet.
Global	global_name	Name of a global net (used with Class "G" property value).
Frexp	CASE <clause>*	Identifies a CASE frame.
Frexp	FOR <clause>*	Identifies a repeated frame.
Frexp	IF <clause>*	Identifies a frame to be included conditionally.
Frexp	OTHERWISE <clause>*	Otherwise case for the CASE frame.
Pin	<pin_name> (<range>)	Name of pin on symbol.
Rule	<range>	Identifies bus lines to extract with ripper ("Class" R).
Net	<net_name> (<range>)	Name of a net or bus.

Class Property

The Class property identifies its owner object as having some special characteristic. Ports, off-page connectors, net connectors, and rippers all have Class property values that define these devices. The Class property is placed on an instance or symbol body. Instances or symbol bodies tagged with the Class property are specially treated by Design Architect and DVE; they are not included in the evaluated design viewpoint. Refer to page 2-33 for more information on the special instances that are defined using the Class property.

Properties on pins propagate to the net vertices under the pins when an instance having the Class property is placed on a sheet or updated if those properties may be owned by nets and do not already exist. If you wish to propagate properties in this manner, you must explicitly declare "net" as a legal owner of the desired properties using the Set Property Owner command in the Symbol Editor.

When an instance with a Class property attached is placed on a sheet, making a connection to an existing net, the Init and Net properties which may have been placed on the pin of the symbol are propagated to the net vertex under the instance pin, assuming the net vertex does not already have an Init or Net property. If an Init property already exists on the net vertex, it is replaced by the instance pin's Init property only if the new instance is a global instance (Class property value = G).

If the property is created on a symbol, its behavior upon symbol instantiation is determined by the values specified for the symbol_visibility_switch and symbol_stability_switch arguments in the $add_property() function. If these switches are not specified, the values of the property_visibility_switch and property_stability_switch internal state variables are used.

You can also use the Class property to declare a valid dangling net vertex or instance pin. Add the Class property with a value of "dangle" to a pin or net vertex to indicate that the Check command should not issue a warning because that object is unconnected.

For example, if you want to connect only one output pin of an instance of a flip-flop, you can add this property to the other output pin to identify it to the Check command as an acceptable dangling pin. To add the Class property to a pin or net, you may first need to execute the Set Property Owner command to declare pins and/or nets as valid owners of this property.

Global Property

The Global property defines a global net such as VCC and GND. The Global property is assigned with the Class property value "G" and forms a property/value pair for the device body. If you assign the Global property to a body without also assigning the Class G property to the body, the design will pass the Check command without generating an error or warning. However, the net will not be recognized as global in that case. Global connectivity is established directly downward and at the same level in hierarchy by giving nets the same name as the Global property value.

Inst Property

All schematic items have unique object handles which are assigned, maintained, and used by the application. Usually, they are not visible to you. You can also assign names (with the visibility and other attributes under your control) that can be used to identify each instance. This is accomplished by assigning unique names, for example "U23-A", to instances with the Inst property.

The values used with Inst property assignments must be unique on all sheets of a schematic. The Check -Schematic command detects repeated "Inst" values for the current schematic sheet level in Design Architect.

Net Property

The Net property value is used to name the net and is assigned to a net vertex.

Pin Property

The Pin property value placed on a symbol pin is used to name the pin. The pin property on the symbol provides the connectivity interface between levels of design hierarchy.

Rule Property

The Rule property is used on ripper devices with the Class property value "R" and specifies which wire or group of wires is to be ripped, or branched, from a bus. The Rule property must be assigned to objects with the Class property value "R". The Check command generates an error message if the Class property value "R" is present without the Rule property.

You must adhere to the following guidelines when assigning the Rule property to a Class "R" device:

- You must observe proper syntax for the Rule property value. This syntax is discussed beginning on page 2-24.
- The width of the Rule property must match the width of the ripped bus.

Frexp Property

This property is used to define frames. Frames provide you with the ability to repeat or conditionally include a circuit in a schematic sheet. The number of iterations, or the conditions determining inclusion or selection are controlled by parameters assigned during design creation and evaluation, and make use of the frame expression assigned as a value to the Frexp property. The frame expression uses similar constructs to those used in high level programming languages.

All frames must have the Frexp property assigned to them with a valid Frexp property value. The value assigned to the Frexp property must adhere to a specific syntax which uses key words such as FOR, IF, CASE, OTHERWISE, DOWNTO, and TO with the assignment, equality, and relational (:=, ==, !=, <, <=, >, >=) characters. For example "FOR i := 1 TO 5" is correct, but "FOR i += 1 TO 5" is not. The syntax for FOR, IF, CASE, and OTHERWISE frames is discussed next.

Special Notation for CASE, FOR, and IF Property Values

The Frexp property contains specific syntax that can be used to indicate property values. The clause or range required is defined before each description. Names or values that you must supply appear in italics, and any punctuation shown is necessary. Except for the FOR example, property value syntax described in these examples is defined by the AMPLE language.

These values are only applicable to the Frexp property.

CASE <clause>

Clause: *parameter=="value"* or *parameter == "value"*

In the CASE frame clause, if the value equals the parameter, the circuitry defined within the frame is included in the schematic sheet. If not, and an OTHERWISE frame exist, the OTHERWISE frame is included. The CASE parameter name follows the rules for AMPLE identifiers, whose default value is declared with the Set Parameter command. The value is any valid AMPLE expression.

OTHERWISE <clause>

Clause: *variable_name*

The OTHERWISE value is used in conjunction with the CASE value. If the evaluation of the CASE value is false, the OTHERWISE frame is included. The variable_name is a local variable which follows the rules for AMPLE identifiers.

FOR <clause>

Clause: *variable_name* := *expression* TO *expression*

or

Clause: *variable_name* := *expression* DOWNTO *expression*

The FOR frame expression specifies that the frame contents are to be repeated on the sheet "n" times. The variable "n" can be a variable in a frame expression on an outer frame. The value of "i" as it iterates through the values 0 to n-1 in the following example can be used to evaluate the value within this frame.

Example: FOR i := 0 TO n-1

DOWNTO works the same way as the TO example, except it decrements the start index value by one. For example, FOR i := n-1 TO 0, would generate the "i" values of n-1, n-2, to 0 in that order.

The variable_name is a local variable which follows the rules for AMPLE identifiers. Frame expressions on frames in an inner nest can involve the dummy variables assigned in outer nest, or property names valid for Design Architect instance items.

Note In expressions of this type, the ":=" operator must be preceded and followed by a space, and the colon (:) must be followed immediately by the equal sign (=), with no intervening spaces.

Positive and negative integers and integer expressions can be used as indices. Integers are treated as unsigned values, so you will receive a warning message if you use negative indices. These messages inform you that names in the design database may be different than expected (as they will be represented in two's-complement form). For example, a net name expression such as $strcat("OUT_", I) used in the FOR frame expression "FOR I := -1 TO 0" produces the net names "OUT_65535" and "OUT_0", instead of "OUT_-1" and "OUT_0".

Because the evaluated value of -1 is larger than the terminating value of 0, a warning message is issued, and the design logic within the frame is omitted from the design viewpoint.

Note To avoid unexpected (and possibly unpleasant) results, Mentor Graphics strongly recommends that you do not use negative indices.

The relative size of indices used in a FOR frame expression affects the number of iterations generated as follows:

- When the start index is less than the end index, the number of iterations is equal to (end_value - start_value +1). Ten iterations are generated with the expression “FOR I := 1 TO 10".
- Only one iteration exists if the start index equals the end index, such as “FOR I := 1 TO 1".
- When the start index is greater than the end index, no iterations are generated. An example of this is “FOR I := 10 TO 1". A warning message is displayed if this occurs.

Figure 3-4 illustrates a typical FOR Frame.

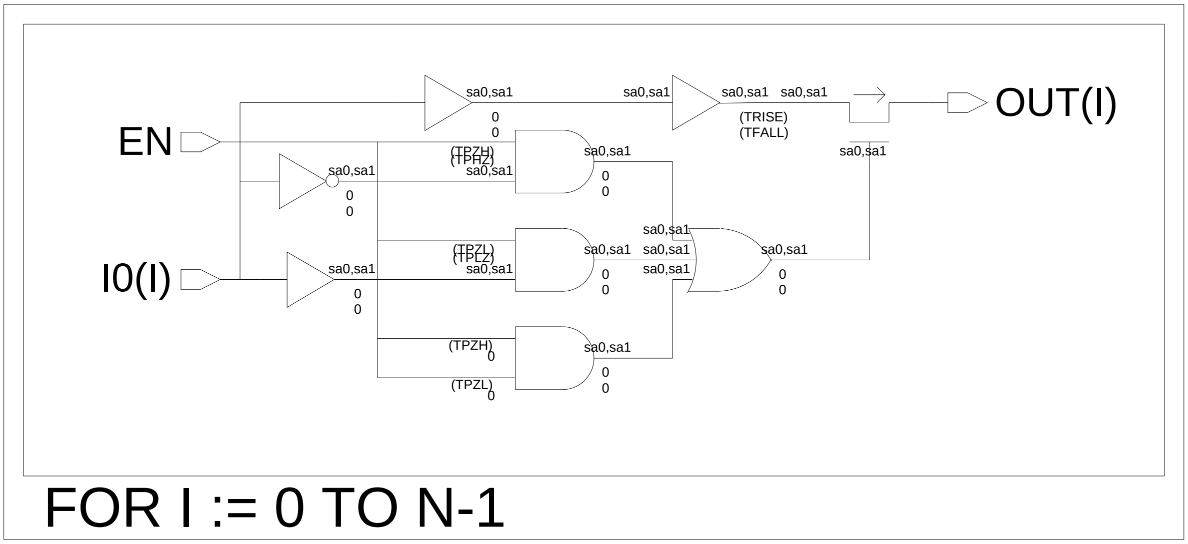


Figure 3-4. Typical FOR Frame

IF <clause>

Clause: *expression*

In the IF expression, if the expression evaluates to FALSE (or zero) at design evaluation time, the frame is not included in the design. Otherwise, the frame is included.

Frame expressions can involve property names that are valid for instance items. In the following example, the contents of the IF frame are included on the sheet, if the instance property “logic” is set to the property value “TTL”.

Example: IF logic == “TTL”

FOR Frames Generated by Repeating Instances

In order to create a repeating instance, the INST property value should contain a one-dimensional bus syntax over a continuous range. The range subscript must contain both a left and a right value, separated by the “:” character and surrounded by parentheses. The range may be either ascending or descending; for example, INST = XINST(3:0) or INST = XINST(0:3). Commas or semi-colons are not allowed and are flagged as errors during a Check Sheet. You cannot use bundled names for repeating instances; for example, INST = {X1, Y1, Z1}.

You can use parameters in the subscript expression; however, the parameter must be used in a consistent manner in any bus that connects to the instance so that the system can correctly generate the connectivity of the FOR frame. In this case, the system uses the value of the subscript expression to build the FOR frame expression.

The name of the FOR frame variable is the internal name of the instance with the “$” removed and an “_REPEAT” appended to it; for example, instance "I$28" is given a FOR frame variable of "I28_REPEAT." Thus for example, if instance "I$28" has an Inst property value of "XINST(3:0)," then the FOR frame expression generated by the system would be “FOR I28_REPEAT := 0 to 3.” Ascending and descending subscripts, such as “(3:0)” or "(0:3)," result in the same FOR frame expression. So, "XINST(3:0)" and "XINST(0:3)" result in the same FOR frame; that is, “FOR I28_REPEAT := 0 to 3.” Additionally, the Inst property does not need to have a base name and a subscript; it can have just a subscript. Thus, an Inst property value of (3:0) is acceptable.

Chapter 4
Editing in the Context of a Design

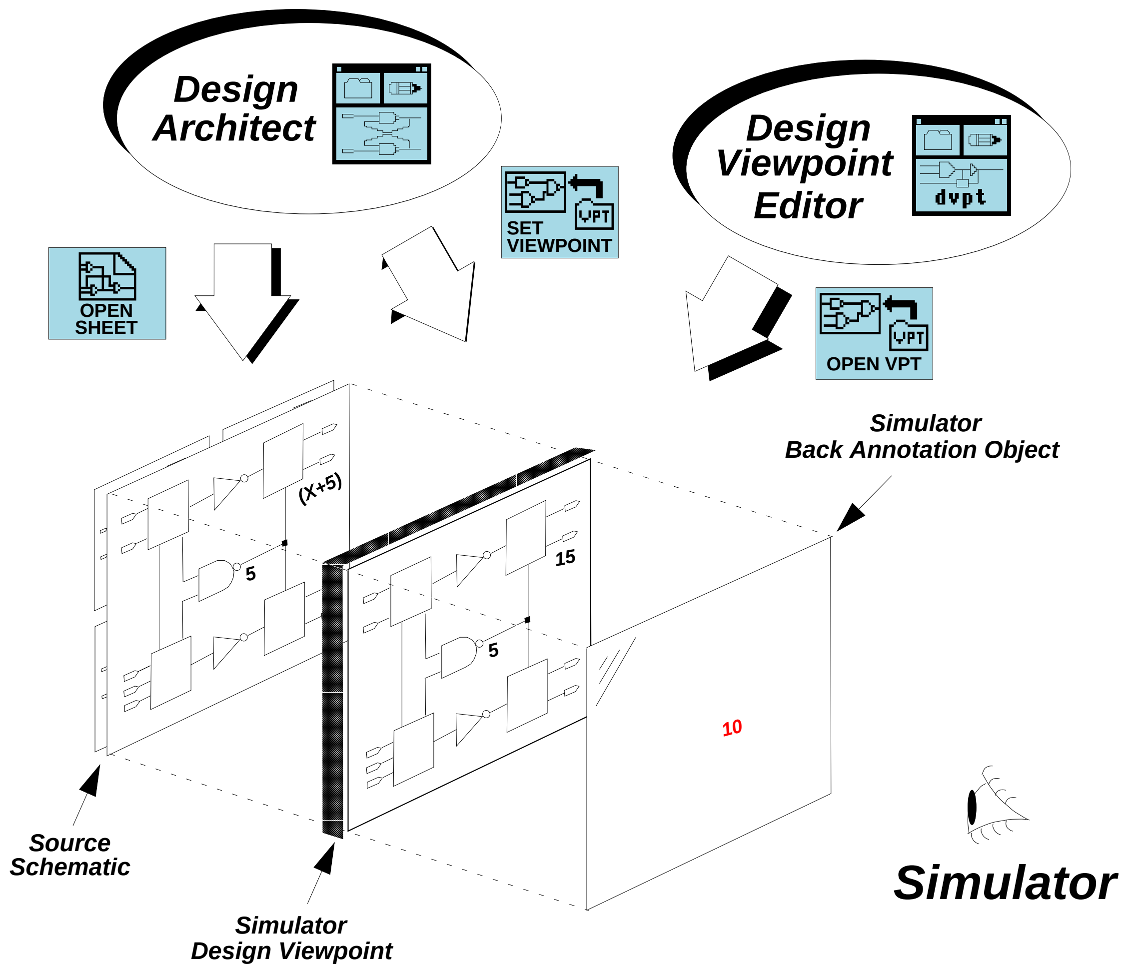
The following topics provide a conceptual overview of Design Viewpoints and Back Annotation objects and explain how to use Design Architect to merge back annotations onto a source schematic.

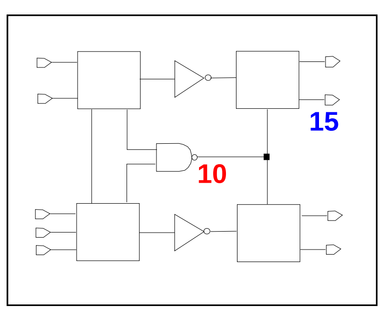
What is a Design Viewpoint?

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 Figure 4-1. 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*.

Figure 4-1 provides a conceptual illustration of the Design Viewpoint.

You may think of a design viewpoint object as a picture frame through which a downstream tool views the source 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.





What the Simulator Sees

Figure 4-1. Conceptual Illustration of a Design Viewpoint

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 Figure 4-1, 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 part of the figure, even though the source schematic is unchanged. All downstream tools must view a source schematic through a design viewpoint. Typically, if a schematic doesn't have a design viewpoint, the downstream tool creates one automatically when the tool is invoked on the design.

Design viewpoints can only be edited with a tool called the Design Viewpoint Editor. (Refer to the *Design Viewpoint Editor User's and Reference Manual* for more information about editing design viewpoints.) 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, but you cannot edit the design viewpoint directly.

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 in Figure 4-2 shows how the concept of the design viewpoint makes this possible.

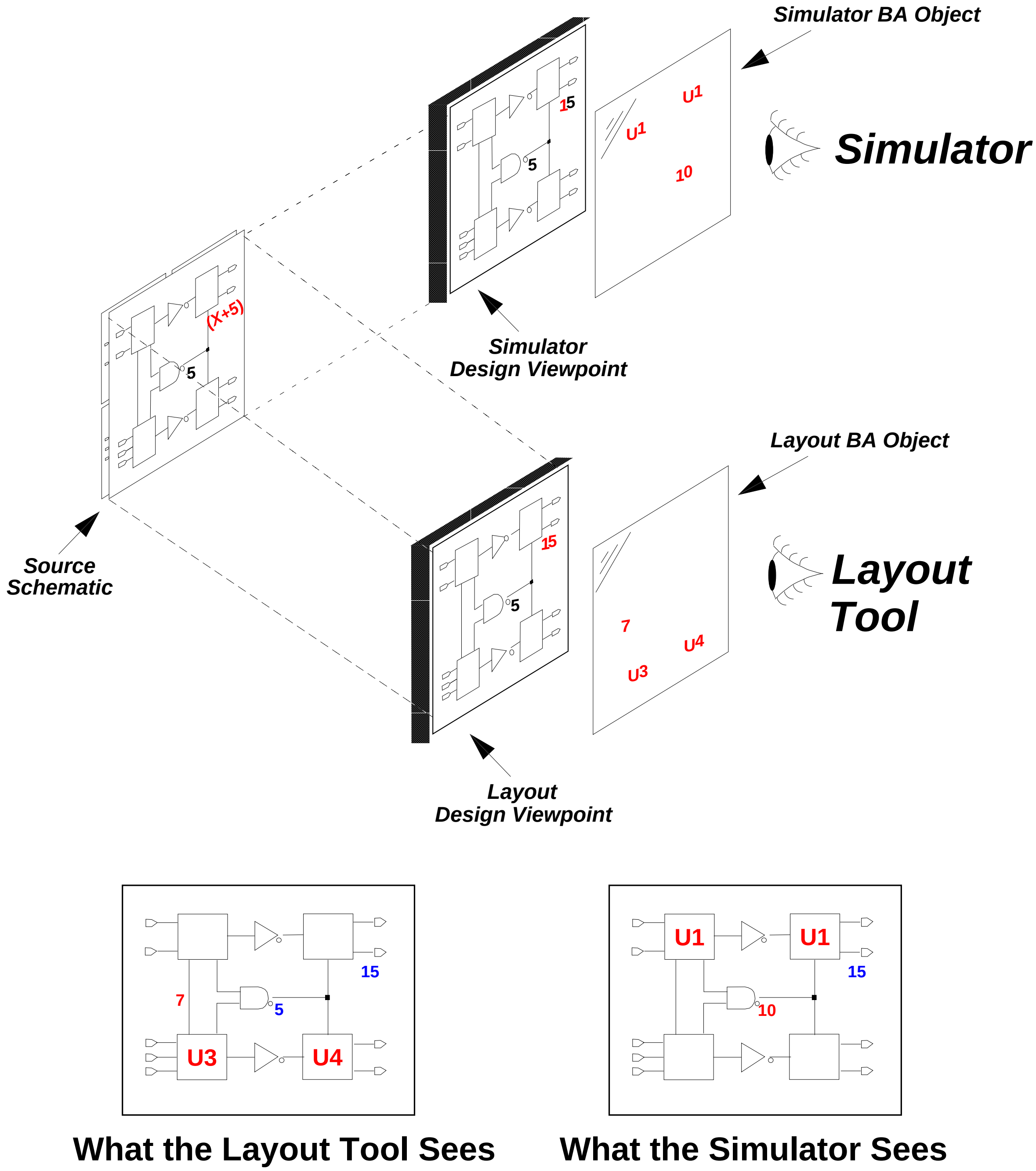


Figure 4-2. Multiple Views of a Source Design

As shown in Figure 4-2, the Simulator and the Layout tool both see the reflected image of the source design in their respective design 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

The ability to *connect* any Back Annotation object to any viewpoint makes it possible for design changes to be shared between tools. Figure 4-3 illustrates how back annotations recorded in a physical layout back annotation object are connected to a simulation design viewpoint.

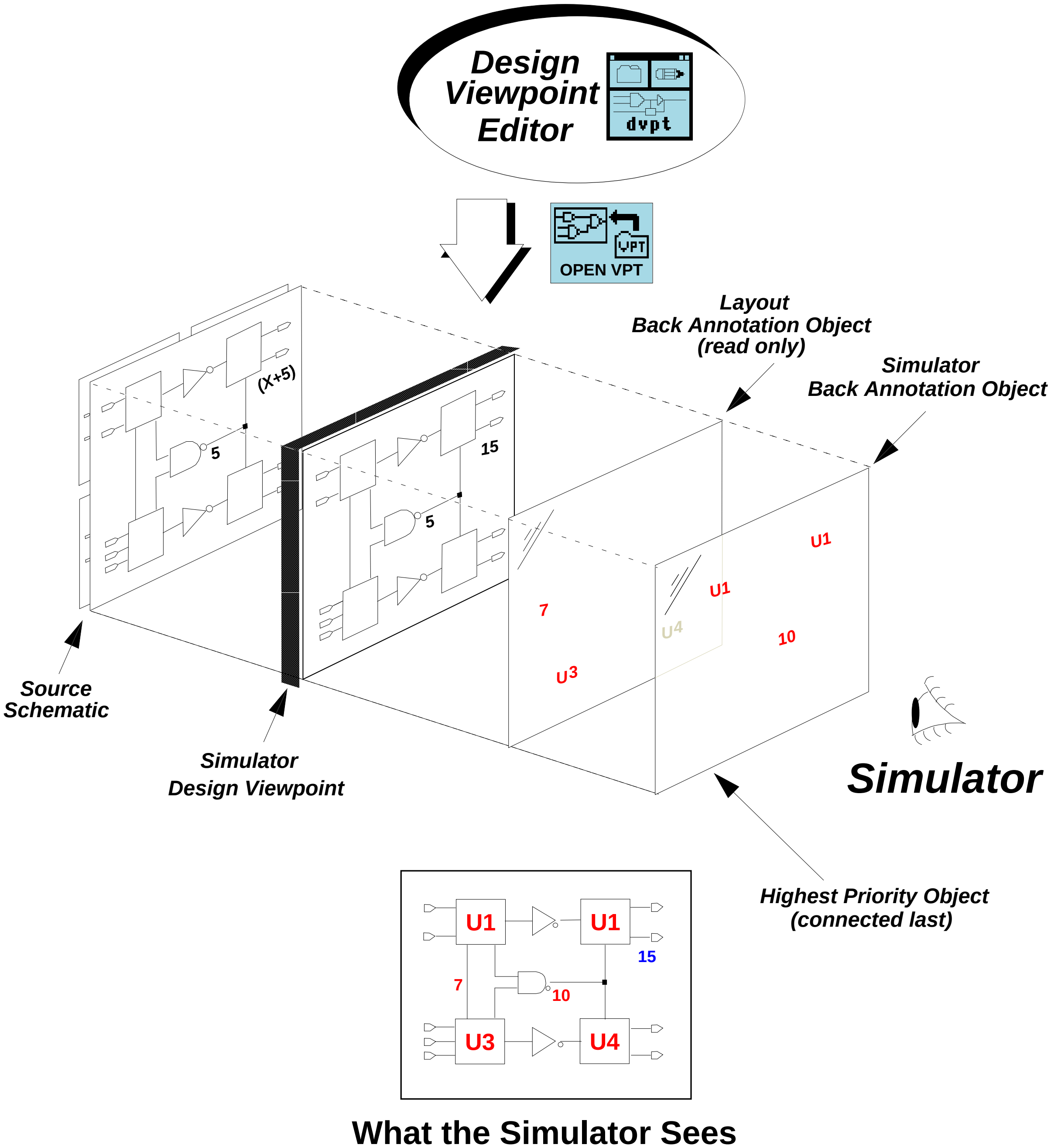


Figure 4-3. View Layout Changes in the Simulator

In Figure 4-3, the Layout Tool Back Annotation object is now connected to the Simulation design viewpoint. It can at the same time also be 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 illustration at the bottom of Figure 4-3 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. A Mentor Graphics shell-level utility called **Reconcile** has been provided to help design team members manage back annotations from different sources. The Reconcile utility is documented in the *Design Viewpoint Editor User's and Reference Manual*.

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 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.

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.

Figure 4-4 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.

In a similar manner, the information in an ASCII back annotation file may be imported to another specified back annotation object.

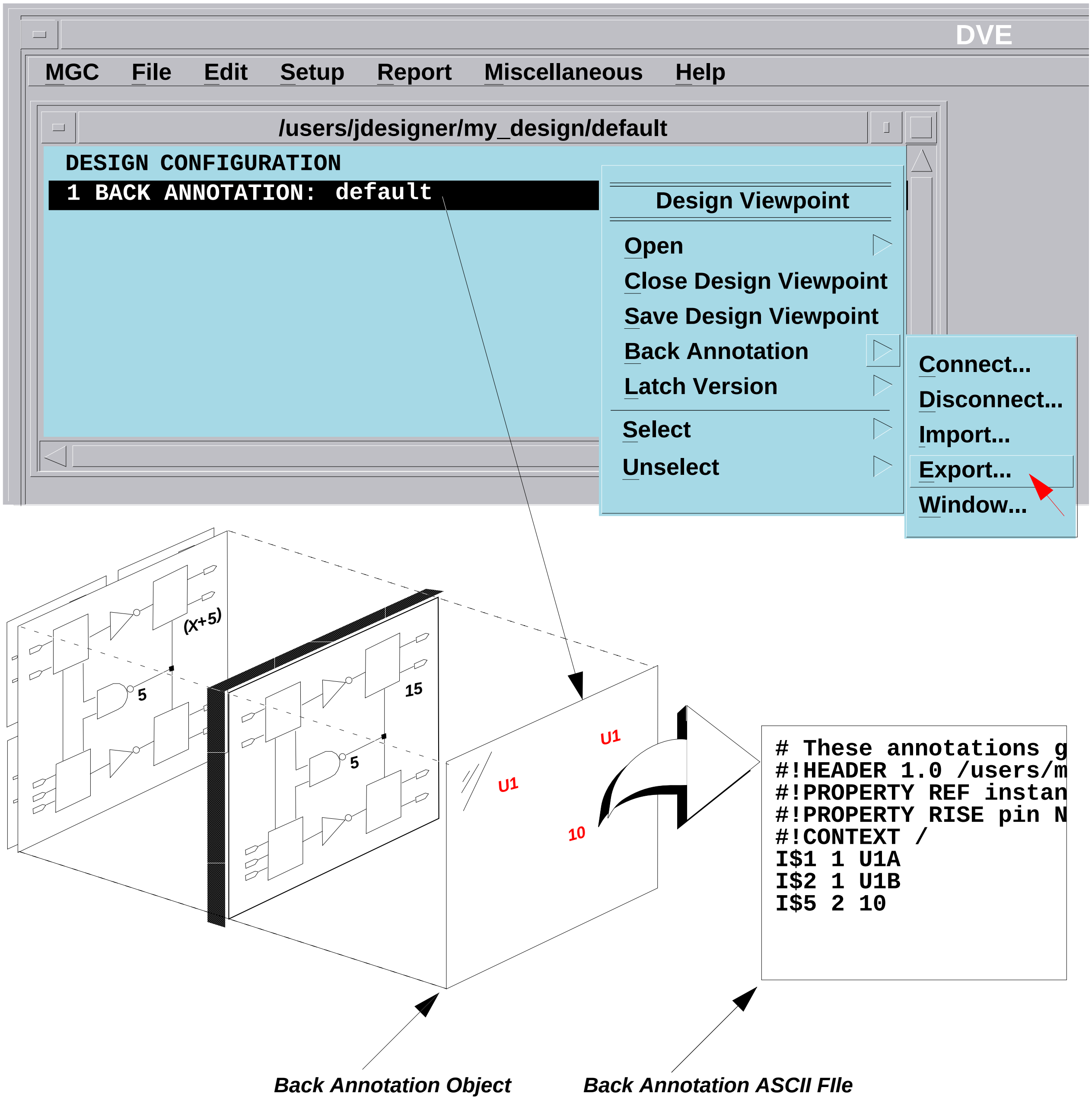


Figure 4-4. Importing and Exporting ASCII Back Annotation Files

Iconic View of Design Viewpoints

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.

Figure 4-5 shows the default location for the design viewpoints and back annotation objects.

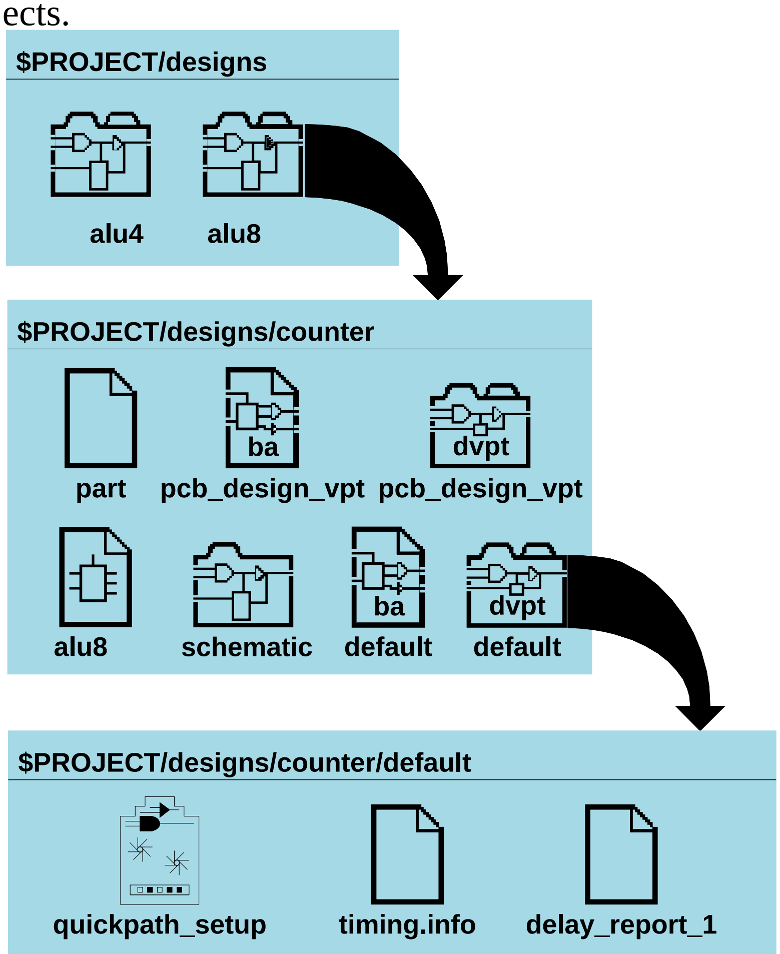


Figure 4-5. Iconic View of Design Viewpoints

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

Figure 4-6 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.

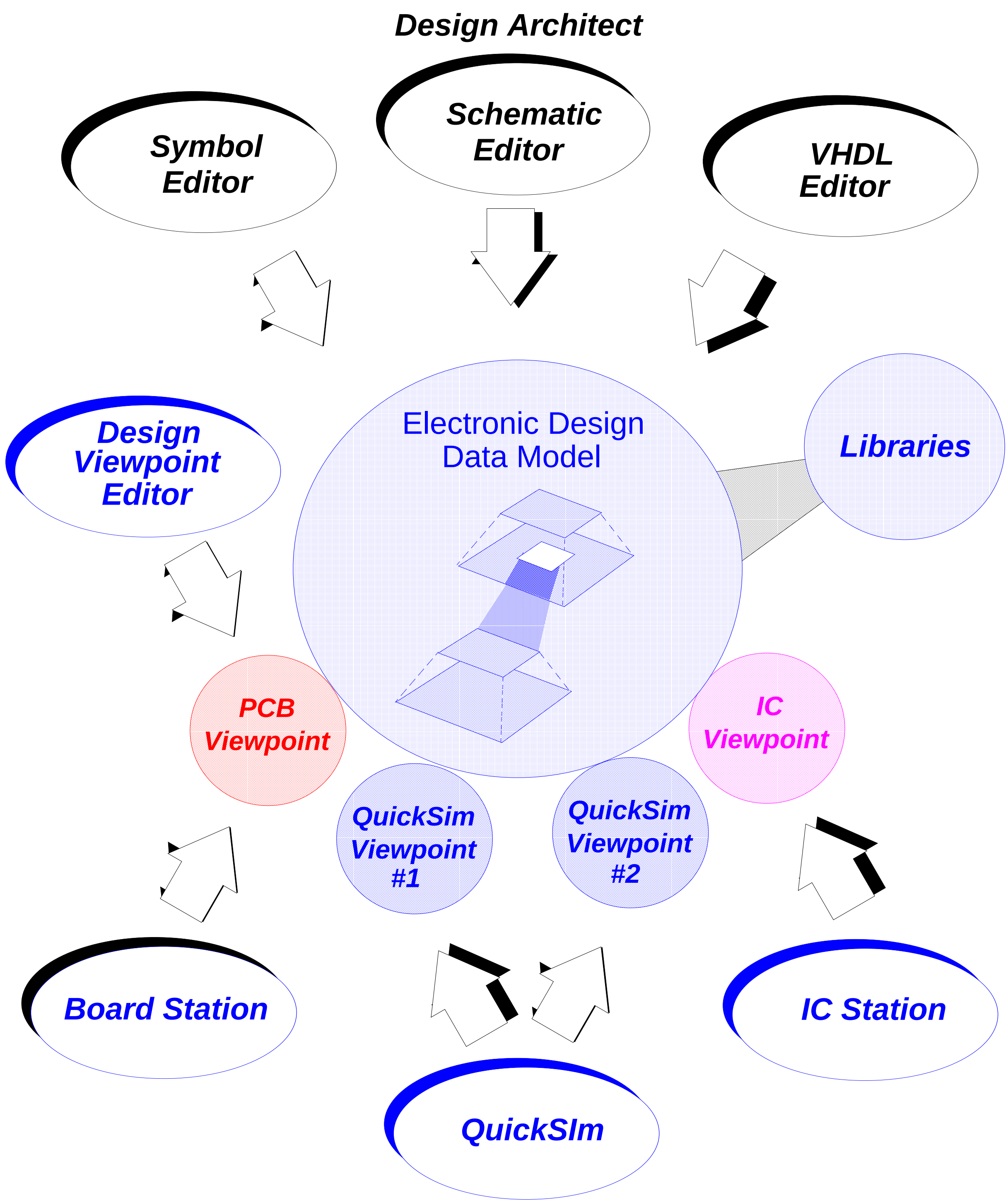


Figure 4-6. Downstream Tools and Viewpoints

How Design Viewpoints are Created

A design viewpoint can be created in several ways as shown in Figure 4-7.

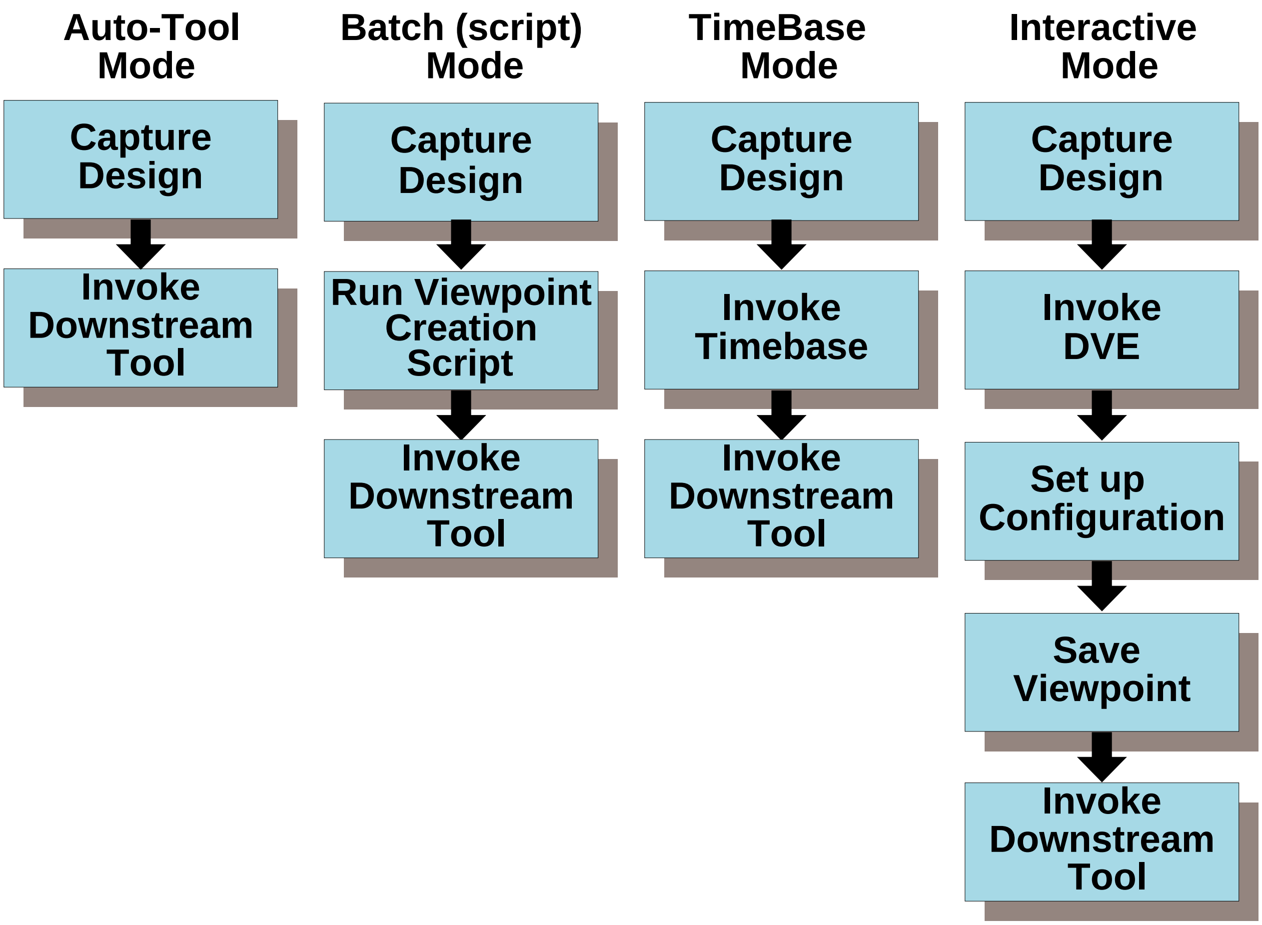


Figure 4-7. How Design Viewpoints are Created

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.

Properties in the Context of a Design

The following topics describe how to set the visibility of new back annotations, how to view properties, and how to add new properties in the context of a design viewpoint.

Setting New Annotation Visibility

By default the following back-annotation properties are hidden if they do not already exist on the sheet:

part_no	brd_loc	geom
refloc	pow_typ	pow_max
pow_min	junction_max_t	pow_derating
pow_del_max	pow_del_typ	pins_out
mfg	therm_jc	therm_r
comp_height	therm_cond	spec_heat
mass_density	surface_area	pcb_pin_loc
pcb_pin_pad	pcb_ba_net	source
terminator	pcb_ba_name	netdelay
cap_net		

You can customize the visibility of back-annotated objects that do not already exist on a sheet by creating a dofile which is called automatically when opening a design in the context of a design viewpoint. Existing back annotations are not affected. The dofile must be named *setup_new_ba_properties.dofile* and contains calls to the $set_new_annotation_visibility() function. Design Architect searches for the dofile in the following order and uses the first occurrence of the file that it finds:

1. $HOME*/mgc/setup_new_ba_properties.dofile*
2. $MGC_HOME*/etc/cust/setup_new_ba_properties.dofile*
3. $MGC_HOME*/shared/etc/cust/setup_new_ba_properties.dofile*

The following code block shows a sample listing of a *setup_new_ba_properties.dofile*:

```
{ local original_mode = $set_transcript_mode(@off);
$set_new_annotation_visibility(@vi sible, 'baprop1', 'baprop2');
$set_new_annotation_visibility(@hidden, 'baprop3', 'baprop4');
$set_transcript_mode(original_mode);}
```

Design Architect does not issue a warning if this file does not exist, but if the AMPLE syntax is not correct, you will get an error message. The HOME environment variable must be set before using this dofile.

Additionally, if the DES_ARCH_HIDE_BA_ONLY_PROPS environment variable is set to any value, the dofile is overridden and all new back annotation properties are hidden.

Adding Properties

There are three commands that control whether properties are added to the schematic sheet or the back annotation object while editing in the context of a design. The Set Edit Mode command controls whether schematic sheet edits are “on” or “off”; the Show Annotations command turns editing of back annotations “on”, and the Hide Annotations command turns editing of back annotations “off”.

The combinations of setting back annotations on/off and schematic sheet edits on/off controls where and how properties are added. For example, as shown in Table 4-1, if annotations are “off”, and edits are “on”, properties are added to the schematic sheet. If annotations are "off", and edits are "off", properties cannot be added; if annotations are "on", properties are added to the back annotation object.

Table 4-1. Where Properties are Added

	Annotations On	**Annotations Off**
Edits On	Properties added to back annotation object.	Properties added to schematic sheet.
Edits Off	Properties added to back annotation object.	Properties cannot be added.

Note

If you edited the schematic sheet in the context of a design, you must save your sheet before you change the edit mode to "off"

Viewing 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. (See page 3-19 for details on property resolution rules)

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.

Refer to Table 4-2 for the four viewing cases.

Table 4-2. Property Values Displayed

	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.

Traversing the Design Hierarchy

After you have opened a design sheet that has multiple levels of hierarchy, you can traverse the hierarchy of your design with the Open Down and the Open Up commands. The Open Down command opens a sheet one hierarchical level down from a selected instance. The Open Up command opens the sheet one hierarchical level up to the parent instance.

You can lock schematic sheet edits by attaching the Source_Edit_Allowed property with the value of “False” to the parent instance. In this case, when you traverse 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”.

Merging Back Annotations to Schematic

You can merge back annotations into the schematic sheet when editing in the context of a design viewpoint. When a schematic sheet is open with back annotations displayed and schematic edits "on", you can merge all back annotations shown on the current schematic sheet using the Merge Annotations command. This command merges annotations on only one sheet at a time.

The Merge Annotations command replaces all the schematic sheet property values with the back annotated property values from the connected back annotation objects on the currently-viewed sheet. After this command is executed, if you decide to save the sheet, the back annotation objects will no longer contain the property values which were successfully merged into the schematic sheet.

Property values may not be successfully merged if the property has a stability switch value that does not allow changes to the schematic sheet value. Back annotations for a symbol's fixed properties are stored in the viewpoint.

Caution If the schematic sheet is used in more than one place in your design, and you merge back annotations to that one sheet, all other components that use this sheet see the changes. Since all occurrences of the component see the changes, you should not merge to reusable sheets.

Viewing Back Annotations

In the following example, a schematic sheet is opened in the context of a design viewpoint from within Design Architect, and viewing of back annotations is enabled. Next, a design sheet in the same viewpoint is opened on another instance with back annotations enabled. The purpose of this example is to show how to enable and disable the viewing of back annotations in the context of a design viewpoint in Design Architect. You will also see the relationship between identical sheets used in multiple instances.

For this example assume that you have:

- A design named “my_design” with two 74161 instances with instance handles I$1 and I$2; see Figure 4-8.

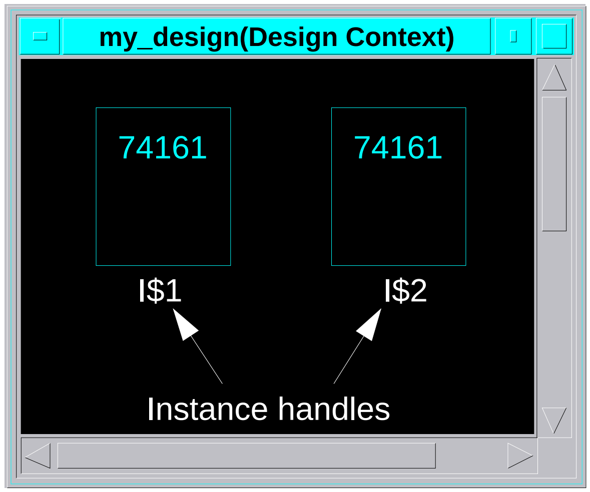


Figure 4-8. “my_design” Design

- 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 Design Viewpoint Editor window as shown in Figure 4-9.

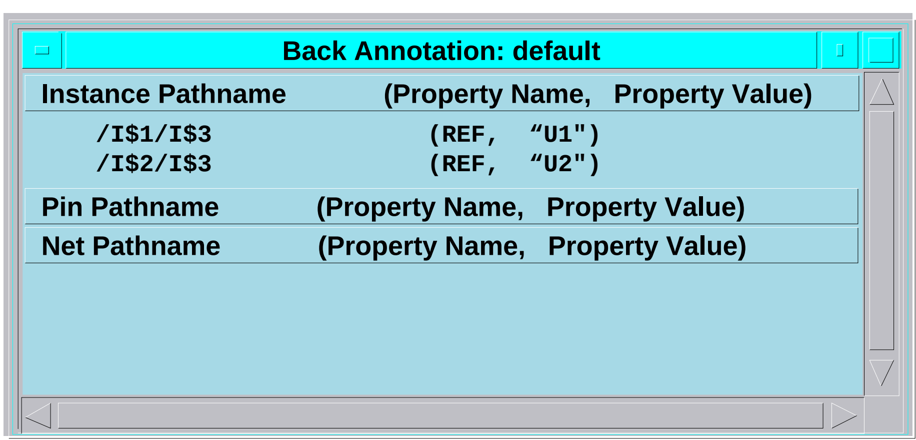
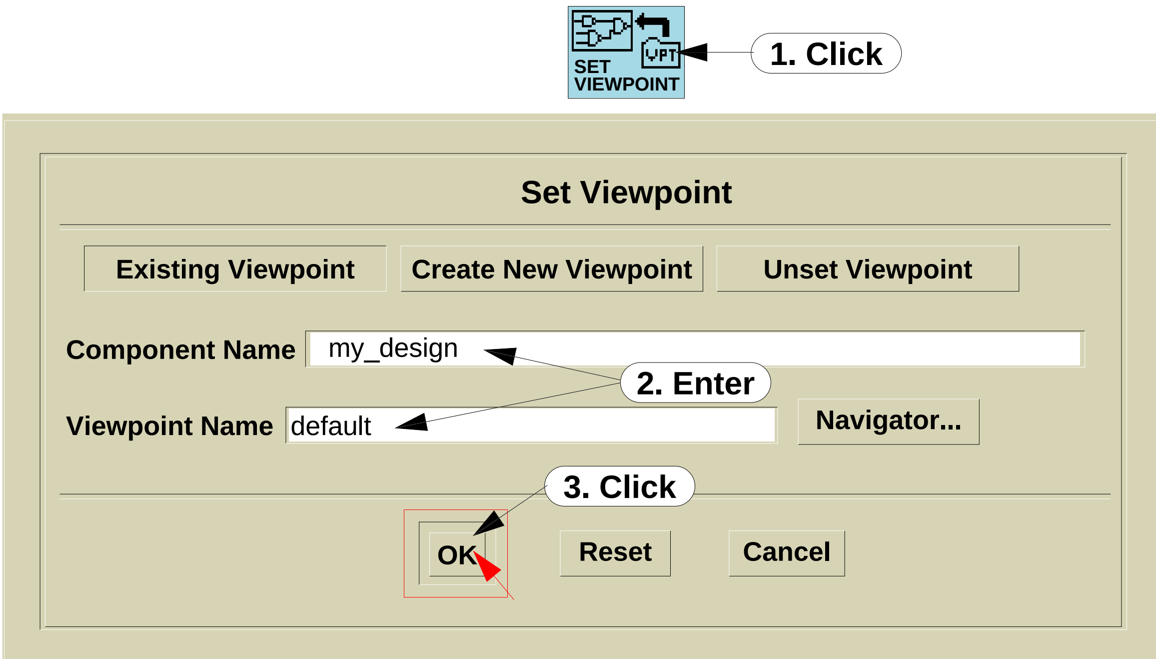


Figure 4-9. “default” Back Annotation Window

Assume that you open **my_design** in the "context of a design viewpoint," by clicking on the following icon and filling out the dialog box:



The Open Design Sheet dialog box appears and you click **OK**.

By default, both the viewing of back annotations and the evaluation of parameters is enabled, as shown in Figure 4-8. For this and the following examples, the viewing of back annotations and the evaluation of parameters is initially turned off.

To view the sheet under the I$1 instance, you select the instance and execute the Open Down command. A new window displays the schematic sheet for 74161 with instance handle I$1 in the context of the "default" design viewpoint.

For more information about design configuration rules, see the *Design Viewpoint Editor User's and Reference Manual*. Remember that the back annotation object is connected. The “74161” window for I$1 is shown in Figure 4-10.

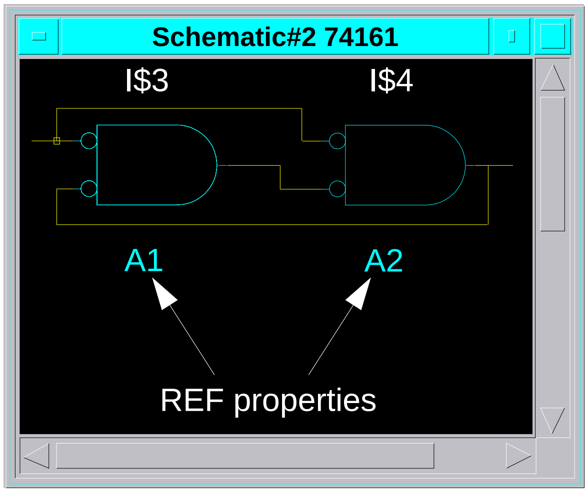


Figure 4-10. “default: I$1" Window

The schematic sheet of instance I$1 has two symbols, I$3 and I$4, both of which have a property named “REF”. Because back annotations are not currently being viewed, the property values in the design view of the sheet are A1 and A2, which are the same values as the source schematic sheet.

The first line in the “default” back annotation window shows that the instance “I$1/I$3” has a “REF” property whose back annotation property value is “U1”. When you display back annotations with the Show Annotations command, the REF property value for instance I$1/I$3 changes from “A1” to “U1”, as shown in

Figure 4-11. Turning on back annotations does not change the REF property value on the schematic sheet, which is still “A1”.

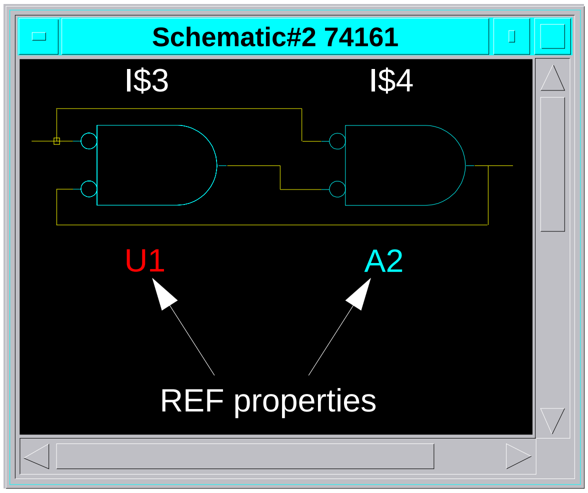


Figure 4-11. “default: I$1" Window with Back Annotations

The display of back annotation values can be turned off using the Hide Annotations command.

If you specify instance handle I$2 of “my_design” and Open Down to component 74161, a window displays the schematic sheet for the 74161, that is, I$2 in the context of the “default” design viewpoint. In the view of I$2, shown in Figure 4-12, notice it is identical to I$1, and that back annotations are not displayed and evaluation is disabled.

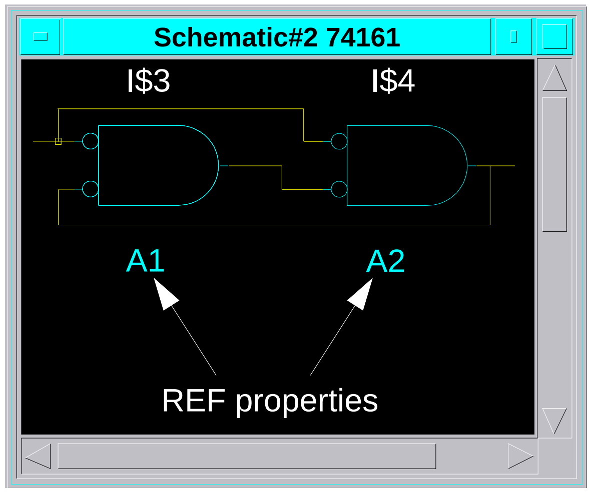


Figure 4-12. “default: I$2" Window

The second line in the “my_ba” back annotation window defines that the instance “I$2/I$3” has a “REF” property, whose back annotation property value is “U2”. When you turn on the display of back annotations, the “REF” property value for instance I$2/I$3 changes from “A1” to “U2”, see Figure 4-13.

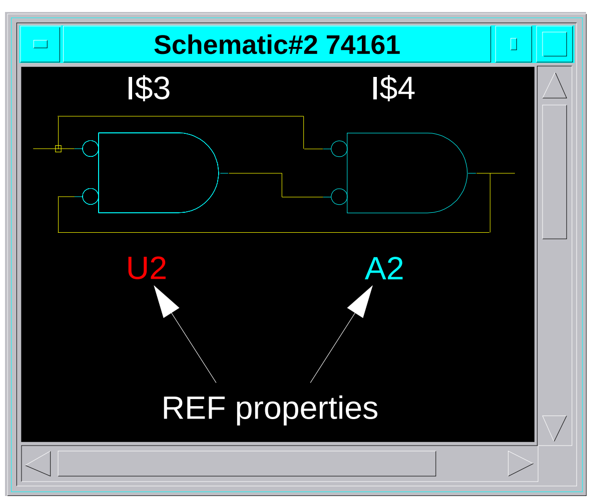


Figure 4-13. “default: I$2" Window with Back Annotations

The 74161 component instance I$3 is referenced with two unique properties in the context of "default" viewpoint for the same reusable component. Since the 74161 component is reused in the design, merging the back annotations to the schematic sheet would give only the current-viewable property value to the schematic sheet.

Evaluating Properties

In the next example, a design sheet is opened in Design Architect, with evaluation of property values and the viewing of back annotations disabled, to show the schematic sheet property values. Property evaluation is then enabled to show the property values, resulting from applying the design viewpoint parameters and hierarchy to the schematic sheet properties. Next, the display of back annotations is enabled. This example illustrates the concept of the evaluation and resolution of property values with respect to back annotations.

While editing in the context of a design, you can set the evaluation property values to be either "on" or "off" by using the Set Evaluations command. If "on" is specified, all property values are evaluated; if "off" is specified, property values are displayed unevaluated.

For the example, the "my_design" design has a property named COMP whose value is 74161, as shown in Figure 4-14. The REF source property value for I$1/I$4 has been modified to "$strcat(COMP, '_U2')" for this example.

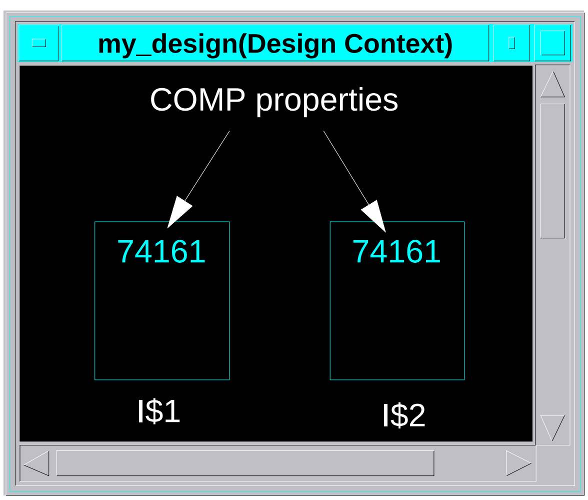


Figure 4-14. "my_design" Design with COMP Property

Also for this example, the “default” back annotation object has a new REF property value defined for I$1/I$4, as shown in Figure 4-15.

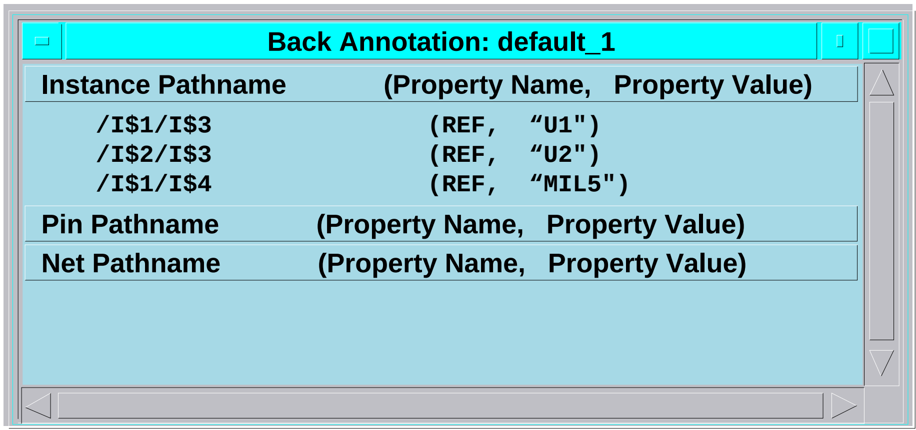


Figure 4-15. “default" Back Annotation Window with I$1/I$4

If you specify instance handle I$1 in the Open Design Sheet command, a window displays the schematic view of the sheet for the 74161; that is, I$1 in the context of the “default” design viewpoint. Notice in Figure 4-16 that back annotations are not displayed and evaluation is disabled.

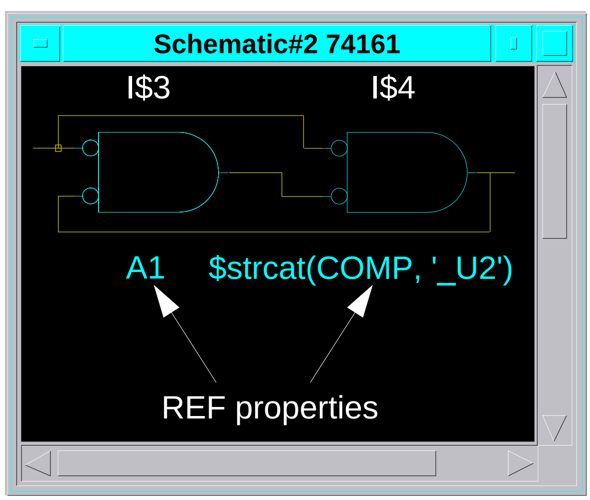


Figure 4-16. “default" with Expression

If evaluation is enabled using the Set Evaluations command, the displayed REF property value for I$1/I$4 changes to “74161_U2”, shown in Figure 4-17.

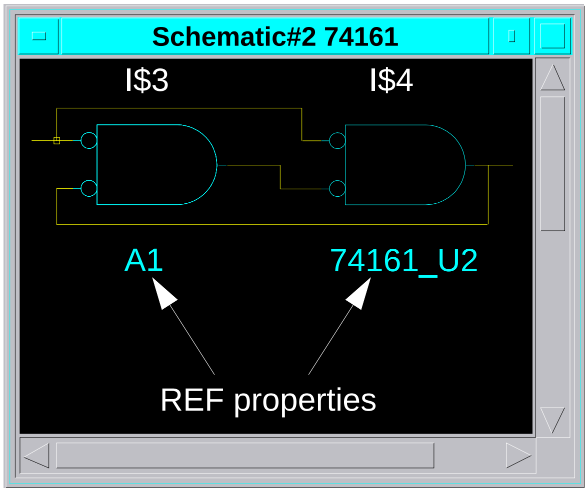


Figure 4-17. “default" with Expression Evaluated

If back annotations are enabled, the displayed REF property value for I$1/I$4 changes to the value specified in the connected back annotation object, “MIL5”, regardless of the evaluation setting, shown in Figure 4-18.

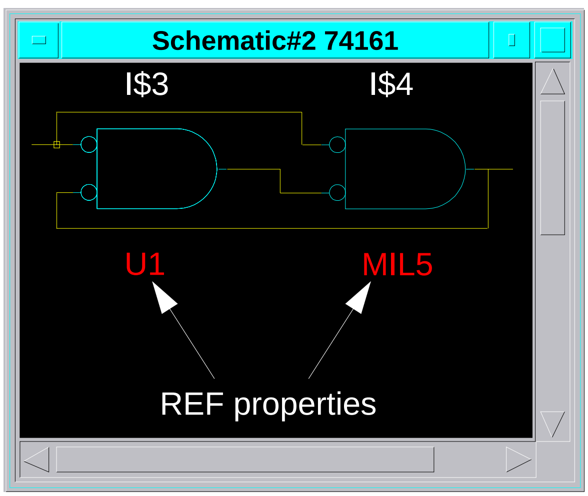


Figure 4-18. “default" with Back Annotations Enabled

Expressions in Back Annotation Objects

You can also place expressions in back annotation objects. 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 following example, a design sheet is opened in Design Architect, with evaluation of property values and viewing of back annotations disabled, to show the schematic sheet property values. The display of back annotations is then enabled to show the unevaluated value of the back annotated property. Next, property evaluation is enabled to show the resulting property value.

For this example the back annotation object has been modified to use an expression for the I$1/I$4 REF property value, as shown in Figure 4-19. Assume that the “my_design” is the same as Figure 4-14.

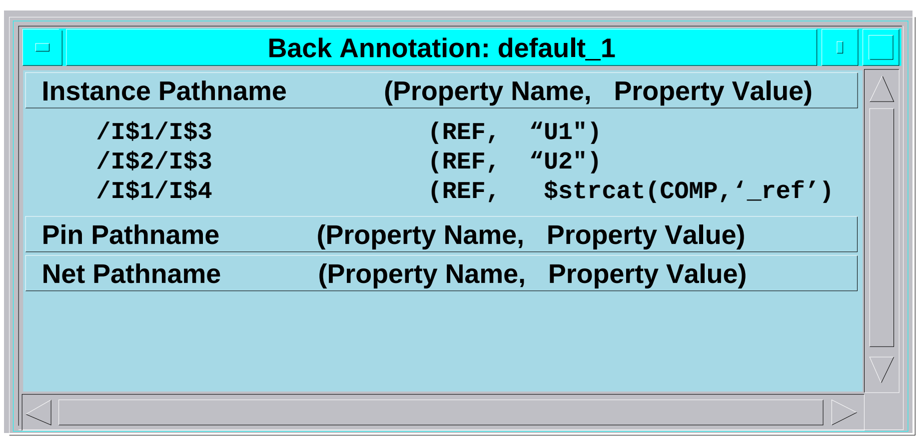


Figure 4-19. “default" Back Annotation Window with Expression

Before back annotations are displayed, the sheet appears as shown in Figure 4-20, with the REF property values of A1 and A2.

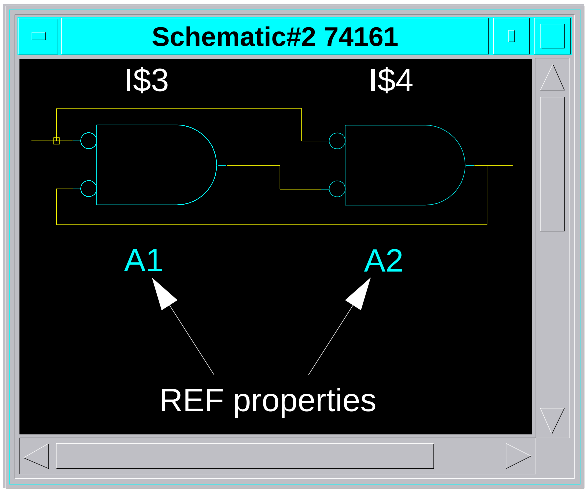


Figure 4-20. “default: I$1” Window

When back annotations are displayed without evaluation, the I$1/I$3 REF property value changes to “U1”, and the I$1/I$4 REF property value changes to “$strcat(COMP, '_ref')”, as shown in Figure 4-21.

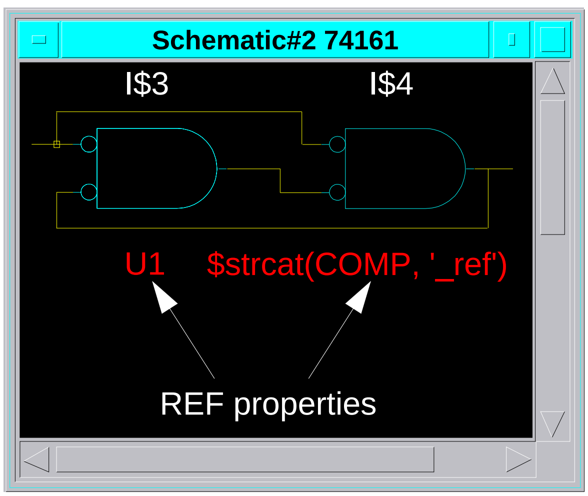


Figure 4-21. “default" with Back Annotation Expression

After evaluation is enabled with the Set Evaluations command, the I$1/I$4 REF property value changes to “74161_ref”, as shown in Figure 4-22.

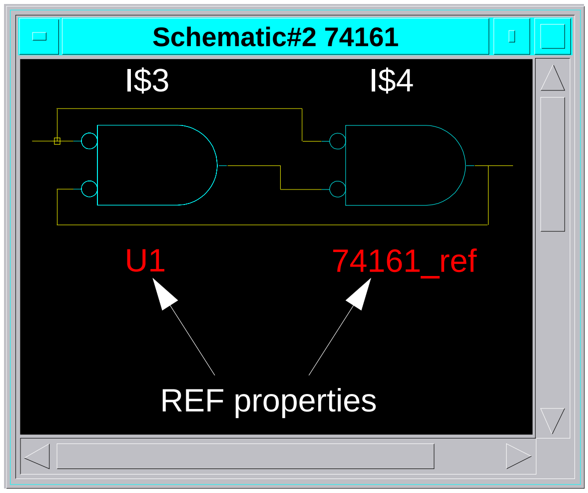


Figure 4-22. “default” with Back Annotation Expression Evaluated

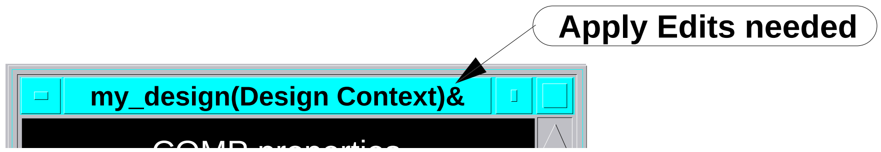
Applying Edits to the “In-Memory” Design

When you invoke Design Architect on a Design Viewpoint and turn annotations on, you may edit both the annotations and the source schematic at the same time.

Assume, for example, that you graphically add a hierarchical instance to the root sheet while you are editing in the context of a design viewpoint. Before you can **Open Down** into this new hierarchical instance, you must apply this edit to the image of the design data that is in memory. This can be done in one of two ways (1) execute an $update_all() function which saves all the design sheets to disk before updating the in-memory design, or (2) execute File > Apply Edits. When you use the Apply Edits method, you update the memory directory, thus eliminating the time it takes to save all the sheets to disk plus you eliminate the additional version updates that take place.

Apply Edits is just a short hand approach of updating the in-memory design so you can see the effects of your edits without updating the sheets that are saved on disk.

When you are editing in the context of a design viewpoint and there is a need to apply the edits to the in-memory design, an ampersand "&" appears in the banner of the Schematic window as shown below.



After you execute the File > Apply Edits pulldown menu, the ampersand goes away.

Reconnecting Annotations when Objects are Deleted

Sometimes during the course of editing a design, an object like an instance is deleted and replaced by other instance. If the original instance owns one or more properties that are back annotated through a back annotation object, the back annotations become unattached. Design Architect gives you the ability to check for and report on unattached annotations and either reattach them to current objects or delete them from the design.

Chapter 5
Design Error Checking

Mentor Graphics applications are designed to insure that you produce a valid, workable circuit. To produce a workable circuit, a full set of checks must be passed, starting in Design Architect when the design is created, continuing after the design is evaluated, and finally when the downstream application is invoked on the design.

Performing error checks early in the design process reduces rework.

Error Checking in Design Architect

Design checks are grouped into selective categories: schematic checks, schematic sheet checks, and symbol checks, as illustrated in Figure 5-1.

Mentor Graphics requires symbols and schematic sheets to pass a set of required Design Architect checks. Required schematic sheet checks are listed in Appendix A, in "Schematic Sheet Checks" starting on page A-1. Required symbol checks are listed in "Symbol Checks" starting on page A-12.

In addition to the required checks available, Design Architect includes a set of optional checks that can be incorporated into your own design check and validation process. You can specify that a sheet not be marked as having passed check successfully until some set of the Design Architect optional checks pass without errors. Optional checks are listed in Appendix A.

Designs are not complete and may not be processed further until they have passed the minimum required checks. For example, if the symbol does not pass the required symbol checks, the symbol will not be valid for instantiation on a schematic sheet. Also, if a schematic sheet does not pass its required checks before a downstream application is invoked, the downstream application will issue a warning when it is invoked, highlighting a problem that may be uncovered at a later time.

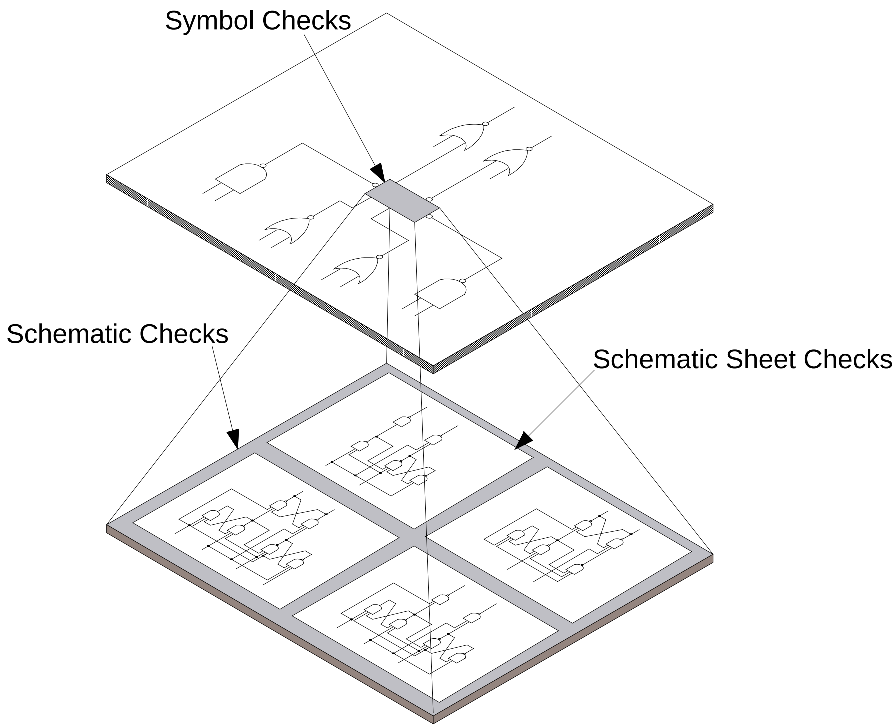


Figure 5-1. Symbol, Schematic, and Schematic Sheet Checks

The Check Command

The Design Architect Check command is used to:

- Validate that the symbol or schematic sheet is syntactically correct, and can be used by other Mentor Graphics applications.
- Issue warnings to identify areas which could be the result of user error.
- Issue messages which are informative (for example, the not-dots check provides a list of not-dots active on the sheet).
- Automatically name instances and nets by their handles.

The Check command also performs checking appropriate to the object currently being edited. The type of checks executed by a particular Check command can be specified by a previous Setup Check command, or by setting the switches on the Check command itself.

Table 5-1 lists Check switches for schematic sheet checks.

Table 5-1. Check Command Schematic Sheet Switches

-INStance -SPecial -Net -FRame -PArameter -EXpression -PIns -OWner	-OVerlap -NOTDots -Closedots -Dangle -INIt_props -Userrule -UserruleFile

Table 5-2 lists Check switches for symbol checks.

Table 5-2. Check Command Symbol Switches

-SPecial	-INTerface
-PIns	-Userrule
-SYMBolbody	-UserruleFile

Table 5-3 lists Check switches for schematic (all schematic sheets in a design) checks. Refer to the *Design Architect Reference Manual* for descriptions of Check command switches and internal state variables.

Table 5-3. Check Command Schematic Switches

-SChematicINTerface	-SChematicNet
-SChematicSpecial	-SChematicUserrule
-SChematicInstance	-SChematicuserruleFile

Checks can be selected for individual schematic sheet and symbol elements. For example, if you want to check only the nets on a schematic sheet, you could execute the Check command with the -Net switch set to “all”, and set the remaining switches to “nocheck”. Most Check command switches can be set to a value of “all”, “errorsonly”, or “nocheck”. The “all” value displays both errors and warnings for the specified item. The “errorsonly” value displays only the errors, and the “nocheck” value turns off the specified check switch.

For a step-by-step procedure on how to setup and execute checks, see “Checking a Schematic for Errors” on page 6-41, and “Checking a Symbol for Errors” on page 6-90.

Setting Up the Check Command

The Check command switches are set at invocation to execute, by default, all of the required Mentor Graphics checks for each of the check groupings. You do not need to set up the required checks, though you may want to add or delete optional checks from the list of default checks. This is done with the Setup Check Sheet command for individual schematic sheet checks, the Setup Check Schematic command for schematic checks, and the Setup Check Symbol for symbol checks. Check switches set with the Setup Check command remain set for the duration of the session, or until a subsequent Setup Check command is executed, or the check internal state variables are changed.

User-Defined Error Checking

You can extend the functionality of DA's basic check capability by adding your own user-defined macros. User-defined macros are executed and reported in the same manner as other DA checks.

A user-defined macro is written in the AMPLE language, and has access to the full capability of DA functions within the specific editor's scope. A user-defined macro can be specified for a schematic sheet check, schematic check, and symbol check. A macro specified for schematic sheet or schematic checks has access to all functions within the scope of the Schematic Editor. A macro specified for a symbol check has access to all functions within the scope of the Symbol Editor.

Every user-defined macro must have a $set_userrule_error() and/or a $set_userrule_warning() function included that passes a formatted error string back into DA for subsequent display in the check report. This is the only way to cause errors or warnings to be included in a check report. To learn more about how to write AMPLE macros, refer to the *AMPLE User's Manual*.

The setup procedure used to activate a user-defined check is similar to the setup procedure used to set up other checks. A macro file_name and -Userrule switch are specified as arguments to the "Setup Check" commands and the Check command. When both arguments are set and the Check command is executed, the user-defined macro is executed with the other specified checks, and errors generated by the macro are reported like other Check errors. To find out more about how to set up your symbol checks and schematic checks, refer to page 6-90 and page 6-41 respectively.

This example defines a symbol check to enforce character restrictions on each pin on a symbol. This macro loops through a list of pin names, identifying invalid pin name syntax, and notifying DA of the errors with the $set_userrule_error() function.

```
// This AMPLE macro check is executed on symbols, and checks
// for enforcement of character restrictions for each pin of a
// symbol.
// This macro will do the following:
// (1) extract a set of pin handles
// (2) declare a regular expression defining valid pin name
//     syntax
// (3) loop through each pin
//    (3a) extract pin_name using the DA
//         $get_object_property_attributes function
//    (3b) perform pattern match between pin_name and valid
//         pin_name syntax as defined by the regular
//         expression "pattern"
//    (3c) notify errors to DA using the $set_userrule_error()
//         DA function
{
 local pin_handles = $get_pin_handles();
 local pattern="^[a-zA-Z][a-zA-Z0-9_$]*(\\([^)].*\\)){0,1}$";
 local i, pin_name;
 for (i = 0; i < length(pin_handles); i = i+1) {
 pin_name = $get_object_property_attributes(pin_handles[i],
     "pin", @value)[0];
 if ($string_locate(pin_name, pattern, 0) == UNDEFINED)
 {
   $set_userrule_error($strcat("Invalid pin name '",pin_name,
     "' on ", pin_handles[i]));
 }
}
```

Listing Status of Checks

Current settings can be reported using the Report Check command. This command shows the current settings of each internal state function and the current status of each corresponding check category for the active schematic sheet or symbol.

Evaluated Design Checking

Evaluated design checking occurs outside of Design Architect. Evaluated design checks examine the contents of an entire design by using the configuration rules defined in the design viewpoint to evaluate the design. These checks examine the design for mismatched connections, unique names, parameter values, and many other types of checks. The individual evaluated design checks are described in the *Design Viewing and Analysis Support Manual*.

Figure 5-2 shows the meaning of evaluated design checks with respect to a design. Unlike schematic sheet checks, evaluated design checks examine the design at different hierarchical levels.

Extended design checking is available in DVE and during the invocation of most downstream applications, such as QuickSim II.

NOTE: For detailed descriptions of error, warning, and information messages issued when performing evaluated design checks, see the *Design Viewing and Analysis Support Manual*.

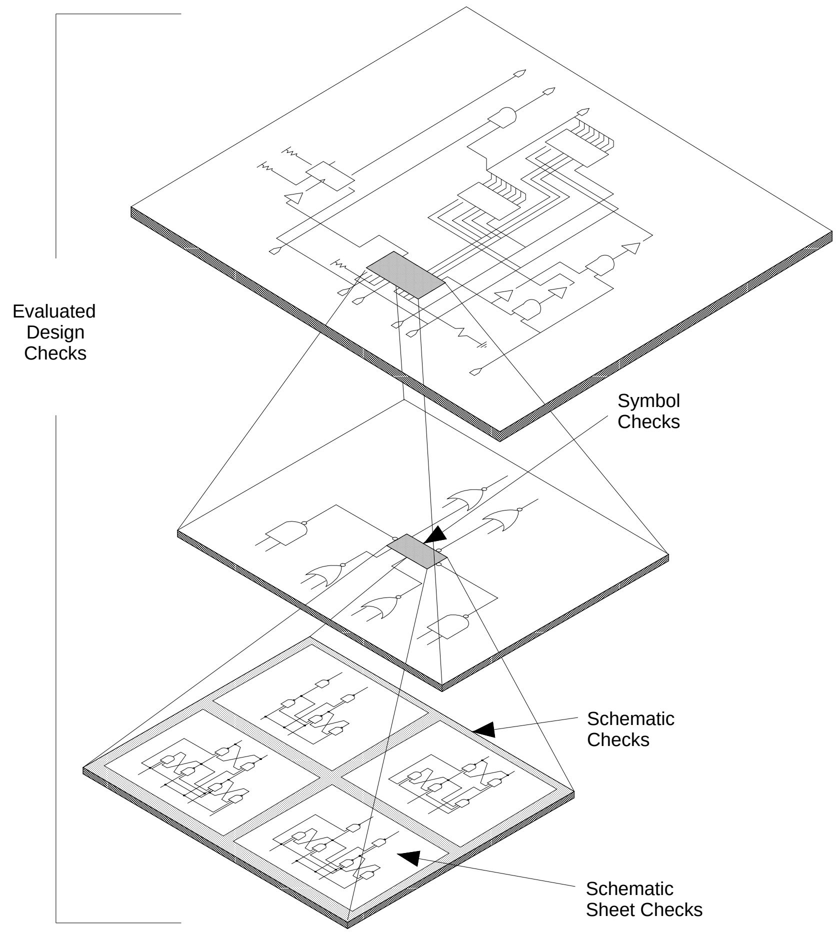


Figure 5-2. Evaluated Design Checks

Chapter 6
Operating Procedures

The following topics describe the most commonly used schematic and symbol editing procedures in the Design Architect Symbol and Schematic Editors.

Procedure Conventions

You will need to keep in mind the following information when referring to these operating procedures:

- In the examples, what you type and menu paths are shown in **boldface** type.
- A standard typeface dollar sign ($) character represents a shell prompt.
- Square brackets indicate the name of a palette, followed by the name of the icon: **[Text] Sequence Text**.

  If needed for clarity, the name of the window, in parentheses, precedes the palette name: (Schematic) **[Text] Sequence Text**.

  The first item is generally the name of the menu (Setup), or it appears in most popup menus (Select). The name of the window may precede the menu name if needed for clarity.

Invoking DA

You can invoke Design Architect windows and design data from the Design Manager or an operating system shell.

From the Design Manager

To open a schematic, symbol, or VHDL editing window, you first invoke the Design Manager by entering the following command at a shell prompt:

```
$ dmgr
```

This shell command opens the Design Manager with a Tools window and a Navigator window within the Design Manager window. The Tools window contains icons that represent the tools authorized to run on your workstation; the Navigator window contains either a list of elements or icons that represent data objects. These windows are illustrated in Figure 6-1.

You can modify your startup file to automatically enter the Design Manager when you log in to your user account. Refer to the *Common User Interface Manual* for information about customizing startup files.

Two methods of invoking DA editors are provided from the Design Manager: *tool-centered* and *data-centered*. For tool-centered invocation of Design Architect, move the cursor to the Tools window and double-click the Select mouse button on the Design Architect icon.

For data-centered invocation from the Design Manager, move the cursor to the Navigator window, then double-click the Select mouse button on either the list element or the icon that represents the data object you want to edit or view. The Design Manager invokes the default tool for the selected data object. When more than one tool can operate on the selected data, a list of valid tools is displayed in a popup menu. You can then choose from the list of tools.

Refer to the *Design Manager User's Manual* for more information about how to invoke a Mentor Graphics application from the Design Manager.

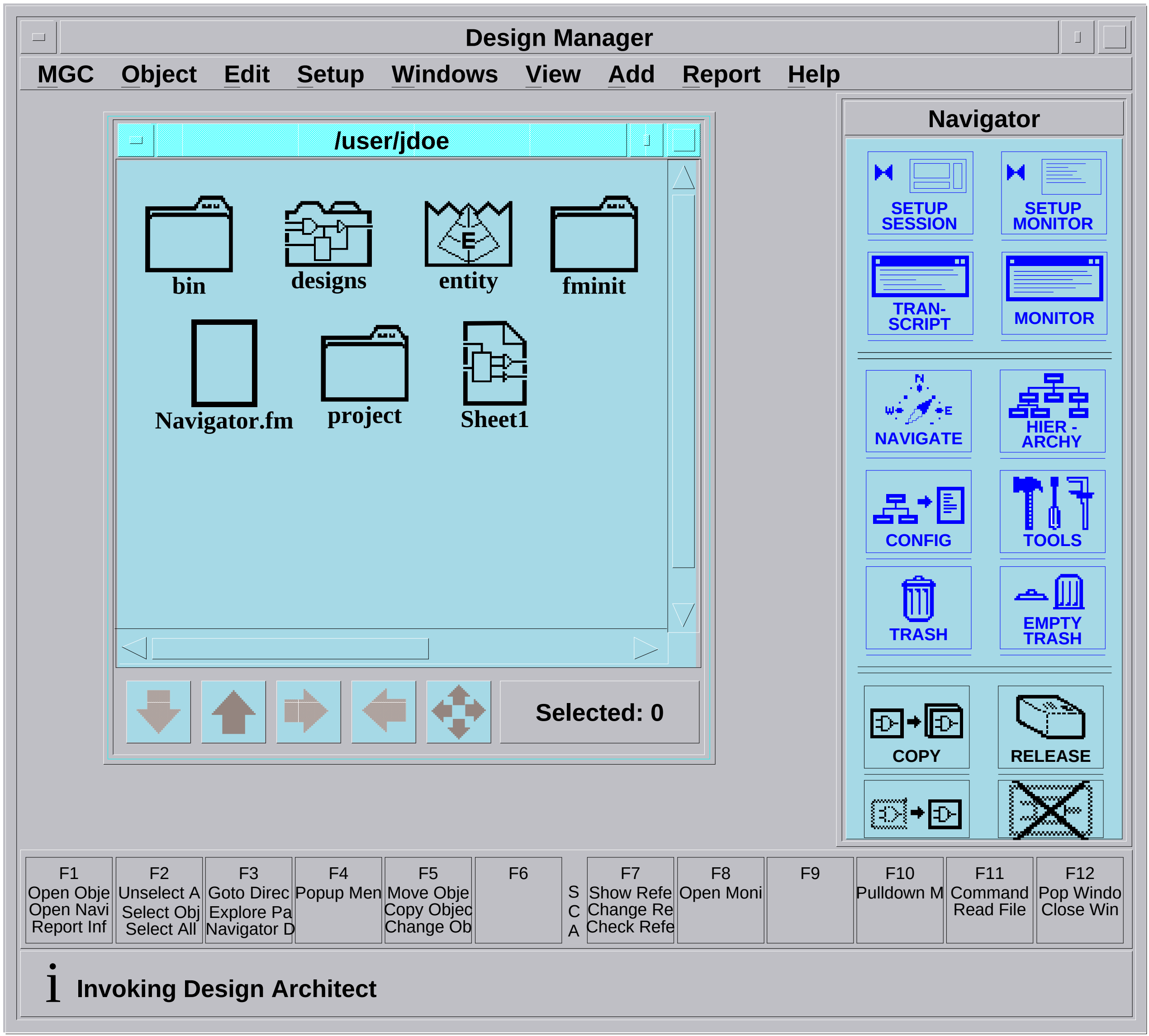


Figure 6-1. The Design Manager

From the Operating Shell

To invoke the Design Architect editors from an operating system shell, enter the following command at a shell prompt:

```
$ da
```

No arguments are needed for invocation. A new sheet or symbol is not automatically opened for editing or viewing, unless you specify a pathname and appropriate switches with the invocation, or execute one of the **Session** > **Open** popup menu items from the Design Architect Session window.

NOTE: When referencing a design object, if you provide a relative pathname that does not begin with the dollar sign ($) character, that relative pathname will be converted to an absolute pathname, based on the value of the environment variable MGC_WD. You must ensure that the value of MGC_WD is set to the correct value for your current working directory. If it is not set properly, an incorrect pathname for the reference may be stored.

For a complete listing of switches available for the **da** shell command, refer to "Shell Command Dictionary" in the *Design Architect Reference Manual*.

Exiting Design Architect

To exit from Design Architect, select the **Close** or **Quit** menu item from the active Design Architect Session window border. If you have other windows open in the Design Architect session area and if edits have been made since the last save in these windows, a dialog box is displayed for each of these windows asking whether you want to save the edits or discard them before closing the individual window within the Design Architect session. When all other windows are closed, then the Design Architect Session window is closed.

Obtaining Online Help

All Mentor Graphics applications have a **Help** pulldown menu which provides access to both quick help and reference help. The same menu appears when you choose the **Session > MGC > Help** popup submenu item. Menu items with an arrow have a submenu.

To list all commands that are available for a particular window, first activate the window by clicking the Stroke (middle) mouse button in that window. Type "*" in the window, then press the Ctrl-? or Ctrl-Shift-? keys to display a list of commands.

Quick Help

Quick help is an ASCII file describing the object(s) you specify. You can display a quick help file for each of the first six menu items, except "On Functions", by clicking the Select mouse key on the menu item.

Choosing "On Functions" displays a prompt bar in which you enter the name of a function. When you press the Return key or click the **OK** button, a description of the function, along with the syntax (in most cases), is displayed in a window.

You can print the help for strokes by clicking the Select mouse button on the Print button near the bottom of the help window.

Reference Help

The menu items beginning with "Open" are reference helps; they open a manual for online viewing in the BOLD Browser. To display the Getting Started with Design Architect Training Workbook, choose the **Help > Open Tutorial > Design Architect** menu item. If there is no BOLD Browser session open on your workstation, a message box is displayed, asking if one should be created; click the **Yes** button.

You can access reference help from a quick help message window by clicking the **Ref Help** button. Reference help is also available through the first three **Help** menu items. The submenu items open summary tables in the *Design Architect Reference Manual*.

More Help Submenu

Choosing **Help > More Help > Release Notes Highlights** displays a list of new features in the current release, and lists of new, changed, or deleted functions.

Selecting and Unselecting Objects

The following procedures describe how to select, unselect, reselect, reopen selection, and set the default selection filter. Refer to "Object Selection" starting on page 2-63 for a description of how the selection/unselection mechanism operates.

Selecting a Single Object

Before you can manipulate objects, you must select the objects you want to change. By default, the Select mouse button selects various objects for you. You can use it to select a single object or a number of types of objects which fall within an area of a sheet.

To select a single object, follow these steps:

1. Position the cursor on the object to be selected.

2. Click the Select mouse button.

The selected object becomes highlighted on the display, as shown in Figure . The basepoint (hourglass) icon is a reference point for future manipulations. The select count in the status line of the window reflects the number of selected objects (in this case, 1).

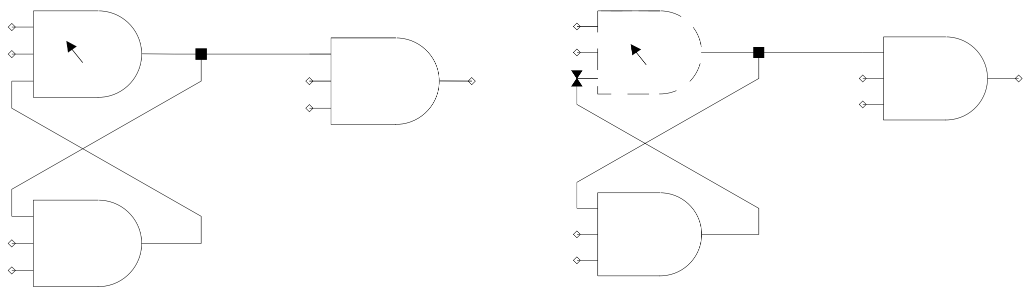


Figure 6-2. Selecting a Single Object

Selecting Multiple Objects

To select multiple objects, as shown in Figure 6-3, follow these steps:

1. Position the cursor at one corner of the objects to be selected. Press and hold the Select mouse button.

2. Move the cursor while still holding the Select mouse button. A dynamic rectangle is created which defines an area of the sheet. Manipulate the rectangle until it surrounds the objects to be selected.

3. Release the Select mouse button.

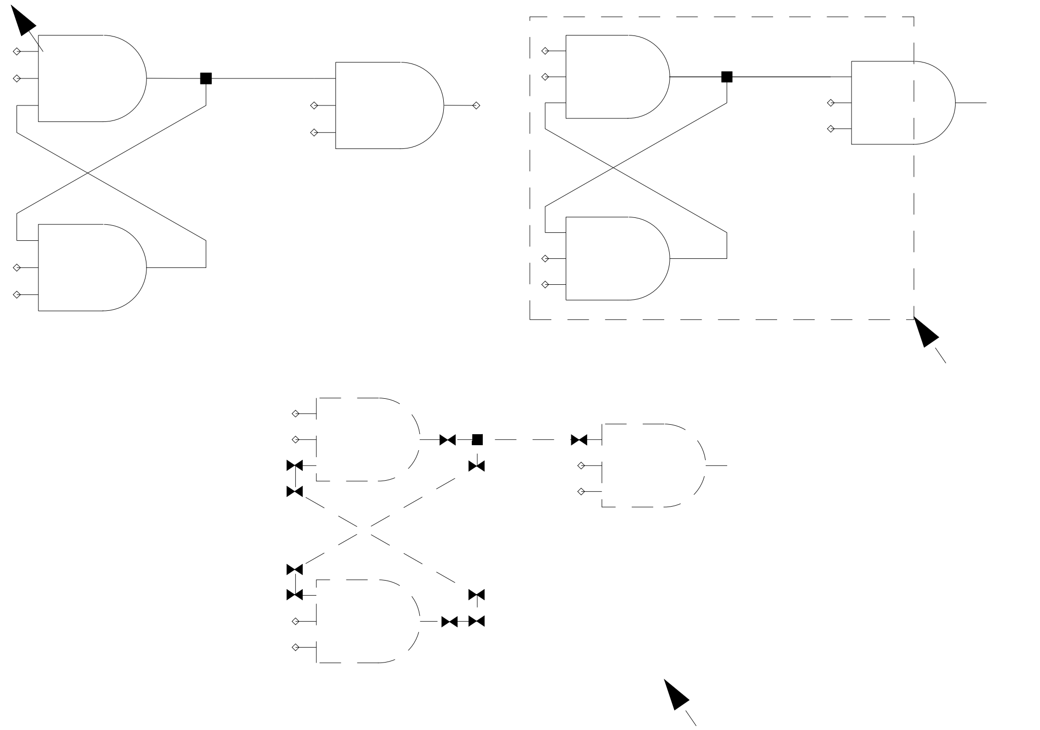


Figure 6-3. Selecting Multiple Objects

The object types selected are controlled by the Selection Filter. Objects completely or partially intersected by the rectangle are selected. Each selected net vertex has a selection (bow tie) icon. The basepoint icon is a reference point for future selections. The select count in the status line reflects the number of selected objects.

Unselecting a Single Object

To unselect a single object, position the cursor on the object you want to unselect. Click the Select mouse button.

The object is now unselected. Note that if you do not move the cursor and click the Select mouse button again, this action reselects the currently unselected object.

Unselecting Multiple Objects

To unselect multiple objects, as shown in Figure 6-3, follow these steps:

1. Position the cursor at one corner of the objects to be selected.

2. Press the Shift-F2 (Unselect Area Anything) function key sequence and hold.

3. Move the cursor while still holding the function key. A dynamic rectangle is created which defines an area of the sheet. Manipulate the rectangle until it surrounds the objects to be unselected, then release the keys.

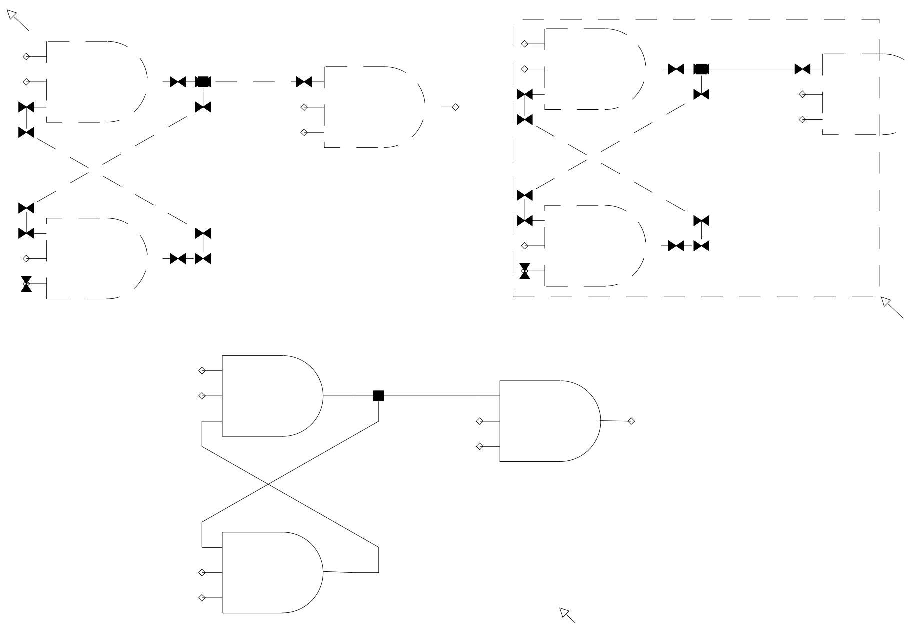


Figure 6-4. Unselecting Multiple Objects

Unselecting Everything

To unselect all selected objects on a sheet, press the F2 (Unselect All Anything) function key or the **Unselect All** button, or execute the **Unselect** > **All** > **Anything** menu item. Objects that were previously unselected remain unselected.

Reselecting a Selection Set

To reselect the last closed and discarded selection set, press the Ctrl-F4 (Reselect) function key or execute the **Select > Reselect** popup menu item. Refer to "Reselection" on page 2-66 for a description and example of the reselection mechanism.

Reopening a Selection Set

To reopen the last closed selection set, execute the **Select > Reopen Selection** popup menu item, or press the Ctrl-F1 (Reopen Selection Set) function key. Refer to "Reopen Selection" on page 2-66 for a description of the Reopen Selection command.

Setting the Default Selection Filter

To setup the default selection filter, perform the following step:

1. Either choose the **Setup > Select Filter** menu item, or click the Select mouse button on the **Set Select Filter** button in any palette. The Setup Select Filter dialog box appears.

2. Click with the Select mouse button on the object types you want selected by default. Refer to "Selection Filters" on page 2-68 for a description of how selection filters work.

Manipulating Graphical Objects

The following topics describe how to move, copy, delete, rotate, pivot, and flip selected schematic and symbol objects. These edit operations do not automatically make new electrical connections when a net passes over any existing pins or vertices. The connectivity before the edit is preserved.

Moving Objects

To move objects from one position to another, perform the following steps:

1. Select the object(s) to be moved. For information about selecting and unselecting objects, refer to page 6-6.
2. Press the Ctrl-F2 (Move) function key or choose the **Move > Selected** popup menu item. The Move prompt bar appears in the schematic window with the location cursor on "To Location". The moving pointer also appears when you move the mouse into the active window.
3. Press, but do not release the Select mouse button.
4. While the Select mouse button is depressed, move the object(s) from one location to another. A ghost image of the object(s) appears on the screen. This image is dragged across the screen as the cursor moves.
5. Release the Select mouse button when the ghost image is in the proper location.

Repeat Moving

To move the same object(s) again, hold the Shift key down, move the cursor inside the schematic window, and click the Menu mouse button (right). This repeat key sequence only works if no other popup menu command has been issued in the meantime.

Moving Objects Between Windows

You can move objects to and from different schematic and symbol windows. The procedures for these operations are the same. When objects are moved from one type of editor to another, a conversion of object type may occur. Refer to the "Inter-Window Copy and Move" starting on page 2-72 for a description of how object types are converted when moved from one editor to another.

To move object(s) from one schematic or symbol window to another schematic or symbol window, perform the following steps:

1. Activate the Schematic or Symbol Editor window from which you wish to move objects by clicking the Stroke mouse button in the window area.

2. Select the object(s) to be moved.

3. Execute the **Move > Selected** popup menu item. The Move prompt bar is displayed in the schematic window with the location cursor on "At Location". The moving pointer appears when you move the mouse into the active window.

4. Press, but do not release the Select mouse button.

5. Drag the ghost image of the object to the desired window and the location within that window. The moving pointer is located on the basepoint of the ghost image.

6. Release the Select mouse button when the ghost image is in the final position.

Copying Objects

To copy object(s) from a schematic sheet, perform the following steps:

1. Select the object(s) to be copied.

2. Press the Shift-F5 (Copy) function key, or click the Select (left) mouse button on the **Copy** palette button, or choose the **Copy > Selected** popup menu item. The Copy prompt bar is displayed in the schematic window with the location cursor on "At Location". The moving pointer appears when you move the mouse into the active window.

3. Press, but do not release the Select mouse button.

4. Drag the ghost image to the position where you want the copy placed. The moving pointer is located on the basepoint of the ghost image.

5. Release the Select mouse button when the ghost image is in the final position.

Repeat Copying

To copy the same instance again, hold the Shift key down, move the cursor inside the schematic window, and click the Menu mouse button (right). This repeat key sequence only works if no other popup menu command has been issued in the meantime.

Copying Objects to a Line

You can place copies of one or more selected objects in a line, specifying their locations by the offset between the basepoint of the selected objects and the basepoint of the first copy. The line of copied objects can be in any direction. To create a diagonal line of four copies of two instances, perform the following steps, and refer to Figure 6-5.

1. Select the instances to copy.

2. Choose **Copy** > **Multiple** from one of the popup menus. This displays the Copy Multiple prompt bar. Enter the number of copies in the "Count" text entry box. Press either the Return key or the Tab key to move the location cursor to "Placement".

3. Press, but do not release the Select mouse button. Drag the ghost image of the selected items to the desired location for the first copy.

4. Release the Select mouse button when the ghost image is in the correct position for the first copy. The distance and angle between the basepoint of the selected objects and the location you specify determine the placement for the other copies. The last copy remains selected. Figure 6-5 shows the result of this Copy Multiple.

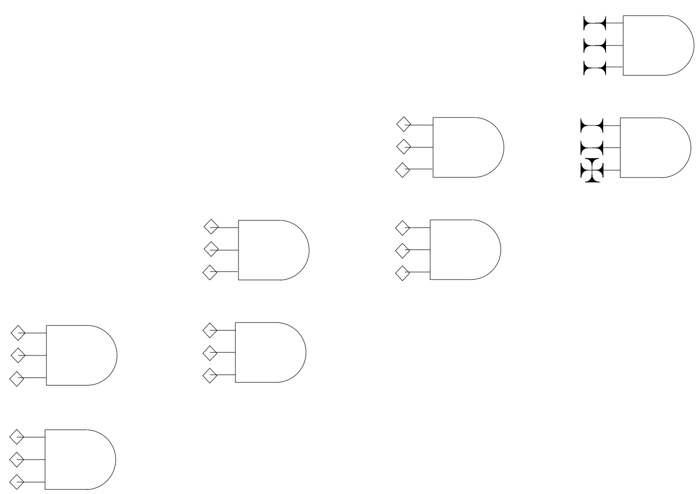


Figure 6-5. Result of Copy Multiple

Copying Objects to an Array

There are two methods of copying one or more selected objects to an array. If you know the x- and y-offsets, perform the following steps.

1. Select the object to copy.
2. Choose **Copy > To Array** from one of the popup menus.
3. Enter the number of columns in the "X Count" text entry box and the number of rows in the "Y Count" text entry box. Press the Tab key to move from one prompt bar entry field to another.
4. The offset values displayed in the prompt bar are the minimum values you can use without objects overlapping when the array is created with the selected object in the upper left corner. Change values as needed.
5. Click the Select mouse button on **OK**. Figure 6-6 shows the array created. The last copied object remains selected.

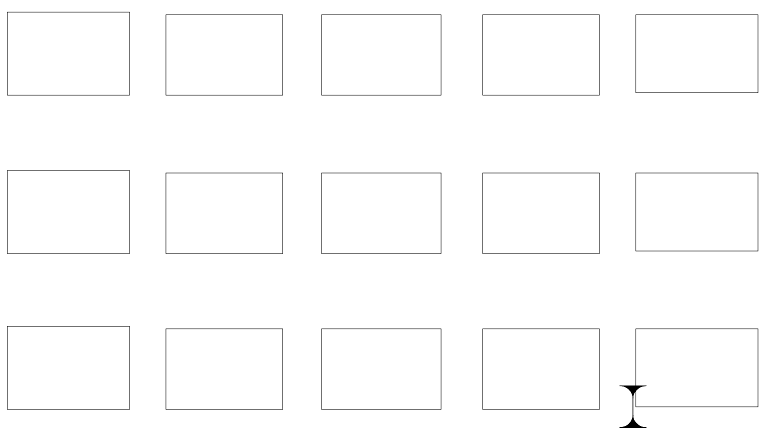


Figure 6-6. Result of Copy to Array

If you want to use the mouse cursor to specify the row and column locations, you can use the Copy Multiple command as follows:

1. Select the object to copy.
2. Choose **Copy > Multiple** from one of the popup menus.
3. Enter the number of rows in the "Count" text entry box in the Copy Multiple prompt bar. Press the Tab key to move the location cursor to "Placement".
4. Press, but do not release the Select mouse button. Drag the ghost image of the selected object to the desired location for the second row of the array, then release the button. This creates the first column.
5. Select the column of objects.
6. Choose **Copy** > **Multiple** from one of the popup menus.
7. Enter the number of columns in the "Count" text entry box. Press the Tab key to move the location cursor to "Placement".
8. Drag the ghost image of the first column to the location for the second column, then release the button. The last column of the array remains selected.

Copying Objects Between Windows

You can copy objects to and from different schematic and symbol windows. The procedures used to copy between different windows are the same. When objects are copied from one editor to a different editor, a conversion of object type may occur. Refer to "Inter-Window Copy and Move" starting on page 2-72 for a description of how object types are converted when copied from one editor to another.

To move object(s) from one schematic or symbol window to another schematic or symbol window, perform the following steps:

1. Activate the window from which you wish to copy objects by clicking the Stroke mouse button in the window area.

2. Select the object(s) to be copied. For information about how to select and unselect objects, refer to page 6-6.

3. Press the Ctrl-F3 (Copy) function key sequence, or click the Select (left) mouse button on the **Copy** palette button, or choose the **Copy > Selected** popup menu item. The Copy prompt bar is displayed in the window with the location cursor on "At Location". The moving pointer appears when you move the mouse into the active window.

4. Press, but do not release the Select mouse button. Drag the ghost image of the object(s) to the location within the window where you wish to copy the object(s). The moving pointer is located at the basepoint of the ghost image.

5. Release the Select mouse button when the ghost image is in the final position.

Resizing Instances

You can set the schematic environment to allow resizing of instances.

Caution Changing the default on a sheet to allow resizable instances is irreversible.

To enable resizing of instances within a sheet, perform the following steps:

1. (Optional, but preferred) Set the schematic environment to automatically allow resized instances by doing the following:

   a. Enter the following function in an appropriate *da_session.startup* file:

   ```
   $set_environment_dofile_pathname(@sheet,
                                    'dofile_pathname')
   ```

   b. Enter the following function in the dofile specified in the above function:

   ```
   $allow_resizable_instances()
   ```

   If you are unsure in which startup file and dofile to put these functions, contact your system administrator.

2. If resizable instances are not automatically set in the schematic environment according to the last step, issue the "$allow_resizable_instances()" function in a popup command line.

To resize one or more instances in a schematic, follow these steps:

1. (Optional) Ensure that resizable instances are enabled in the schematic using the following command in the Schematic window:

   $get_allowable_resizable_instances()

   If the transcript returns @true, then the sheet is set up for resizing instances. If the transcript returns "@false", then you must set the environment to allow resizable instances using the previous procedure.

2. Select the appropriate instance(s) to be resized.

3. Execute the **Resize > Half Size | Quarter Size | Normal Size | Four_x Size | Two_x Size** item in the Schematic popup menu.

   All the size choices are absolute; that is, they are relative to the "normal" size of the component as established when the symbol was created in the Symbol Editor. Thus, if you choose "Four_x Size", the selected instance(s) will be four times normal size. If you then choose "Half Size", for example, the instance(s) will be one-half normal size, not one-half the Four_x size.

   The grid size is adjusted for both the Half Size and the Quarter Size so that the pin spacing on the smallest instance is still accurate.

Grouping Objects

To create a group of objects on the schematic sheet, perform the following steps:

1. Select the objects to be grouped. For information about selecting and unselecting objects, refer to page 6-6.

2. Execute the **Miscellaneous > Group** pulldown menu to display the Group prompt bar.

3. Enter the appropriate value beside "Group Name."

4. Choose the appropriate mode beside "Existing."

5. Choose whether the name is persistent or temporary beside "Duration."

6. **OK** the prompt bar.

Once a group is created, you can select the group using the following steps:

1. Execute the **Select > Group** popup menu item to display the Select Group prompt bar.

2. Enter in the text box the name of the group you want to select.

3. **OK** the prompt bar.

Ungrouping Objects

To remove the name of a group from a set of objects, perform these steps:

1. Execute the **Miscellaneous** > **Ungroup** pulldown menu item to display the Ungroup prompt bar.

2. Enter the name of the appropriate group beside "Group Name."

3. **OK** the prompt bar.

Reporting Groups

To list the names of the groups available in a schematic design, follow these steps:

1. Execute the **Report** > **Groups** pulldown menu item.

Deleting Objects

To delete object(s) from schematic sheet, perform the following steps:

1. Select the object(s) to be deleted. For information about selecting and unselecting objects, refer to page 6-6.

2. Click the Select mouse button on the **Delete** palette button, or execute the **Delete** > **Selected** popup menu item.

The selected object is now deleted. Instances, frames, net vertices, pins, properties, comment text, and comment graphics can be deleted in this manner. Properties can also be deleted by executing the **Delete** > **Property** popup menu item.

NOTE: Notice that the basepoint icon is left behind after you delete a selected object(s). This icon remains until something else is selected. It facilitates placing the object(s) in the same location when you issue the Undo command. The basepoint icon is not a part of the design.

Pivoting and Rotating Objects

Pivoting and rotating are two identical operations when executed on an individual object. However, when you pivot or rotate a group of selected objects, there is an important difference. Pivoted objects move with respect to the origin on each individual object. Rotated objects move with respect to the basepoint of the selected objects. Furthermore, pivot operations do not affect nets, while rotate operations do.

Perform the following steps to pivot or rotate an object:

1. Select the object(s) you want to pivot or rotate. For information about selecting and unselecting objects, refer to page 6-6.

2. Execute the **(Schematic) Instance > Rotate/Flip > Pivot** or **Instance > Rotate/Flip > Rotate** menu item. Cascading to the right of these menu items are four more menu selections. Select one of the following:

   - **-90** - moves object(s) 90 degrees, clockwise
   - **90** - moves object(s) 90 degrees, counter-clockwise
   - **180** - moves object(s) 180 degrees
   - As Specified

The selected object(s) are pivoted (or rotated) to the specified position. The rotation must be multiple of 90 degrees. The Rotate and Pivot functions are also available in the **(Schematic) [Add_Route**] palette, and in the **Symbol Body & Pins** menu in the Symbol Editor, and the **Mixed Selection** menu in the Symbol and Schematic Editors.

Flipping Objects

Perform the following steps to flip an object or a group of objects.

1. Select the object(s) you want to flip. For information about selecting and unselecting objects, refer to page 6-6.

2. Execute the **Instance > Rotate/Flip > Flip** menu item. Choose either Horizontal or Vertical from the cascading submenu.

The selected object(s) are flipped to the specified position. Flip is also available in the **(Schematic) [Add_Route**] palette, and in the **Symbol Body & Pins** menu in the Symbol Editor, and the **Mixed Selection** menu in the Symbol and Schematic Editors.

Note Objects are flipped, pivoted, and rotated in place. If you want to flip, pivot, or rotate object(s) that you are moving or copying, the **Copy** and **Move** menu items have cascading menu items for these operations.

Creating a Schematic

Sometimes you will start working on a new schematic, and other times you will want to modify an existing schematic. The following topics describe some of the basic procedures used to create and edit a schematic. If you are unfamiliar with the basic elements of a schematic, read "Elements of a Schematic" starting on page 2-19.

When specifying a component or any other object that begins with a dollar sign ($), do not begin the pathname with the "$" character. Any relative pathname that begins with a "$" is assumed to be a soft pathname. To reference an object in your current working directory that starts with a dollar sign, use ./$object_name instead of $object_name.

Opening a Schematic Sheet

To open a schematic sheet, press the Open Sheet function key, or click the Select mouse button on the **[Session] Open Sheet** icon in the palette. You can also open a sheet from the Session popup menu, or from the File pulldown menu. Each method displays the Open Sheet dialog box which prompts you for the component and sheet names.

The system assumes you are editing "sheet1" of the default "schematic" model. You can change the sheet name for the default model, and you can open an existing sheet in read only mode, or list the component hierarchy in a window. If you need help selecting a component, press the **Navigator** button. The dialog navigator appears on the screen allowing you to traverse your directory structure to select a Design Architect component. Refer to page 6-137 for a description of how to use the dialog navigator. You can replace the default schematic and sheet names by pressing the **Options** button. The options for a new sheet are different than those for an existing sheet. Click the **New Sheet** button to see the Open Sheet Options dialog box illustrated in Figure 6-7.

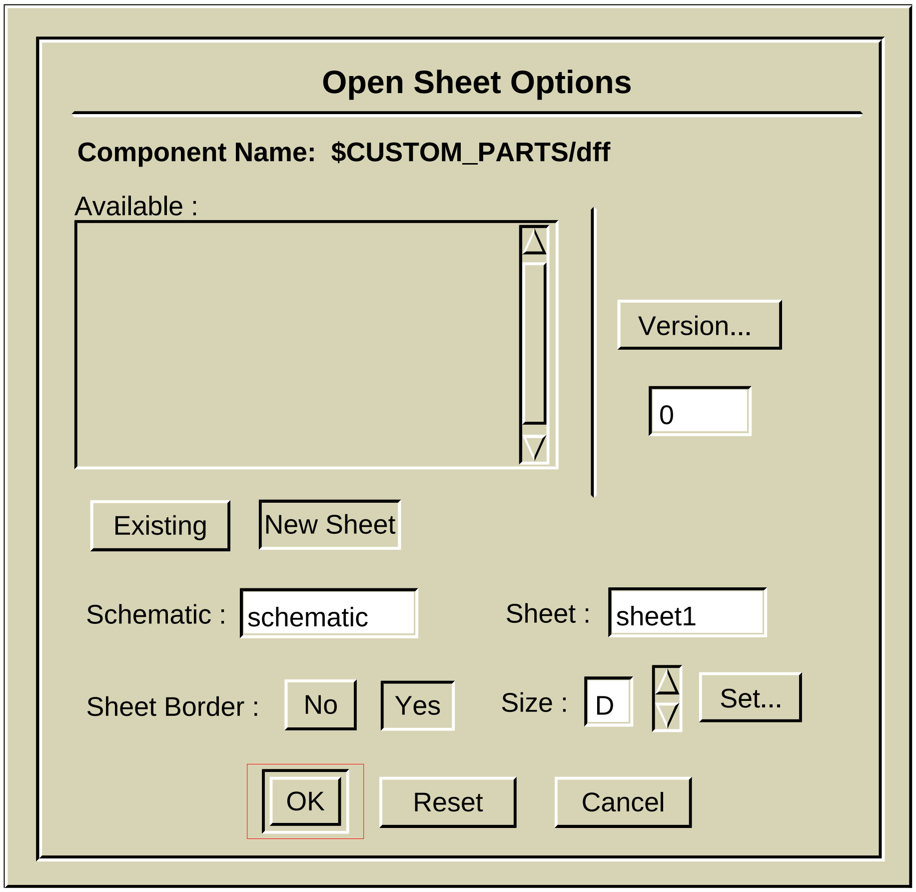


Figure 6-7. Open (new) Sheet Options Dialog Box

The Open Sheet Options dialog box lists the names of available sheets in the component. You can click the Select mouse button on a name in the list, or you can enter schematic and sheet names in the respective text entry boxes in the dialog box. By default, the most current version of a sheet (indicated by "0") is opened; if you want an older version, enter the number in the **Version** box. To see which versions exist, click the **Version** button. If you want to execute a startup file for this sheet, click **Yes** for that option and enter the file pathname.

You can automatically create a sheet border and a title block on a new sheet by clicking the Sheet Border **Yes** button, and selecting the desired sheet size. If you click the **Set** button, another dialog box is displayed with the available sheet sizes and the title block option button. Click **OK** on each dialog box; a new sheet is displayed in a schematic edit window. If you requested a title block, a dialog box is displayed for you to enter information.

When you are opening an existing sheet, the **Auto Update Mode** allows you to specify whether instances should be updated when the sheet is opened and, if so, how the properties are merged. Click on one of the following buttons:

- **No**: Out of date instances are not updated when the sheet is opened.
- **Clear**: Instance-only properties are deleted; all other properties are reset to the current symbol values.
- **Symbol**: Instance-only properties are not changed; all other properties are reset to the current symbol values.
- **Instance**: All existing properties are unchanged; new properties on the current symbol are added to the instance.
- **Auto**: Instance-only and Value_Modified properties are not changed; new properties on the current symbol are added to the instance.

For more information about how properties are updated, refer to "Updating Properties on an Instance of a Symbol" on page 3-13.

Setting Up the Schematic Editor

Before you start working on a schematic sheet you can change some or all of the default attribute settings for your schematic editing environment. Attributes such as pin spacing, grid spacing and snap, net drawing, and comment text and graphics display are all set to default settings when a new schematic sheet is opened. Menu items contained in the **Setup** menu set these attributes. The following procedures show you how to set up these attributes. These settings are available after the first Schematic Editor window is opened.

Setting Pin Spacing

The pin spacing attribute sets the minimum distance between pins on the symbol and on the schematic sheet.

In the schematic editor, if pin spacing is set to .25 inches, for example, there must be at least .25 inch between pins. Pin spacing is a real number measured in user units: inch, centimeter, millimeter, or pin.

In the symbol editor, you create symbols using pin grid units for spacing. When a symbol is placed on a schematic sheet, Design Architect sets the pin spacing for the symbol to the pin spacing of the schematic.

To setup the pin spacing on the schematic sheet or the symbol, perform the following steps:

1. Place the cursor in a Schematic or Symbol Editor window and press the Select mouse button.

2. Execute the **Setup > Net/Comment/Page > Page** menu item in the schematic editor or the **Setup > Other Options > Page** in the symbol editor. The Set Page prompt bar appears.

3. Type the pin space number in the "Pin Space" text entry box.

4. Enter the user units (inch, pin, mm, cm) by clicking the choice stepper button until the unit you want is displayed. Even though you are allowed to choose a user unit in the symbol editor, all pin spacing is measured in pin grid spaces in the Symbol Editor window.

5. When pin spacing setup is complete, press the **OK** button.

Setting Grid Spacing and Snap

A pattern of grid points is normally displayed in the editing window you are working in to assist you in drawing straight lines and finding points of reference. If you like, you can turn the grid pattern off or redefine the layout of the grid points. You can also stipulate that any object drawn will snap to the nearest grid point. Each window can have independent grid settings allowing different object placement characteristics (dynamics) for each window.

To set up the grid spacing and snap, perform the following steps:

1. Activate a symbol or schematic edit window and execute the **Setup** > **Grid/Report/Color** > **Grid** menu item. The Set Grid dialog box appears.

2. Enter the number of grid points to be established between pins in the **Grids Per Pin** text box . A value of 4 means 4 grid points within 1 pin space. A value greater than 1 defines a finer grid by placing the specified number of points between each pin spacing interval. A value less than 1 is a coarser grid, which you can use to "spread out" objects in a design. The default is 4.

3. Type in the **Minor Multiple** text box the number of grid locations between displayed locations. Dots indicate minor multiple grid points. The default is 1.

4. Type in the **Major Multiple** text box the number of visible grid points to be highlighted with a cross. This feature can be used to highlight pin spacing or to note relative distances between various objects on the sheet. The default is 4.

5. Click the Select mouse button on the snap you want (**On/Off**).

6. Click the Select mouse button on whether to show the grid (**On/Off**).

7. When the grid and snap setup are complete, press the **OK** button.

The number used for each grid setting must be an even divisor of 1920. If the number you specify is not a divisor of 1920, the next larger divisor will be used. Valid numbers include 1, 2, 3, 4, 5, 6, 8, 10, 12, ... Numbers not supported include 7, 9, 11, 13, 14, ... If the system uses a number other than the one you specify, you will receive a warning message.

Setting Net Drawing Attributes

Before you begin drawing nets, you can specify how nets are graphically represented (bus width and net style), and other net drawing characteristics, such as automatic orthogonal net drawing, automatic net routing, and pin snapping.

To set up the net characteristics, perform the following steps:

1. Place the cursor in a Schematic Editor window and press the Stroke mouse button to activate the window.

2. Execute the **Setup > Net/Comment/Page > Nets** menu item. The Setup Net dialog box appears in the active Schematic Editor window.

3. Type in the **Set Dot Size** text box the dot size (default is 0.025 user units).

4. Type in the **Set Snap Angle** text box the snap angle (default 44.9).

5. Click on either **Circle** or **Square** to choose the dot style.

6. Press the **Set Ortho** button **On** and the **Set Snap** button **On**, to set up orthogonal routing and pin snap.

7. If you want nets automatically routed immediately after they are drawn, press the **Set Auto Route** button On. The net router defines an orthogonal path for a connected net that avoids instance extents, comment objects, and other nets.

8. Select the net style (Solid, Dotted, Long Dash, Short Dash) and bus width (3 pixels, 5 pixels, or 7 pixels) by pressing the Select mouse button on the appropriate buttons.

9. If you want junction dots to appear where bus rippers join bus lines, press the **Set Ripper Dots** button **On**.

10. If you want close-dots displayed on the sheet, press the **Set Close Dots** button **On**. The close-dot appears on a vertex when a non-orthogonal net segment passes so close to the vertex that it is visually difficult to determine that they are not connected.

11. **Set Auto Ripper** specifies whether single bit bus rippers are placed automatically during net creation when the current net width is "1" (default wire width), and one of the input vertices falls on a net segment with width greater than "1" (default bus width is "3"). If you press the **On** button, you also need to specify a ripper component and symbol name. The default is the 1X1 symbol of *$MGC_GENLIB/rip*.

12. When net setup is complete, press the **OK** button.

Drawing a Schematic

There are five basic procedures used to draw a circuit: choosing and placing component symbols, copying and moving objects, drawing nets, terminating nets, and naming nets. Schematic sheets are drawn in a Schematic Editor window in Design Architect.

Choosing and Placing Component Symbols on a Sheet

Component symbols can be selected and placed on a schematic sheet from a library palette or by typing the pathname to the component symbol in a dialog box. A library palette can be activated by selecting a library menu item under the **Libraries** menu. If *$MGC_HOME/pkgs/mgc_analog_uw* is installed, Design Architect will automatically load the AccuParts library menus. A menu selection is available for every Mentor Graphics component library installed. The library palette includes a list of all library components available from that library.

Choosing from the library palette:

1. Place the cursor in a Schematic Editor window and press the Stroke mouse button. This activates the window.

2. Execute the **Libraries > MGC Digital Libraries > Display Libraries Palette** menu item. A palette listing of installed Mentor Graphics libraries replaces the schematic palette.

3. Move the cursor to the library palette and scroll through the list of libraries. Activate a library by placing the cursor over the library name and clicking the Select mouse button. A palette appears with a listing of all components in the activated library.

4. Move the cursor to the palette and scroll through the list of components. Activate a component symbol by placing the cursor over the component name and clicking the Select mouse button.

5. Move the cursor to the schematic window. The moving cursor is now displayed, prompting you for a location to place the symbol. Move the cursor to display a ghost image of the symbol. Drag the ghost image to the desired location and click the Select mouse button.

Choosing from the Dialog Navigator:

1. Activate the Schematic Editor window by pressing the Select mouse button. Execute the **Add > Instance > Choose Symbol** popup menu item. The Choose Symbol dialog box with a dialog navigator is displayed. Refer to "Using the Dialog Navigator" on page 6-137 for information about how to use a dialog navigator.

2. Choose a component name, change property values, if needed, then click the **OK** button. The Add Instance prompt bar appears.

3. If the symbol name of the component you want is not the default name, type the desired symbol name in the Symbol Name entry box.

4. Click the Select mouse button on the "At Location" button. The moving cursor is now displayed, prompting you for a location to place the symbol. A ghost image of the symbol is displayed. Move the ghost image to the desired location in the active window and click the Select mouse button.

From the Add Instance dialog box:

1. Execute the **Add > Instance > Symbol by Path** popup menu. The Add Instance dialog box is displayed.

2. Enter the component name; if you do not know the component name, and you wish to navigate through directories to find it, click the Navigator button. Using the navigator, you can select a component name. Refer to page 6-137 for more information about how to use the dialog navigator.

3. Click the **Options? YES** button if you want to specify a symbol other than the default. Property values can also be added or modified in this dialog box by clicking the **Options? YES** button and entering the property name(s) and value(s) in the fields provided.

4. When option selection is complete, click the **OK** button.

5. Move the cursor to the schematic window. The moving cursor is now displayed, prompting you for a location to place the symbol. Move the mouse to see the ghost image, then drag the ghost image of the symbol to the location desired and click the Select mouse button.

Choosing the active symbol (the *active symbol* is the last symbol instantiated, and is displayed in the Active Symbol window):

1. Execute the **Add > Instance > Active Symbol** or **Active Symbol > Add Active Symbol** menu item. The Place Active Symbol prompt bar is displayed

2. When you move the cursor in the schematic window, a ghost image of the symbol appears. Drag the ghost image to the desired location and click the Select mouse button.

You can also place an instance of the active symbol by clicking the Select mouse button in the Active Symbol window, dragging the ghost image to the desired location, and clicking the Select mouse button.

Viewing the Active Symbol History List

The active symbol history list is simply a list of the symbols that have been activated during the edit session, and some common symbols from $MGC_GENLIB, such as ports and ground, that are listed by default. To look at the list, choose the **Active Symbol > Symbol History > List** menu item, or press the Ctrl-H keys. To reactivate a symbol in the list, click the Select mouse button on the symbol name in the dialog box.

Loading an Active Symbol History

You can load symbols into the active symbol history list, then activate and place the symbols from the list as you need them. This is convenient and faster than other methods of activation and instantiation when you need just a few components from each of several component libraries. Following are two methods of loading the symbol history list.

Interactive loading:

1. Execute the **Libraries > MGC Digital Libraries > Display Libraries Palette** menu item.
2. Click the Select mouse button on the desired library. Activate the desired component to activate it and display it in the Active Symbol window.
3. When the prompt bar appears, click the Select mouse button on **Cancel**.

Repeat steps 2 and 3 for each symbol you want in the list.

The second method of pre-loading symbols is putting function calls in a file, which can be read with the $dofile() function. The following example shows how to activate symbols from a file:

```
$set_active_symbol("$MGC_GENLIB/4bit_multi", "", [], "");
$set_active_symbol("$MGC_GEN LIB/and3", "", [], "");
$set_active_symbol("$MGC_GENLIB/rip", "8X1", [], "");
$set_active_symbol("$MGC_GENLIB/rip", "1X3", [], "");
```

If these lines were placed in the file, *$HOME/da/load_symbols*, the following would execute the function calls:

```
$dofile("$HOME/da/load_symbols")
```

When you are ready to instantiate symbols from the history list, view the list, select the symbol, and place it on the sheet, as described in "Viewing the Active Symbol History List".

Activating a Symbol From the Symbol Editor

If you have been editing a symbol, and you want to instantiate it on a sheet, perform the following steps:

1. In the Symbol Editor, check the symbol, then save it.
2. Set the select filter to select only symbol bodies; select the symbol body.
3. Move the cursor to the Active Symbol window. Choose the **Active Symbol > Activate Selected** menu item.
4. Activate a schematic window; instantiate the symbol using any of the previously described methods.

Setting a Default Component Library

You can specify a default library that you want displayed whenever you choose the **Libraries > Display Default Palette** menu item. This lets you move quickly from one library to another when most of the components you need are in one library, but you still need a few components from other libraries. Perform the following steps to set *gen_lib* as the default:

1. Execute the **Libraries > MGC Digital Libraries > Display Libraries Palette** menu item. The library palette replaces the schematic palette.
2. Press the Select mouse button on "gen_lib" in the library palette.
3. Execute **Set Default Palette** from either the **Libraries** pulldown menu or the **Palette** popup menu. Now, when you want gen_lib displayed, execute either **Libraries > Display Default Palette** or **Palette > Display Default Palette**.

Setting the Interface Default

You can set an interface default to use when adding instances to a schematic sheet from one of the MGC Digital Libraries. For example, you can use this feature if you want the ANSI interface for all instances that you add. The interface default, if available for the component you want to instantiate, overrides the component default interface. If the interface default is not present in a component, then the component default interface is used.

To set the interface default so that the component default interface is used when adding an instance to a schematic, choose the **Libraries > MGC Digital Libraries > Set Interfaces Defaults > Default Interfaces** menu item.

To set the interface default so the ANSI interface is used when adding an instance to a schematic, choose the **Libraries > MGC Digital Libraries > Set Interfaces Defaults > Symbol > ANSI** menu item.

To set the interface default so the positive logic interfaces are used when adding instances, choose the **Libraries > MGC Digital Libraries > Set Interfaces Defaults > DeMorgan's Logic > POS Logic** menu item.

Updating and Replacing Instances

The Update command lets you update a symbol instance with the newest version of the same symbol. The Replace command lets you replace a symbol instance with an instance of a different symbol, such as replacing an AND with an OR.

The method used to merge current symbol properties with properties attached to instances that are updated or replaced is determined by the following switches:

- -Clear
- -Symbol
- -Instance
- -Auto

These switches are described in "Property Merge Options," beginning on page 3-14.

For example, to update some instances on a sheet using the -Instance option, perform the following steps:

1. Select the instances you wish to update.

2. Choose the **Instance** > **Update** > **Instance** menu item.

To update selected instances using the default property merge, choose **Instance** > **Update**. Update is also available through the **Edit** > **Update** > submenu. The default Update menu pick is Auto.

To automatically update all instances on a schematic when you open a sheet, specify the desired Auto Update Mode choice on the Open Sheet dialog box. You can set up your Design Architect session to perform automatic updates using a different property merge option by executing the $set_auto_update_mode() function. For example, to perform an update with the -Instance merge, type the following function:

```
$set_auto_update_mode(@instance)
```

If you do not want subsequently opened sheets automatically updated during the current session, type this function:

```
$set_auto_update_mode(@noupdate)
```

When you set the auto_update mode, that setting remains in effect for the current Design Architect session, or until you explicitly change it. If you do not specify an auto_update_mode, sheets are not automatically updated when they are read.

The Replace command, like Update, is accessible through the **Edit** pulldown menu and the **Instance** popup menu. You can replace selected instances with the active symbol, or you can choose a replacement symbol from a library, or you can enter the pathname of the replacement symbol in a dialog box.

To replace selected instances with the active symbol, choose the **Active Symbol** > **Replace Selected** menu item.

Replace Instance is also available in the Palette popup menu.

To replace a selected symbol instance by choosing the replacement symbol from a library (when you do not know the pathname), perform the following steps:

1. Display the library that contains the desired component, as described in "Choosing and Placing Component Symbols on a Sheet" on page 6-29.

2. Choose the **Palette > Replace Instance** menu item.

3. Click the Select mouse button on the desired component in the library.

If no instances were selected, you will be warned that the replace did not occur because no instances were selected to be replaced. Select the instance to replace, then select the replacement symbol.

The **Palette** > **Replace Instance** menu item changes to **Palette** > **Add Instance**, indicating that the next component selected from a library will be instantiated on the sheet.

Instance > Replace > From Library Menu and **Edit > Replace > From Library Menu** are used in the same manner: select the instance to be replaced, then choose the menu item. These methods use the default replacement property merge set by the specific library menus. Mentor Graphics library menus set the default to -Clear.

You can replace a selected symbol instance with the active symbol by choosing the desired property merge from the **Instance** > **Replace** > **Active Symbol** > submenu.

If you know the pathname to the replacement component, select the instance(s) to be replaced, then choose **Instance > Replace > Other**. The Replace Instance dialog box is displayed for you to enter the pathname. If you want a symbol other than the default, or a property merge other than -Clear, click the **Options? YES** button and enter the appropriate information.

Drawing and Routing Nets

To draw a net perform the following steps:

1. Press the F3 (Add Wire) function key, click on the **[Add/Route] Add Wire** icon, or execute the **Net > Add Wire** or **Add > Wire** popup menu item. The Add Wire prompt bar is displayed on the screen, prompting you to select the beginning net vertex location.

2. Position the cursor where the net is to begin (usually, at an instance pin location). Click the Select mouse button. This is the start of the net segment, and is identified by the moving pointer.

3. Move the cursor to where the net segment is to end and click the Select mouse button. The net segment is created from the start point to the one you just specified. Notice that the moving pointer moves to the end of the new net segment.

4. To continue the net, move the cursor to the vertex and click the Select mouse button. A net can be continued to as many points (vertices) as necessary. Notice that at each net vertex there is a small hollow dot.

5. To complete a net, double-click the Select mouse button.

The Add Wire prompt bar is still displayed. Follow steps 1 through 5 to add more net segments. To exit from the Add Wire mode, click the **Cancel** button on the prompt bar. As you create net segments, and before the net is unselected, they can be deleted with the Delete key or the Backspace key.

Automatic Net Routing

To set up automatic net routing, perform the following steps:

1. Activate the schematic window by moving the cursor into the window and pressing the Stroke mouse button.

2. Execute the **Setup > Set AutoRoute On** menu item. Nets are now automatically routed as drawn.

Net routing concepts are discussed in "Draw and Route Nets" on page 2-49.

Connecting and Disconnecting Net Vertices

After moving or copying objects, you may need to change some net connections. A not-dot on a vertex indicates that not all segments passing through the vertex are connected, even though they appear to be connected.

To force connections for an instance or an area, select the instance or area, then choose the **Add** > **Connections** > **Connect Area** menu item. To force connections at all not-dot locations on a sheet, choose the **Add** > **Connections** > **Connect All** menu item. The not-dots disappear, indicating there is an electrical connection. The not-dots are replaced by junction dots at overlapping net segments. Connect All is also available through a function key and in the **Add/Route** palette.

To disconnect nets, choose the **Add** > **Connections** > **Disconnect Area** or the **Add** > **Connections** > **Disconnect All** menu item.

Naming Nets

You can name one or more selected nets by clicking on the Name Net icon in the **Text** palette, or by choosing the **Net > Name Nets** popup menu item. A net must be selected (not a vertex). A prompt bar is displayed as follows:

- If there is no Net property on the net, you are prompted to add one.

- If there is already a Net property on one of the vertices, you are prompted for a new Net property value.

- If there is already a Net property, but it is not attached to any of the selected vertices, you are prompted to place another Net property of the same value on one of the selected vertices. You can change the current property value at the same time, if you wish.

In all cases, the Net property is added to only one of the selected vertices.

Modifying Net Names

A net should always terminate at a component's pin, or connect with another net at a junction. The Schematic Editor uses several components for terminating a net at an input or output point. The components portin, portout, offpag.in, and offpag.out provide net termination. By default, the portin and portout symbols assign the name NET to an unnamed net when attached. To prevent many different nets from being named NET (if two nets have the same name, the simulator sees them as being connected), you will need to change the name of the nets so they each have a unique name.

To modify a net name, perform the following steps:

1. Place the cursor over the name of the net.
2. Press the Change Text Value function key, or execute the **Edit >**

   Change Attributes > Text > Value menu item.
3. When the prompt bar appears on the screen, type in the new text.
4. Press the OK button on the prompt bar.

The new net name appears at the same location.

You can also modify selected net names by clicking on the **Text > Name Net** palette icon, or by choosing the **Net > Name Nets** popup menu item. This is described in "Naming Nets" on page 6-38.

Moving Net Names

Sometimes, after placing a net property value on the sheet, you may decide that you want it somewhere else. To save the effort of deleting the property and adding a new one, you can easily move the net property text value by doing the following:

1. Place the cursor on the text you want to move.

2. Press the F7 (Select Text and Move) function key and hold it down. Notice that you do not have to select the text beforehand; this is done automatically for you.

3. A ghost image of the text outline is displayed when the mouse is moved. Move the mouse until the text is positioned where you want it.

4. Release the F7 (Select Text and Move) function key to lock in the new position of the text.

The net property text value is now in its new location.

Terminating a Dangling Net

All input nets and buses should begin with a portin or offpag.in component from the *gen_lib* component library or any other component with a Class = "P" or Class = "O" property value. Similarly, output nets and buses should be terminated with a portout or offpag.out component. Warnings can result if this is not done.

See "Choosing and Placing Component Symbols on a Sheet" on page 6-29 for details about how to place these components onto your schematic.

See "Assigning Properties and Property Owners" on page 6-95 for details on how to add property values.

Declaring Valid Dangles

You can specify that a dangling net vertex or instance pin is valid and should not be reported by the Check command when you check the schematic. You do this by attaching the Class property with a value of "dangle" to any unconnected net, bus, or instance pin that you want the Check command to recognize as valid.

When you attempt to add the Class property to a pin or net, you may receive the following error message:

```
//  Warning: Added 0 properties (1 failed for bad owners)
(from: Capture/gdc/warning B6)
```

If this occurs, use the Set Property Owner command to declare pins and/or nets as valid owners of the Class property, then add the property to the pin or net.

Checking a Schematic for Errors

Once the schematic has been drawn, instances placed, nets added, and properties added, the last step before saving and registering is to check the schematic for errors. All schematic sheets must pass a set of required checks before the schematic is usable. Required schematic checks are set up at invocation time and are executed with the Check command. Default schematic checks for the Check command are described in Appendix A "DA Design Checks" of this document.

To execute the default schematic sheet checks, perform the following steps:

1. Activate the Schematic Editor window you wish to check by placing the cursor in the window and clicking the Stroke mouse button.

2. Press the Ctrl-F5 (Check) function key. Errors and warnings are displayed in the Check Sheet window by default for each individual check. The error log, by default, is displayed in its own window, but can be sent to a file, or to the transcript.

Figure 6-8 shows a Check Sheet log for a schematic sheet.

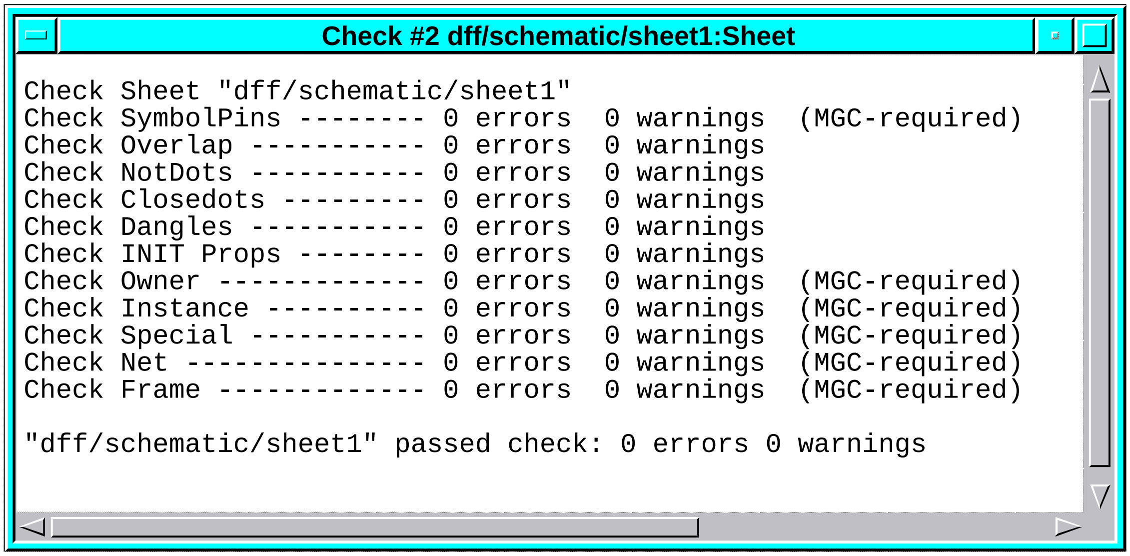


Figure 6-8. Check Sheet Log

To set up your own default schematic sheet checks, perform the following steps:

1. Activate a Schematic Editor window by placing the cursor in the schematic window and clicking the Stroke mouse button.

2. Execute the **Setup** > **Check** > **Sheet** menu item. The Default Sheet Check Settings dialog box appears in the active Schematic Editor window.

3. Select the checks you wish to execute by clicking the Select mouse button beside the appropriate check name button. Select one of the three buttons displayed for each check. The label **Errors/Warnings** means display both error and warning messages, the label **Errors only** means display errors only, and the label **No check** means this check is not executed.

4. Press the **OK** button, when check settings are complete.

   Default check settings you set with the **Setup** > **Check** menu item are set only while in the application. When you exit from Design Architect these settings are lost. The required default checks are set when Design Architect is invoked.

To specify and execute a set of schematic sheet checks, perform the following steps:

1. Activate a Schematic Editor window by placing the cursor in the schematic window and clicking the Stroke mouse button.

2. Choose the **Check > Sheet > As Specified > Using Current Settings** menu item. The Sheet Check dialog box appears in the active schematic window. The check settings in the dialog box show how they were last set.

   Alternately, you can choose the **Check > Sheet > As Specified > Using Default Settings** menu item. The Sheet Check dialog box appears in the active schematic window. The current internal default check settings are displayed in the dialog box.

3. Select the checks you wish to execute by clicking the Select mouse button beside the appropriate check name button. Select one of the three buttons displayed for each check. The label **Errors/Warnings** means display both error and warning messages, the label **Errors only** means display errors only, and the label **No check** means this check is not executed.

4. Press the **OK** button when check selection is complete. The checks selected are now executed.

Note The check settings you specify with the **Check > Sheet > Check As Specified > Using Current Settings** menu item are set only for that execution of the Check command. However, the current settings can be saved as default settings by setting the "Update Default Settings" switch from the Sheet Check dialog box.

Saving a Sheet and Registering a Schematic

To save a schematic sheet and register a schematic, execute the **File > Save Sheet** menu item. The schematic sheet is saved, and the schematic (all the schematic sheets) is registered to the default component interface for the component specified when the sheet was opened.

To save a schematic sheet and change the registration, follow these steps:

1. When the schematic sheet is ready to be saved, select the **File > Save Sheet > Change Registration/Label** menu item. The Save Sheet dialog box appears in the active Schematic Editor window

2. Using the Save Sheet dialog box, execute the following steps:

    a. To delete registration from component interface(s), type the name of the component interface to delete in the **Delete Registration From Interfaces** text entry box.

    b. To register the schematic to another component interface(s), type the component interface name in the **Add Registration From Interfaces** text entry box.

    c. To remove multiple labels associated with the component interface(s), type one label per box in the **Remove Labels** text entry boxes.

    d. To add multiple labels to a component interface(s), type one label per box in the **Add Labels** text entry boxes.

Schematic registration is discussed in more detail starting on page 2-73.

Creating a Bus and Bus Connections

Buses let you represent multiple nets without drawing them individually. This increases drawing speed, reduces space requirements, and increases readability. Figure 6-9 shows a typical bus, four inverters connected into a bus for a set of output nets.

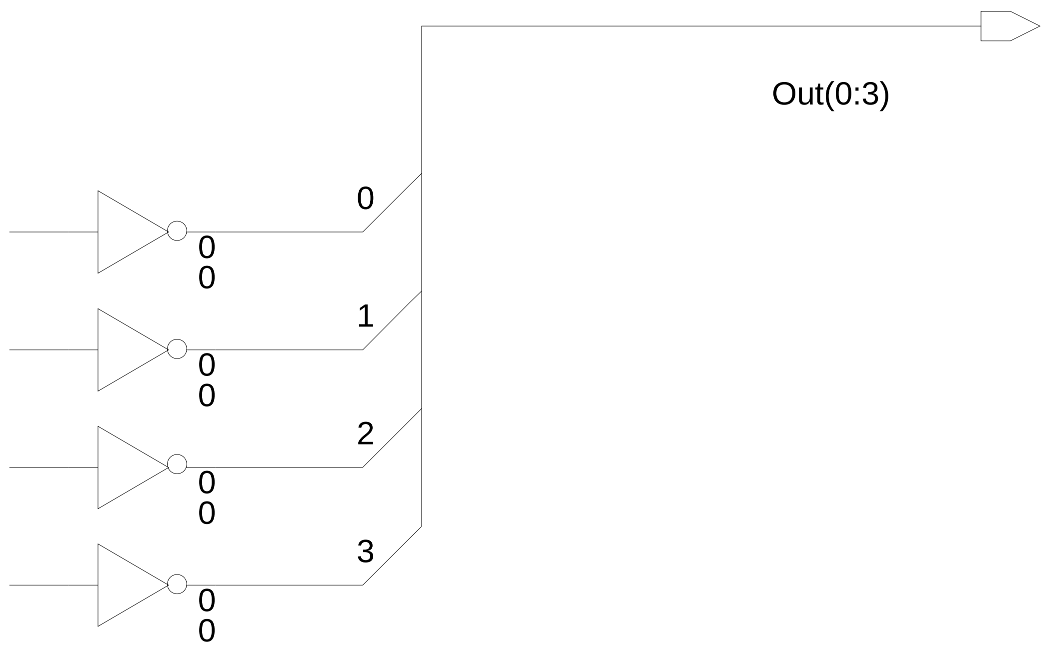


Figure 6-9. A Bus Connected to a Four-Wide Output Port

The following topics describe procedures that demonstrate:

- How to create and represent buses
- How to run individual lines from the bus through the use of bus rippers

Information is also presented on the use of the netcon component, which is used to connect two nets having different Net property values.

Creating a Bus

You create a bus by assigning a net name which defines an array of nets. Net name syntax is described on page 2-24. For example, a bus could use the following naming conventions:

"**bus_net_name(msb:lsb)**"

- **bus_net_name** is the name of the net representing the bus. It can be any legal name allowed in Design Architect. No space is allowed between the name of the bus net and the parenthesis. The parenthesis is required. An example of a bus name is *address*.

- **msb** is the most significant bit of the bus. No spaces are allowed between the msb, the first parenthesis, and the bus_net_name. The colon must follow the most significant bit, with no intervening spaces.

- **lsb** is the least significant bit of the bus. Following the least significant bit of the bus is the final parenthesis.

Downstream applications such as Design Viewpoint Editor (DVE) and QuickSim II interpret buses based on bit ordering; the bit appearing first is considered to be the msb (that is, "0:7" labels bit 0 as the msb, whereas "7:0" labels bit 7 as the msb).

When Design Architect compares or evaluates values on a bus, it scans the range of bit values from left to right. Thus, you can arrange your wires in ascending order (from left to right) or you can arrange your wires in descending order (once again, from left to right).

Regardless of the way you number the wires in your bus, you must always be consistent within your design. Portions of the same bus must always have its wires arranged in the same order.

When you name buses, keep the following limitations in mind:

- The least significant bit and most significant bit must be non-negative.
- No suffix is allowed following a right parenthesis. Thus, net name A(10) is legal, but name A(10)IN is illegal. The Check command will report an error if such suffixes are encountered.

An example of a full bus name is *address(31:0)*. This name represents the following:

- A bus whose name is *address*
- A bus whose wires range from 31 to 0 (zero)

Again, the ordering of the bits is a convention you establish within your schematic. Design Architect only checks that the bus lines define legal limits and numbers.

To create a bus from a net, perform the following steps:

1. Draw the bus:

   a. Click on the **[Add_Route] Add Bus** icon, press the Shift-F3 (Add Bus) function key, or choose either the **Add > Bus** or the **Net > Add Bus** popup menu item.

   b. Press the Select mouse button at the start location for the bus.

   c. Move the mouse cursor to the end location of the bus, and double click the Select mouse button.

   d. Click the **Cancel** button on the prompt bar to terminate the Add Bus command.

2. Name the bus:

   a. Select a vertex on the bus segment by clicking the Select mouse button on one of the vertices.

   b. Click on the **[Text] Net Name** icon, or choose the **Net > Name Nets** popup menu item. The Add Property dialog box appears.

   c. Type "Net" in the **Property Name** text box.

   d. Type the name that defines the bus in the **Property Value** text box. Net name syntax is described on page 2-24.

   e. Press the **OK** button.

   f. Move the cursor in the schematic window. Press the Select mouse button and drag the property name text to the location to where you want it displayed. Release the mouse button.

Representing a Bus Graphically

To increase the readability of your schematic, you can represent buses with different graphical rendering (line width and style). The default bus width is three pixels, and the default style is solid. To change the graphical rendering for the bus, perform the following steps:

1. Click the Select mouse button on the bus graphic to select it.

2. To change the graphical rendering for the bus width, select the desired **Net** > **Change Net** > **Width** > **1 pixel | 3 pixels | 5 pixels | 7 pixels** menu item.

3. To change the graphical rendering for the bus style, select the desired **Net** > **Change Net** > **Style** > **Solid | Dot | Long Dash | Short Dash** menu item.

Creating a Bus Ripper

On a schematic sheet, you may be required to run individual lines from the bus to either another bus or a component. To accomplish this on your schematic, you need a special component called a *bus ripper*. A bus ripper connects individual lines or sub-buses from a source bus to a destination wire, bus, or device pin in a precise order.

The bus ripper has a Class property value of "R", indicating that the component is used to extract a range of lines from a bus (see Table 3-4, "Structured Logic Design Properties", on page 3-26).

The following topics provide information about the bus ripper component, and directions for connecting a bus ripper to a DRAM with eight data pins.

Understanding the Bus Ripper Component

You can find the bus ripper component in *$MGC_GENLIB/rip*. Figure 6-10 shows a bus ripper for connecting eight wires to a bus. Figure 6-10 represents only one type of bus ripper (8x1); many other types are also available.

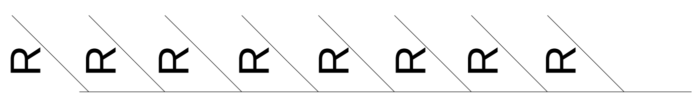


Figure 6-10. A 8x1 Bus Ripper from $MGC_GENLIB/rip

Table 6-1 describes the variations of the bus ripper that are available:

Table 6-1. Available Bus Rippers in $MGC_GENLIB/rip

Symbol Name	Description
1X1	1 wire wirex 1 grid
1X2	1 wire x 2 grids
1X3	1 wire x 3 grids
1X4	1 wire x 4 grids

Table 6-1. Available Bus Rippers in $MGC_GENLIB/rip [continued]

Symbol Name	Description
8X1	8 wires x 1 grid
1r1	1 wire x 1 grid, rounded corner
1r2	1 wire x 2 grids, rounded corner
4X1	4 wires x 1 grid
3X1	3 wires x 1 grid
2X1	2 wires x 1 grid
16X1	16 wires x 1 grid

To select and activate an instance of a bus ripper symbol on a schematic sheet, perform the following steps:

1. Click the Select mouse button on the **[Add_Route] Library** icon. This displays the library palette.
2. Click the Select mouse button on "gen_lib" in the library palette. This displays the components in *$MGC_GENLIB.*
3. Scroll down the component names until you see "rip". Click the Select mouse button on the arrow after the name. This displays the list of bus ripper symbol names shown in Table 6-1.
4. Click on the name of the desired symbol. The Place Active Component prompt bar is displayed.
5. Move the cursor to the schematic window. Press the Select mouse button and hold. A ghost image of the symbol is displayed. Drag the ghost image to the location desired and release the mouse button.

Each bus ripper pin owns a Rule property. This property tells you which lines to extract from a "source" bus. Figure 6-10, on page 6-49, shows each bus ripper pin having this property, as identified by the series of eight "R" characters. The Rule property, called the "Ripping Rule," identifies the bus lines that the ripper taps.

When the bus ripper is first instantiated, each Rule property is set to a default value of "R". You must change this property to identify what line or lines of the source bus are connected to an attached net, pin, or sub-bus. For example, if you change the Rule property to "1", then any pin or net attached to that ripper is connected to the "number one" wire of the bus. You must not leave the Rule property unchanged, or you will produce an error when you check the sheet.

Each bus ripper component has at least two pins: the "wire" end and the "bundle" end. Figure 6-11 shows a 1x1 bus ripper illustrating the wire end, the bundle end, and the Rule property.

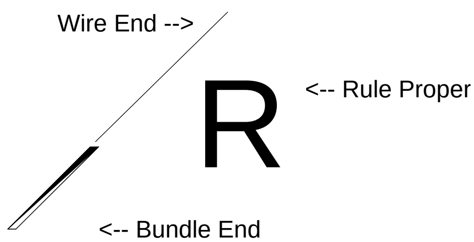


Figure 6-11. Bus Ripper Symbol

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 Graphic-supplied bus rippers) has a Pin property value called "wire". The property value is not required to be "wire".

If you wish to create your own bus ripper component, your bus ripper component must have only one pin whose Pin property value is "bundle". Each other pin must own a Rule property, and the symbol body must own a Class property with a value of "R". If your bus ripper does not have these characteristics, then your bus ripper will not work correctly in Design Architect.

In addition, when you tap a source bus with your own bus ripper, you must obey the following the 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), then the wire end must be connected to the destination bus.

Figure 6-12 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.

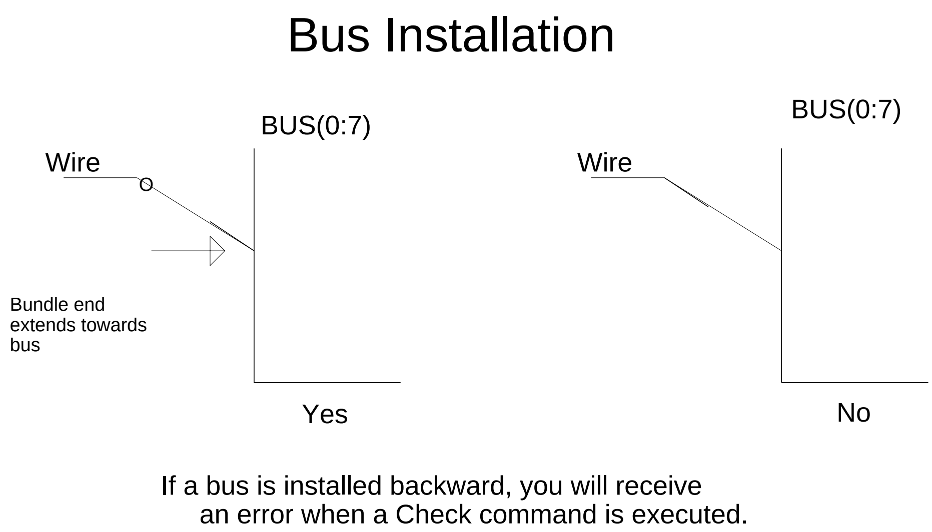


Figure 6-12. Installing a Bus Ripper

Bus rippers allow you to tap the entire source bus or a specific range of wires. That is, bus rippers are not restricted to tapping only single wires. Figure 6-13 shows an example of a bus NETS(3:0), created by bundling individual wires, and a sub-bus called STROBES(127:126) branching off a larger bus. Bus ripper components from *$MGC_GENLIB* are used in both cases.

The STROBES bus taps the bus wires NETS(3) and NETS(2) (which are the same as the wires named QB and Q, respectively), and assigns them to STROBES(127) and STROBES (126). Thus, the following wires are equivalent:

QB = NETS(3) = STROBES(127) and Q = NETS(2) = STROBES(126)

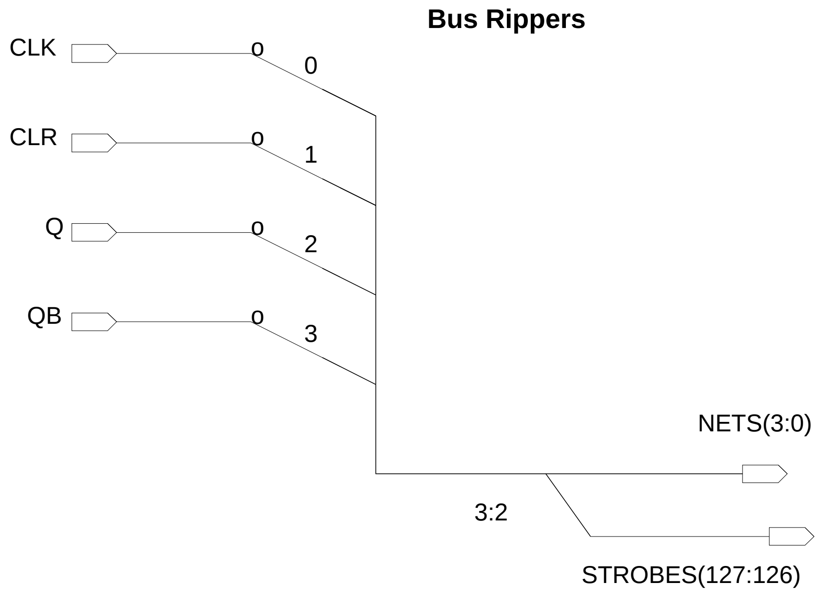


Figure 6-13. A Bus with a Connected Sub-Bus

You must alter the Rule property in a special manner when you run a group of wires from a source bus. Figure 6-14 illustrates the following rules for connecting sub-buses through the use of a bus ripper:

- The Rule property value specifies a range of wires to be extracted. You can use the following methods to identify which wires you want to tap:

  a. The Rule property value follows the range of nets to be ripped. The range format "bus_line1:bus_line2" represents the beginning and ending wires of a range of wires to be tapped. The colon must be present between the numbers, with no intervening spaces. For example, 0:10 is a legitimate way to specify that you want to tap the first to eleventh wires of the bus as a range.

  b. The Rule property value can specify a group of non-sequential wires by the format "wire, wire, [wire]"; "wire" can be any wire on the bus. If the source bus wires are in ascending order, then the order of the tapped wires must be in ascending order; and if the source bus wires are in descending order, then the order of the tapped wires must be in descending order. Here are legitimate examples: 0, 3, 6, 9 or 8, 6, 3

c. The Rule property value can mix single wires with a range of wires. Here are legitimate examples: 0, 3, 5:12 or 20:10, 7

d. The Rule property can be parameterized, allowing the same schematic sheet to be used in different designs which require different wires to be extracted from a bus. Here is an example of a parameterized Rule property: w, x, y, z

In this example, a value must be supplied, using the Add Parameter command for each parameter in DVE. A value can be supplied in Design Architect with the Set Parameter command. If no value is supplied to the parameter in Design Architect, a warning message "undefined parameters" occurs when the schematic is checked.

- The most significant bit and the least significant bit must match. If you always put the least significant bit first when you name a bus, you must continue to follow that convention. The same holds true if your naming convention puts the most significant bit in the first position of the bus name.

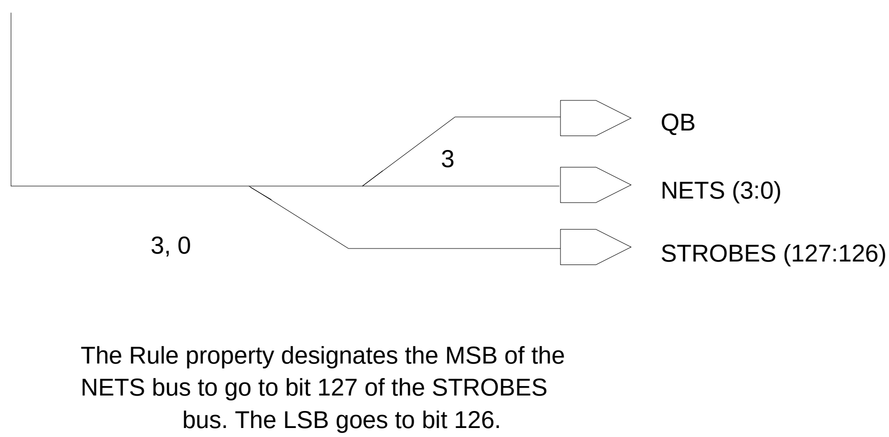


Figure 6-14. A Bus Ripper Extracts a Range of Lines

Connecting a Bus Ripper

The following steps show you how to connect the address pins of a 4164_20 DRAM to an 8x1 bus ripper, and then how to connect the bus ripper to a bus. The DRAM component is available in the *$MGC_DRAMLIB* library.

1. Place the source bus, *address(7:0)*, an 8x1 bus ripper component, and the DRAM component onto your schematic sheet, as shown in Figure 6-15.

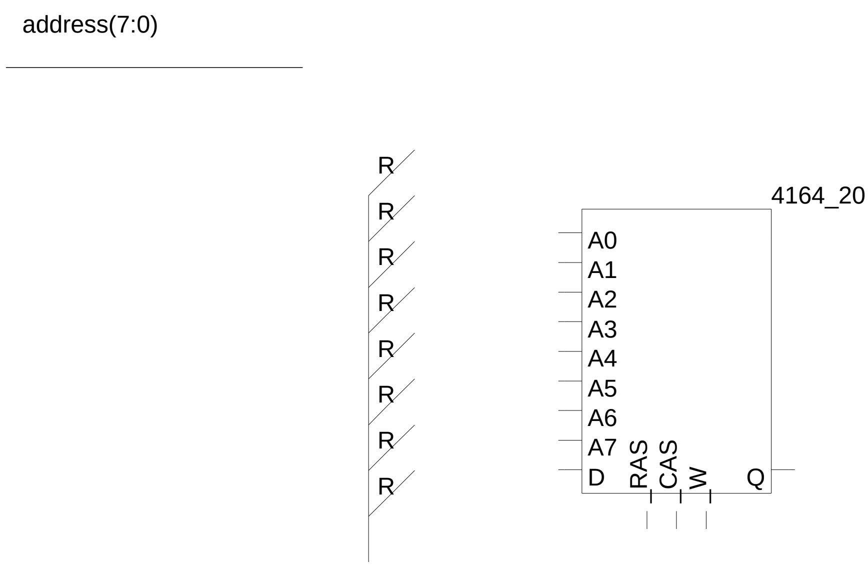


Figure 6-15. Basic Layout

2. Flip the bus ripper component vertically, by first selecting the bus ripper component and then executing the **Instance** > **Rotate/Flip** > **Flip** > **Vertical** popup menu item. To flip and also move the bus ripper, execute the **Instance** > **Move** > **Flipped** > **Vertical** popup menu item.

3. Draw a net segment between the wire end of each separate bus ripper to a pin on the memory component. To draw a net segment from the top-most pin on the bus ripper to the top-most pin on the memory component, perform the following steps:

   a. Press the F3 (Add Wire) function key or click the Select mouse button on the **[Add_Route] Add Wire** palette icon.

   b. Click the Select mouse button on the bus ripper pin.

c. Move the cursor to the corresponding pin on the memory component and double click with the Select mouse button.

d. Repeat steps b and c for all the bus ripper pins.

e. Click the **Cancel** button in the prompt bar.

4. Change the Rule property of each separate bus ripper pin to indicate what wire you want your DRAM pin to match. For example, if you want pin A0 to connect to address(0), then you must change the Rule property value of the given bus ripper to "0".

   To change the Rule property value of each individual bus ripper, perform the following steps:

   a. Click the Select mouse button on the **[Text] Sequence Text** icon. The Sequence Text dialog box is displayed.

   b. Type the initial index number (for this example "0") representing the first Rule property value in the **Beginning Index Number** text box.

   c. The **Step By** value determines the difference between sequenced property values. You can also specify a prefix and suffix for the property values.

   d. Click on **Auto** for the Sequence Type.

   e. Click the Select mouse button on the **OK** button.

   f. The Select Area prompt bar is displayed. Move the cursor to the top of the bus ripper. Press and hold the Select mouse button; move the cursor so that all the "R" property text is within the dynamic rectangle. Be sure no other property text is within the selected area. Release the Select mouse button.

Design Architect automatically replaces the Rule property values within the selected area. Figure 6-16 shows the memory component and the bus ripper after you complete the preceding steps. Note that all the original "R" values of each bus ripper have been changed to indicate what bus line a pin goes to.

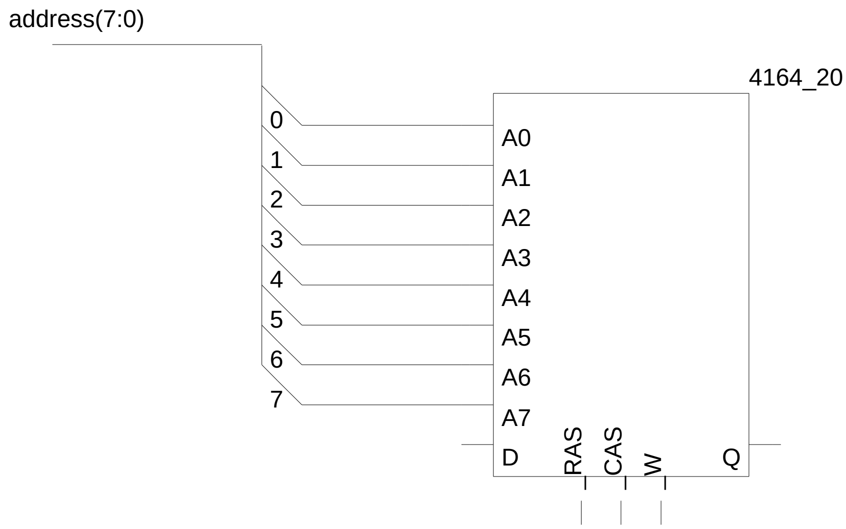


Figure 6-16. Fully Connected Bus Ripper

5. Connect the top of the bus ripper to the *address(7:0)* bus with a net segment. This step does not require you to perform any special actions other than connecting the bus ripper and the *address* bus. Table 6-2 shows how each pin relates to the *address(7:0)* bus.

Table 6-2. Pin and Bus Line Connections

Pin Name	Data Bus Connection	Rule Property Value
A0	address(0)	0
A1	address(1)	1
A2	address(2)	2
A3	address(3)	3
A4	address(4)	4

Table 6-2. Pin and Bus Line Connections [continued]

Pin Name	Data Bus Connection	Rule Property Value
A5	address(5)	5
A6	address(6)	6
A7	address(7)	7

Instantiating 1x1 Bus Ripper Automatically

When the ripper mode is set to "auto" using either the $set_ripper_mode() function or the $setup_ripper() function, Design Architect places a real ripper symbol. At startup, Design Architect uses the 1X1 ripper symbol from the *$MGC_GENLIB/rip* component. You can change the default using the $setup_ripper() function.

Using the Automatic 1x1 Bus Ripper

The following steps show an example of using automatic ripper instantiation:

1. Route a wire to a bus; the bus ripper is placed automatically.

2. Select the bus ripper and its net.

3. Choose **Copy > Multiple** from one of the popup menus. In the prompt bar enter the number of additional ripped nets you need. For example, if you need eight bus rippers, enter "7" for the number of copies.

4. Position the first copy and click the Select mouse button. The copies are created at an equal displacement.

Creating an Implicit Bus Ripper

Implicit rippers are the default when you invoke Design Architect. To place an implicit ripper, follow these steps:

1. Execute the ADD WIRE palette menu item to display the Add Wire prompt bar.

2. Route the wire between the bus or bundle and the object to which you are connecting it using a single click for the beginning of the wire and a double-click for the end of the wire. If the ripper is set for a 45-degree angle, you will need to take that into account when placing the wire.

3. If the wire is routed into a bus, Design Architect displays the Choose Bus Bit dialog box, which tells you the bus name. Follow these steps:

    a. Beside "Bit," enter the bit of the bus that you are ripping. You can either specify just the bit number, such as "17" from bus "data(19:0), in which case Design Architect puts the bus name and parentheses around the bit; or you can specify the entire bus/bit name, such as "data(17)."

    b. **OK** the dialog box.

4. If the wire is routed into a bundle, Design Architect displays the Choose Bundle Member dialog box. Follow these steps:

    a. Either select the bundle member to be ripped from the list of members, or enter the name of a bundle member in the "Bundle Member" entry field. Text that you enter will override any selections made in the list.

    b. **OK** the dialog box.

5. If the wire is routed into an unnamed wide net, Design Architect displays the Name Ripped Net dialog box. Follow these steps:

    a. Enter the name of the wide net beside "Wide Net Name." You can create either a bus or a bundle using the wide net name.

b. Enter the name of the ripped bit beside "Ripped Net Name." Make sure that you enter the entire name, such as "out(3)" from bus "out(7:0)". Giving only a bit number will result in an error during a Check Sheet.

c. **OK** the dialog box; the Add Property To Handle prompt bar appears.

d. Click the Select mouse button in the appropriate location to place the new wide net name.

Changing the Type of Ripper

Implicit rippers are the default when you invoke Design Architect; they are not library symbols, but rather instances that look like rippers. To change the default setup from implicit rippers to the *$MGC_GENLIB/rip* symbol, follow these steps:

1. Display the Setup Ripper dialog box using the SETUP RIPPER palette menu item.
2. Press the button beside "Auto" under "Set Ripper Mode."
3. If appropriate, change other specifications you need for the ripper symbol.
4. **OK** the dialog box.

To change from auto rippers to implicit rippers, follow these steps:

1. Display the Setup Ripper dialog box using the SETUP RIPPER palette menu item.
2. Press the button beside "Implicit" under "Set Ripper Mode."
3. If appropriate, change other specifications you need for the ripper symbol.
4. **OK** the dialog box.

Changing the Angle for Implicit Rippers

When you invoke Design Architect, the default ripper is an implicit ripper set at a 45-degree angle. You can set implicit rippers so that they are attached at a 90-degree angle. To do this, follow these steps:

1. Display the Setup Ripper dialog box using the SETUP RIPPER palette menu item.
2. Press the button beside "Straight" under "Set Implicit Ripper."
3. If appropriate, change other specifications you need for implicit rippers.
4. **OK** the dialog box.

Using the netcon Component

The net connector component *$MGC_GENLIB/netcon* is used to connect together two nets possessing different Net property values. In Design Architect, the result is a single net with two names. But when the schematic is evaluated, the two property values become the same.

There are several occasions when you might want to use the netcon component. For example, you might be copying a portion of an earlier schematic into the one you are currently working on, and find a mismatch in the names of some of the wires on the two designs (you named the reset line "Reset" on one design and "Rst" on the other). By connecting the appropriate nets together with netcon, you can avoid changing either of the Net property values.

NOTE: Although use of netcon may be convenient at times, if it is used too often, the time spent in evaluating the design can increase dramatically.

Creating and Naming a Net Bundle

You can create a net bundle by adding a Net property to a wide net. The value of the Net property must include a comma-separated list of nets, buses, and/or other net bundles. Specifically, net bundle syntax requires a list to be enclosed in curly braces "{}"; for example, "{ground,clk,data(15:0)}."

A member of a net bundle is defined as a net, bus, or nested bundle contained in the list of a net bundle. If a bundle includes a nested bundle, the members of the nested bundle must be enclosed within curly braces; for example, "{clk,data(15:0),{ground,out(15:0)}}."

A net bundle list can be preceeded by a bundle name. Such names cannot be expressions or include parentheses, square brackets, curly braces, or slashes; for example "BUND{ground,clk,data(15:0)}."

You can refer to an existing bundle without again listing its members by using the bundle name and empty curly braces, but only if the full list of members has been defined elsewhere on the sheet or on another sheet of the schematic. For example, "BUND{}" identifies the same net bundle as "BUND{ground,clk,data(15:0)}" within the same schematic.

A net bundle definition can span multiple sheets of a schematic. You create a net bundle using the following steps:

1. Draw a wide net on a sheet.
2. Select the new net.
3. Use the **Name Nets** pulldown menu item to name the net using bundle syntax within the value of the Net property.

You can edit a net bundle by changing the value of the Net property. Errors caused by editing the syntax of a net bundle are identified only when the sheet or schematic is checked. For more information on creating properties, refer to "Assigning Properties and Property Owners" on page 6-95.

Net bundles have the following characteristics:

- A net bundle can contain nets, buses, and other net bundles.
- A net can be contained within different net bundles.
- Only one net bundle in a schematic needs to list the contents; all other occurrences of the net bundle can use the bundle name followed by “{}”.
- The contents of all occurrences of a named net bundle in a schematic must be the same; there cannot be two net bundles of the same name in the same schematic, but containing different members.
- A net that is a member within a bundle is the same as the net by itself; that is, a new net is not created when it is placed in a bundle.
- A net bundle can have properties. However, the properties on a net bundle are not propagated to the individual members, since a net or bus can be in multiple net bundles and there is no way to determine which property should be used if a conflict occurs.
- The order in which the members are specified in a net bundle defines their position. Two declarations of the same net bundle where the members are listed in a different order will produce an error when the sheet is checked.
- The position of a member in a net bundle is important when connecting to pins.
- A net can appear more than once in a single net bundle.
- A net can be ripped more than once from a net bundle.
- A net bundle can connect to pin bundles or wide pins. The connection between the members in a net bundle and the members in a pin bundle or a wide pin is mapped by position.
- A net bundle can be connected through a Net Connector to another net bundle of the same width, or to a bus of the same width.

- The width of a net bundle is the total number of individual nets and bus bits in the bundle. If a net bundle contains a bus, the bits of the bus are counted in the width, but not the bus itself. The same is true for the elements of a net bundle included in another net bundle.
- The width of the net bundle must match the width of a connecting pin bundle or wide pin.
- A net bundle name cannot be a parameterized expression.
- Nets are ripped by name from a net bundle; the ripped net must exist in the net bundle.
- A net bundle can contain parameterized buses.
- The name of a bundle member must be explicit; names generated through evaluating an AMPLE expression are not allowed.

For more information on pin bundles, refer to "Adding and Naming a Pin Bundle" on page 6-87.

Note Net bundles are named using the entire Net property. Thus the net bundle “B{x,y}” is named “B{x,y}”, whereas the bus “B(3:0)” is named “B”.

Ripping Members from Net Bundles

You can rip members from net bundles by name, which is similar to ripping bits of a bus by bit position. To rip a member of a net bundle, follow these steps:

1. Choose the ADD WIRE palette icon to display the Add Wire prompt bar.

2. Connect the net bundle and the object to which the new wire leads; the Choose Bundle Member dialog box appears.

3. Choose a member from the list or enter the name of the member you want to rip from the bundle beside "Bundle Member."

4. OK the dialog box.

   The name of the ripped bundle member appears beside the wire and is now the value of the Net property for that wire. Figure 6-17 illustrates the Choose Bundle Member dialog box.

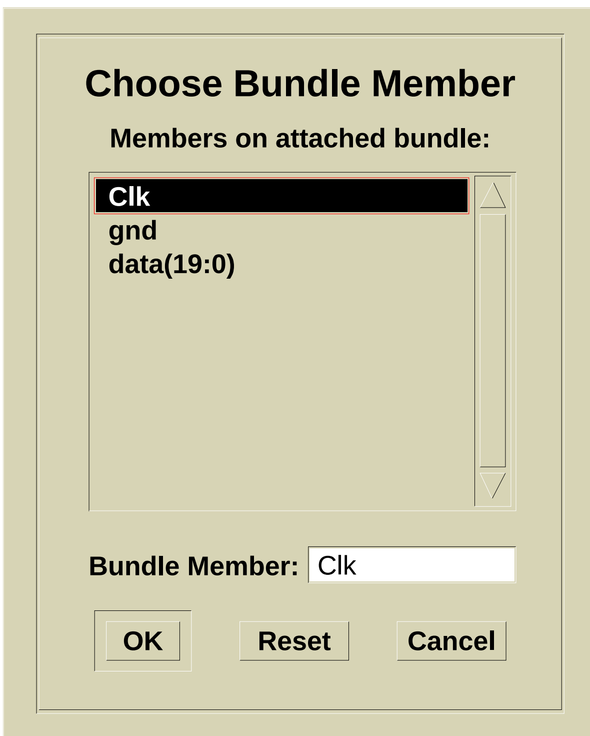


Figure 6-17. Choose Bundle Member Dialog Box

Creating FOR, CASE, and IF Frames

FOR, IF, CASE, and OTHERWISE frames are tools provided by the Design Architect Schematic Editor to allow repetitive or conditional inclusion of circuitry in the final netlist.

Creating FOR Frames

There are many times you find yourself repeating the same circuit over and over. Although you can copy the circuit so that it appears in its entirety as many times as it is needed, by using FOR frames you can save disk space, minimize the number of pages a schematic fills, and make the design easier to understand.

Furthermore, by using a property value variable in the frame expression, the same schematic sheet can be used in different designs requiring a different number of copies of that frame.

To add a FOR frame that repeats the same circuit "N" times, perform the following steps:

1. Execute the **Add > Frame** menu item. The Add Frame prompt bar appears with the location cursor in the "Frame Expression" text box.

2. Type a FOR frame expression, for example: "FOR I := 0 TO N-1". Refer to "Frexp Property" on page 3-30 for a description of valid FOR frame expression syntax.

3. Click the Select mouse button on the "Frame Area" button.

4. Position the moving pointer at the initial edge of the frame. Press, but do not release the Select mouse button.

5. Move cursor to the desired size of the frame, and release the Select mouse button. Refer to Figure 6-18 for an example circuit enclosed in a FOR frame.

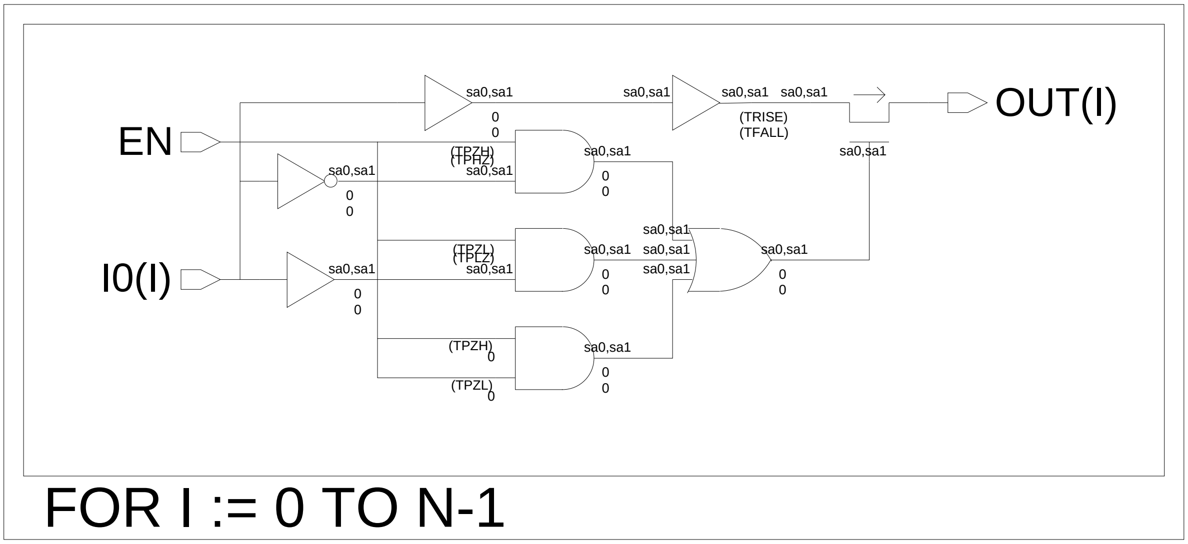


Figure 6-18. FOR Frame Example

Creating Repeating Instances

A repeating instance is a short-hand method of creating FOR frames for single instances. To create a repeating instance, follow these steps:

1. Select the instance that you want to repeat in your design.

2. Execute the **Properties** > **Add** schematic popup menu to display the Add Property dialog box.

3. Select the "INST" item in the list box under "Existing Property Name."

4. Enter a name followed by a continuous range enclosed in parentheses beside "Property Value."

5. Choose the type of visibility appropriate in your design for the Inst property.

6. **OK** the dialog box.

The following are rules used to determine which nets attach to which pins of a repeating instance:

- If a single bit pin is connected to a single bit net, then the net will be connected to the pin on each repeated instance.
- If a single bit pin is connected to a bus, then the width of the bus must be equal to the number of times the instance is repeated. The pin on each repeated instance will be attached to the bus bit in the matching position. A single bit pin cannot be attached to a net bundle.
- If a wide pin is connected to a bus of the same width, then the bus will be connected to the wide pin on each repeated instance. Likewise, if a wide pin is connected to a net bundle of the same width, then the net bundle will be connected to the wide pin on each repeated instance.
- If a wide pin is connected to a bus which is wider than the pin, then the bus width must be equal to the width of the pin times the number of times the instance is repeated. Each sub-bus with a width equal to the width of the pin will be connected to the pin on the repeated instance. A wide pin cannot be connected to a net bundle with a different width.
- A bus connected to a wide pin must be named.
- All other connections are illegal and result in an error during Check Sheet.

Figure 6-68 illustrates an example of a repeating instance.

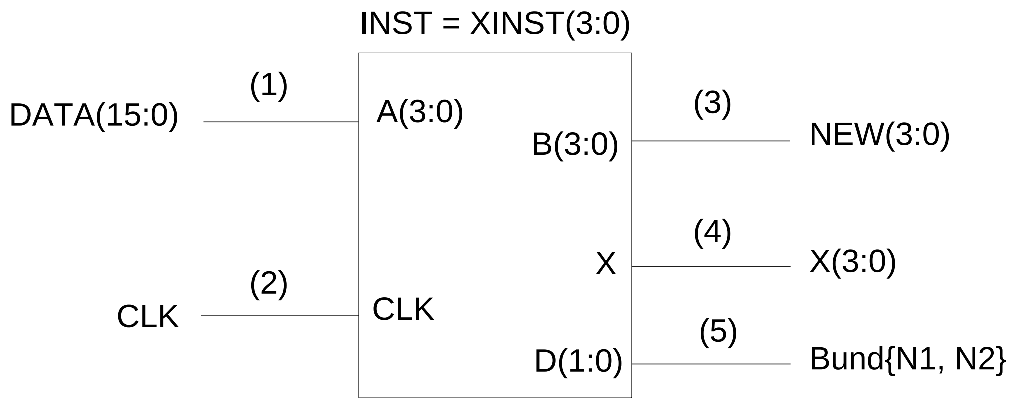


Figure 6-19. Repeating Instance Example

Assume that the system calls the instance "I$231." When the sheet is written, Design Architect creates a FOR frame with the expression "FOR I231_REPEAT := 0 to 3." When the EDDM evaluates the FOR frame, it generates four instances named XINST#0, XINST#1, XINST#2, and XINST#3. Each instance has the same set of pins, A(3:0), B(3:0), CLK, X, and D(1:0), but some are attached to different nets.

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

2. The net CLK is attached to the CLK pin on each repeated instance.

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

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

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

Creating IF Frames

IF frames let you conditionally include circuitry in your schematic. An IF frame is created in the same way as a FOR frame, except the IF frame follows its own IF frame expression syntax. To create an IF frame follow the procedure described in "Creating FOR Frames". Refer to "Frexp Property" on page 3-30 for a description of valid IF frame expression syntax.

The evaluation of an IF frame expressions results in a True or False condition. If True, the enclosed circuitry is included in the schematic sheet. If False, the circuitry is not included in the schematic sheet. The Check command does not check non-included circuitry. You may want to check your circuitry before you create an IF frame around it.

Creating CASE, OTHERWISE Frames

CASE frames allow you to define cases when a portion of a circuit is included in a schematic sheet. You can have multiple CASE frames in a schematic sheet. If the CASE frame expression evaluates to True, the circuitry is included. If the CASE frame expression evaluates to False, the framed circuit is not included, and if an OTHERWISE frame exists, the circuitry within the OTHERWISE frame is included. CASE and OTHERWISE frames are created in the same way as FOR frames, except the CASE and OTHERWISE frames have a different frame expression syntax.

To create a CASE or OTHERWISE frame follow the procedure described in "Creating FOR Frames". Refer to "Frexp Property" on page 3-30 for a description of valid CASE and OTHERWISE frame expression syntax.

Setting Parameters

You need to provide a value for any variables included in frame expressions. You can set a parameter value in Design Architect which is used only when the sheet is checked. Although this value is stored with the sheet, it is not recognized outside of the sheet or by other tools. Suppose you have some framed circuitry that you want repeated ten times, and the Frexp property value is "FOR I = 0 TO N-1". To provide a value to be used when the sheet is checked, do the following in the Schematic Editor:

1. Choose the **Check** > **Parameters** > **Set** menu item to display the Set Parameter prompt bar.

2. Enter "N" in the parameter name text entry box, and "10" in the parameter value text entry box in the prompt bar. Click the **OK** button.

Another method of assigning a value to the variable is to add a property to the symbol body representing the sheet, or to an instance of that symbol on a higher level sheet. You can add the property to the symbol body and give it some dummy value that you change for different instances of the symbol (similar to Net and Rule property values). Here are the steps using the previous frame expression:

1. Open the component in the Symbol Editor.
2. Select the symbol body (be sure nothing else is selected).
3. Click the Select mouse button on the Add Property icon in the Text palette. This displays the Add Property dialog box.
4. Enter "N" for the property name and "1" for the property value, click the type **Number** and the stability switch **Variable** buttons, then click **OK**.
5. Move the cursor to a location for the text, and click the Select mouse button.
6. To indicate the meaning of the number on the symbol, choose the **[Text] Add Text** icon.
7. Type "N=" in the text entry box in the displayed prompt bar. Click the **OK** button, move the cursor to the left of the "1" and click the Select mouse button.

When you place the symbol on a sheet, you can change the value of N for that instance. Because the property stability is variable, its value can be changed at any time.

You can also assign values to variables through back annotation and design viewpoints. Back annotated values take precedence over all others, followed by instance-specific values.

Creating a Symbol

Sometimes you will start working on a new symbol, other times you will want to extend or modify an existing symbol. If you are unfamiliar with the basic elements of a symbol, or the concepts of editing a symbol in-place on a schematic sheet, read "Elements of a Symbol" starting on page 2-52 before you continue on.

Opening a Symbol Editor Window

To open a Symbol Editor window from the Design Architect Session window, click the Select (left) mouse button on the **[Session] Open Symbol** palette icon, or press the F1 (Open Sheet) function key, or type the command or function in the popup command line, or execute the **Session > Open Symbol** popup menu. This menu displays the Open Symbol dialog box and prompts you for the name of the component you wish to edit.

To help you select the component you wish to use, press the Navigator button. The dialog navigator appears on the screen allowing you to traverse your directory structure to select a Design Architect component. Refer to page 6-137 for a description of how to use the dialog navigator.

You can replace the symbol name by pressing the Options button (which opens the expanded Open Symbol dialog box), and type the new symbol name in the Symbol Name text box. Also, from the expanded Open Symbol dialog box, you can open the symbol as editable or read-only. If you want to execute a startup file for this symbol, click **Yes** for that option and enter the file pathname.

After the argument selections are complete, press the **OK** button.

Setting Up the Symbol Editor

Before you start working on a symbol you can change some or all of the default attribute settings for your symbol editing environment. Attributes such as pin spacing, grid spacing and snap, and symbol body attributes are all set to default settings when a new Symbol Editor window is opened. Menu items contained in the **Setup** and **Set** menus set these attributes.

The following procedures show you how to setup these attributes. Refer to "Object Attributes" on page 2-44 for a summary of object attributes.

Setting Grid and Pin Spacing

The procedure for setting grid and pin spacing is the same as in the Schematic Editor setup. Refer to "Setting Pin Spacing" on page 6-26, and "Setting Grid Spacing and Snap" on page 6-26 for these procedures.

Setting Symbol Body Attributes

To set up symbol body text and graphical drawing attributes, perform the following steps:

1. Place cursor in a Symbol Editor window and press the Select mouse button.

2. Execute the **Setup** > **Setup Defaults** > **Symbol Body** menu item. The Setup Symbol Body dialog box appears in the active Symbol Editor window.

3. Click with the Select mouse button on the line style you want (Solid, Dotted, Long Dash, Short Dash).

4. Click with the Select mouse button on the line width you want (1 pixel, 3 pixels, 5 pixels, 7 pixels).

5. Type in the font name you want. Fonts and font registries for all workstations are located in *$MGC_HOME/registry/fonts*. The default is the "stroke" font.

6. Type in the text height you want. The default height is 0.75 user units.

7. Type in the text orientation you want (0 or 90 degrees). The default is 0 degrees (horizontal).
8. Click with the Select mouse button on the text vertical justification you want (Top, Center, Bottom).
9. Click with the Select mouse button on the text horizontal justification you want (Left, Center, Right).
10. Click with the Select mouse button to set the orthogonal drawing mode to (On, Off).
11. Click with the Select mouse button on the text transparency you want (On, Off).
12. Click with the Select mouse button on the fill type you want (Clear, Solid, Stipple).
13. Type in the dot size (diameter) you want. The default size is 0.1 user units.
14. Click with the Select mouse button on the dot style you want (Square, Circle).
15. Press the **OK** button, when symbol body attribute selection is complete.

Drawing a Symbol Body

A symbol body can be made up of the following graphical entities:

- Arcs
- Circles
- Dots
- Lines
- Polygons

- Polylines
- Rectangles

In addition, a symbol body typically has short lines, called "whiskers", that project from the symbol body border to indicate where the pins will be connected. These "whiskers" are not a required part of the symbol, but rather a convention used in the Mentor Graphics component libraries.

The menu items used to draw the symbol body are accessed from the **Add** popup menu. You can also perform these tasks by clicking the Select mouse button on the appropriate **[Draw]** icon.

Before you start drawing your symbol, you can set the dot style, dot width, line style, line width, and polygon fill that will determine the attributes of the graphical entities. To use something other than the default values for these attributes, select the **Setup > Symbol Body** menu item to change the default values. This topic is discussed in the "Setting Up the Symbol Editor" procedure; see page 6-73 for a more detailed description.

All graphical entities can be selected, moved, copied, or deleted.

Drawing an Arc

To draw an arc, perform the following:

1. Click on the **[Draw] Add Arc** icon, or choose the **Add > Arc** popup menu item, or press the F5 (Add Arc) function key. The Add Arc prompt bar is displayed with the location cursor on "Initial Point".

2. Move the mouse so the moving pointer is displayed in the active window. Click the Select mouse button at the desired initial arc point. The location cursor in the prompt bar moves to "End Point".

3. Click the Select mouse button at the desired end point for the arc. The location cursor moves to "Arc Point".

4. Click the Select mouse button at the desired arc point location.

The prompt bar disappears and the completed arc is displayed. The basepoint is positioned on the arc's end point. Line style and width are controlled by values specified in the **Setup > Symbol Body** dialog box, discussed on page 6-73.

Drawing a Circle

The steps in the following list outline the procedure for adding a circle:

1. Click the Select mouse button on the **[Draw] Circle** icon, or choose the **Add > Circle** popup menu item. The Add Circle prompt bar appears with the location cursor on "Center".

2. Position the moving cursor to the desired center point of the circle. Press, but do not release the Select mouse button. The location cursor moves to "Circle Point".

3. Position the moving pointer to indicate the perimeter of the circle (the Select mouse button is still depressed). A ghost image of the circle appears in the window. Release the mouse button.

The prompt bar disappears and the completed circle is displayed. The basepoint is positioned in the center of the circle. The line style, line width, and fill type of the circle are controlled by the values specified in the **Setup > Symbol Body** dialog box, discussed on page 6-73.

Drawing a Dot

To add a graphical dot, perform the following:

1. Select the **Add > Dot** popup menu item. The Add Dot prompt bar appears in the active symbol window. The location cursor is on "At Location".

2. Click the Select mouse button at the desired dot point. The prompt bar disappears and the dot is displayed in the active symbol window. The basepoint is positioned on the dot.

Dot style and size are set by values specified in the **Setup > Symbol Body** dialog box, as discussed on page 6-73. Dots cannot be scaled, rotated, or pivoted.

Drawing a Line

To add a line, perform the following steps:

1. Select the **Add > Two Point Line** popup menu item. The Add Line prompt bar is displayed with the location cursor on "Endpoints".
2. Position the moving pointer at the desired location for the initial point of the line. Press, but do not release the Select mouse button.
3. Position the moving pointer away from the initial point. You will see a line from the initial point to the current location of the moving pointer. With the Select mouse button still depressed, position the moving pointer to the location of the end point. Release the Select mouse button.

The prompt bar disappears and the line is displayed. The basepoint is located on the initial point. The line style and line width are controlled by the values specified in the **Setup > Symbol Body** dialog box, discussed on page 6-73.

Execute this menu item when you want to draw whiskers for pins on a symbol. Place the cursor at the desired point of the border of the symbol as the initial point of the line. As you add whiskers, it is important to remember that pins will always snap to the nearest grid point (as defined by the value of the arguments in the **Setup** > **Grid/Report/Color** > **Grid** dialog box) regardless of whether objects snap to grid. Therefore whiskers should be terminated on a displayed grid coordinate which matches the pin spacing.

Drawing a Polyline

To add multiple contiguous lines, perform the following steps:

1. Select the **Add > Polyline** popup menu item, or the **[Draw] Add Polyline** icon, or press the F3 (Add Polyline) function key. The Add Polyline prompt bar is displayed with the location cursor on "Points".
2. Click the Select mouse button at the initial point of the polyline.
3. Click the Select mouse button at each vertex of the polyline.

4. Continue with step 3, until you have created all the vertices of the polyline. On the last vertex, double-click the Select mouse button.

The prompt bar disappears and the polyline is displayed in the active window. The basepoint is located on the initial point of the polyline.

The line style and the line width of the polyline are controlled by the values specified in the **Setup > Symbol Body** dialog box, discussed on page 6-73.

Drawing a Rectangle

To create a rectangle, perform the following steps:

1. Select the **Add > Rectangle** popup menu item, or the **[Draw] Rectangle** icon. The Add Rectangle prompt bar is displayed with the location cursor on "Rectangle".

2. Position the moving pointer at the desired location of one corner of the rectangle. Press, but do not release the Select mouse button.

3. Position the moving cursor away from the initial edge with the Select mouse button still depressed. You will see a ghost image the size of the rectangle. At the desired location for the diagonally opposite corner of the rectangle, release the Select mouse button.

The prompt bar disappears and the rectangle appears in the active symbol window. The basepoint is positioned on the lower left edge of the rectangle. The line style, line width, and fill type (clear, solid, stipple) of the rectangle are controlled by the values specified in the **Setup > Symbol Body** dialog box, discussed on page 6-73.

Drawing a Polygon

To create a polygon, perform the following steps:

1. Choose the **[Draw] Polygon** icon, or select the **Add > Polygon** popup menu item. The Add Polygon prompt bar appears with the location cursor on "Points".

2. Position the moving pointer at the initial point of the polygon. Click the Select mouse button.

3. Move the cursor to the next polygon vertex and click the Select mouse button.

4. Repeat step 3 until you have created all vertices of the polygon. At the last vertex, double-click the Select mouse button, indicating you have completed the polygon. A polygon is always a closed figure; the segment between the initial point and the last point is automatically drawn for you.

The prompt bar disappears and the polygon appears in the active window. The basepoint of the polygon is located at the initial point. The line style, line width, and fill type (clear, solid, stipple) of the polygon are controlled by the line_style, line_width, and polygon_fill arguments as defined in the **Setup** > **Symbol Body** dialog box, discussed on page 6-73.

Adding and Naming Symbol Pins

Once you have drawn the symbol body, you must include information on where the symbol's input and output pins are on the symbol body. A pin is named by adding a Pin property to the pin.

Pins are graphic entities representing a connection point. The presence of a Pin property tells the system that an object is a pin, while the value assigned to that Pin property separates that pin from all the others on that symbol.

Pin names appear as Pin properties on the symbol. A pin and its Pin property value are used to define where and what electrical connections will be made to the component. Pin properties on a symbol pin should match Net properties on the symbol's underlying schematic sheet in order to establish cross-hierarchy connections. Pins on a component define where an electrical connection may be made to the component when it is placed on a schematic sheet.

You can add pins by clicking on the **[Draw] Add Pin** icon, by executing the **Add > Pin(s)** popup menu item, by executing the corresponding function or command on the command line, or by pressing the Shift-F4 (Add Pin) function key sequence.

Pins must be placed on the pin grid which defines the minimum spacing between pins. Select the **Setup > Grid/Report/Color > Grid** menu item (page 6-73) to define the pin grid. Setting the displayed grid points to match the pin grid makes it easy to see where pins can be placed.

Adding a Single Pin

To add a single pin to a symbol, perform the following steps:

1. Press the Shift-F4 (Add Pin) function key sequence. The Add Pin prompt bar is displayed.

2. Enter a text string representing the name of the pin. Press the Tab key. The location cursor moves to "Pin Location".

3. Click the Select mouse button on the location for the pin.

4. Press and hold the Select mouse button, and move the ghost image of the pin name to the desired location. Release the Select mouse button.

The prompt bar disappears and the pin name appears at the specified location.

Adding Multiple Pins

To add multiple pins to a symbol, perform the following steps:

1. Select the **Add > Pin(s)** menu item, or the **[Draw] Add Pin** icon. The Add Pin(s) dialog box appears.

2. Specify a value for **Name Height** by clicking one of the buttons or typing a value in the text entry box. This value is the height of the pin name with respect to the pin grid.

3. Click on one of the **Name Placement** buttons:

   - Manual. You manually specify the pin location and text location.
   - Name (with diamond). You specify the pin location; the text is automatically placed next to the pin.
   - Name (with diamond and whisker). You specify the pin location; the pin and whisker are created, and the text is placed next to the pin. When you choose this option, specify pin locations one pin grid away from the symbol body to allow space for the whisker.

4. The Pin Type property can be IN, OUT, IXO, or you can omit it. **Pin Placement** specifies whether the pin is placed to the left, top, bottom, or right of the symbol body.

5. Enter the pin names (pin property values) in the dialog box, one per line. Use the Tab key to move to the next line. All pins specified at the same time have the same pintype and placement.

6. Click the **OK** button on the dialog box. The Add Pin prompt bar appears in the active symbol window. The name of the first pin is displayed as the "Pin Property Value". The location cursor is on "Pin Location".

7. Click the Select mouse button at the desired pin location. If you chose manual name placement, click the Select mouse button at the desired pin name location. If not, the pin name is placed automatically.

8. The Add Pin prompt bar is displayed again, with the name of the next pin. Repeat step 7 for each pin you specified in the dialog box. After the last pin has been specified, the prompt bar disappears.

Creating Consecutive Pins

When you need to create many pins of the same type and on the same side of the symbol body, the Copy Multiple and Sequence Text commands are helpful. The following steps show how to add, copy, and renumber the pins on the symbol for the *$MGC_PLDLIB/16hd8* component.

1. Click the Select mouse button on the **[Draw] Add Pin** icon. This displays the Add Pin(s) dialog box.

2. Enter the following information in the dialog box:

   - Name Height: 0.75
   - Name Placement: Name with whisker
   - Pintype: IN
   - Pin Placement: left side
   - Pin name(s): 1

   Click the Select mouse button on **OK**.

3. When the Add Pin prompt bar appears, click the Select mouse button at the pin location in the symbol edit window.

4. Move the Pintype property text ("IN") by placing the cursor over the text and pressing the Select Text and Move function key. Hold the key while you move the cursor to the new text position, as shown in Figure 6-20.

Figure 6-20. Pintype Property Text Location

5. Press the F2 (Unselect All) function key. Using the F1 (Select Area Any) function key, select the pin, whisker, and property text.

6. Choose the **Copy** > **Multiple** menu item from the popup menu. Enter "9" in the Count text entry box. Click the Select mouse button one pin grid below the selected pin. The left panel of Figure 6-21 shows the result.

7. Press the F2 (Unselect All) function key. Click the Select mouse button on the **[Text] Sequence Text** con. Enter the following information in the Sequence Text dialog box, then click the **OK** button.

   - New Prefix: P
   - Beginning Index Number: 1
   - Step By: 1

8. The Select Area prompt bar is displayed; select the pin names (1s). Move the cursor to "P10" and press the Change Text Value function key. Enter "P11" in the New Value text entry box in the prompt bar, and click the **OK** button. The pins and text should look like the center panel of Figure 6-21.

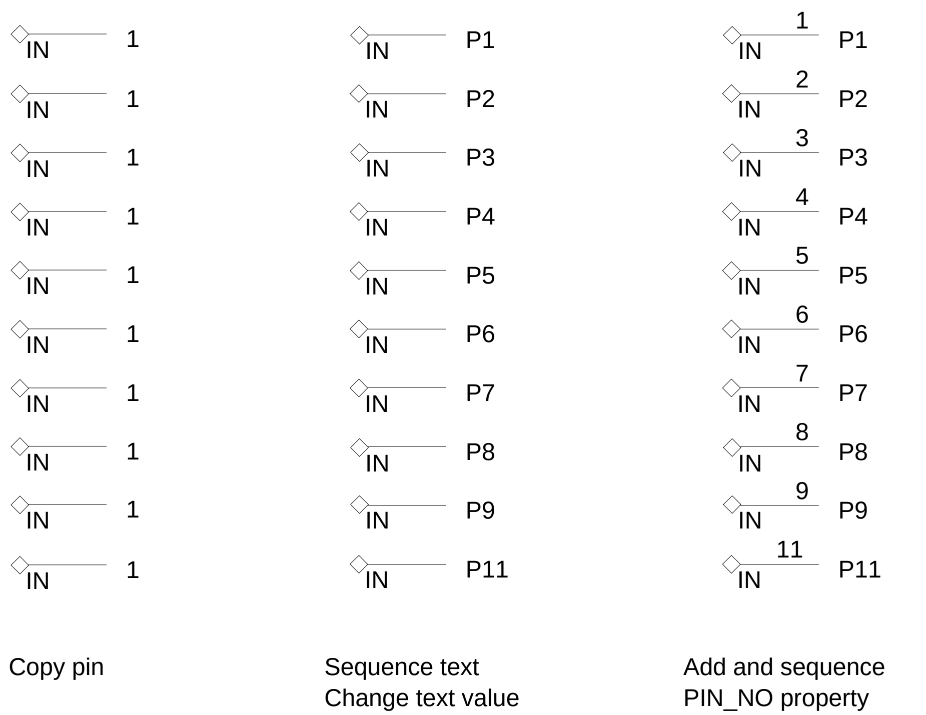


Figure 6-21. Copying Pins and Sequencing Text

9. Change the select filter to select only pins, then select the pins. Click on the **[Text] Add Property** con. In the Add Property dialog box, choose "PIN_NO" from the scrolling list of property names. If it is not there, enter it in the **New Property Name** text entry box. Enter "1" as the property value.

10. When you click the **OK** button, you are prompted for the text location. As you move the cursor in the edit window, an elastic string connects each piece of text with its pin. Move the cursor so the text for each pin is just above the whisker, and click the Select mouse button.

11. Press the F2 (Unselect All(function key. Select the newly created property text, then click on the **[Text] Sequence Text** icon. In the dialog box, specify the following:

    - New Prefix: (no prefix)
    - Beginning Index Number: 1
    - Step By: 1

    After you click the **OK** button, the pins and text should look like the right panel in Figure 6-21. That completes the pins on the left side of the symbol.

12. You use nearly the same steps to create the pins on the right side of the symbol as you did for the pins on the left side. Press the F2 (Unselect All) function key. Click the on the **[Draw] Add Pin** icon. Enter the following information in the Add Pin dialog box:

    - Name Height: 0.75
    - Name Placement: Name with whisker
    - Pintype: OUT
    - Pin Placement: right side
    - Pin name(s): O

    Click the Select mouse button on **OK**.

13. When the Add Pin prompt bar appears, place the pin to the right of pin 2. Move the "OUT" text to just below the pin whisker.

14. Press the F2 (Unselect All) function key. Using the F1 (Select Area Any) function key, select the new pin, whisker, and property text. Copy it directly below the original, and opposite pin 9.

15. Unselect, then add another pin opposite pin 3. This pin has a Pintype property value of "IXO" and pin name "P".

16. Select the pin, whisker, and property text. Choose **Copy > Multiple** from the popup menu. Enter "5" in the Count text entry box. Press the Tab key and click the Select mouse button below the selected pin and opposite pin 4. The IXO and OUT pins should now appear as shown in the left panel of Figure 6-22. Press the F2 (Unselect All) function key.

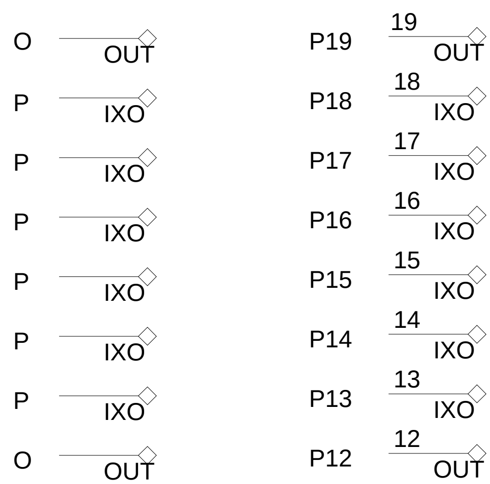


Figure 6-22. IXO and OUT Pins on PLD Symbol

17. Select the Pin property text ("O" and "P") and click the Select mouse button on the **[Text] Sequence Text** icon. When the dialog box is displayed, enter the following information, then click on the **OK** button:

- New Prefix: P
- Beginning Index Number: 19
- Step By: -1

18. Press the F2 (Unselect All) function key. Set the select filter to select only pins, then select the pins on the right side of the symbol.

19. Click on the **[Text] Add Property** icon. In the dialog box, choose the PIN_NO property name, and enter a dummy property value, such as "Z" (you will change it in the next step, but it should be unique). Click on **OK** and place the text just above the whisker, as you did on the left side of the symbol.

20. Press the F2 (Unselect All) function key. Click on the **[Text] Select By Property** icon. Specify the following information in the dialog box, then click on **OK**:

    - Property Name: PIN_NO
    - Property Value: Z (or whatever name you gave in the previous step)
    - Click the **Text** button

21. Click the Select mouse button on the **[Text] Sequence Text** icon. When the dialog box is displayed, enter the following information, then click on the **OK** button:

    - New Prefix: (no prefix)
    - Beginning Index Number: 19
    - Step By: -1

22. Now the right side of the symbol should look like the right panel in Figure 6-22. Finish the symbol by adding a rectangle for the symbol body, adding properties, checking, and saving. Figure 6-23 shows the finished symbol.

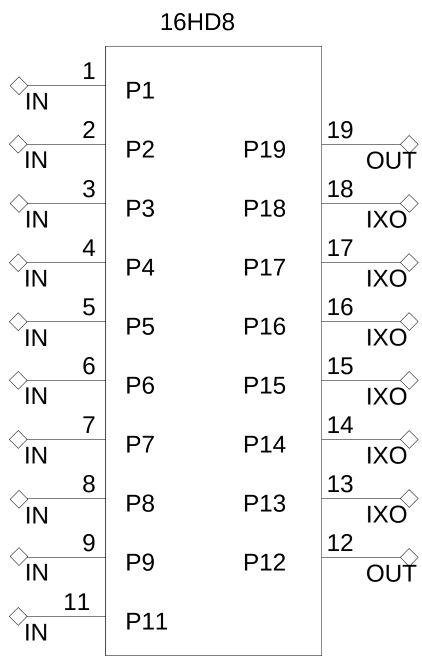


Figure 6-23. $MGC_PLDLIB/16hd8 Symbol

Adding and Naming a Pin Bundle

You can create a pin bundle by adding a Pin property to a symbol. The value of the Pin property must include a comma-separated list of pins or wide pins. The pins included in a pin bundle cannot also occur on the symbol by themselves.

A member of a pin bundle is defined as a pin or wide pin contained in the list of a pin bundle. The members of a pin bundle must be enclosed within curly braces; for example, "U2_pins{P8,P9,P(3:0)}".

When a pin bundle is defined on a symbol, a corresponding pin bundle is also created on the part interface. When the symbol is instantiated, a pin bundle can be connected to either a net bundle or a bus as long as the widths are the same.

You create a pin bundle using the following steps:

1. Add a pin to a symbol.
2. Select the new pin.
3. Execute the **Properties** > **Add** popup menu item to display the Add Property dialog box.
4. Select the "PIN" property in the list box under "Existing Property Name."
5. Name the pin using bundle syntax beside "Property Value."
6. Choose the type of visibility appropriate for your needs.
7. OK the dialog box.

You can edit a pin bundle by changing the value of the Pin property. Errors caused by editing the syntax of a pin bundle are identified only when the symbol is checked. For more information on creating properties, refer to "Assigning Properties and Property Owners" on page 6-95.

Pin bundles have the following characteristics:

- A pin bundle name must be unique within the scope of the symbol; that is, there cannot be two different pin bundles with the same name or both a pin and a pin bundle with the same name.
- A pin can only occur once in the list of pins of a pin bundle.
- A pin cannot exist both on the symbol by itself and in a pin bundle, since this would cause multiple references to the pin on the symbol.
- A pin bundle can contain other pin bundles as long as the nested bundles do not also occur on the symbol by themselves.
- A pin can belong to only one pin bundle.
- Connection of the items in a pin bundle to a net bundle or bus is done by position, not by name.

- A pin bundle can have properties, which are propagated to the individual pins in the pin bundle when a design is evaluated.

For more information on net bundles, refer to "Creating and Naming a Net Bundle" on page 6-62.

Bundles Connected to Ports

When you create a pin bundle on a symbol, you can connect a model of the symbol to the pins in one of two ways:

- Create a net bundle in the model using the same name and the same members in the Net property as those contained in the Pin property that designate the pin bundle.
- Create nets in the model with the same names as the members of the pin bundle.

The nets do not have to be connected to portin or portout symbols, but their names do have to match the pins in the pin bundle.

Checking a Symbol for Errors

Once the symbol has been drawn, pins placed, and properties added, the last step before saving and registering your symbol is to check the symbol for errors. All symbols must pass a set of required checks before the symbol can be placed on a schematic sheet. The Mentor Graphics required symbol checks are set up at invocation time and are executed, by default, with the Check command. Symbol checks descriptions begin on page A-12.

To check the symbol, press the Check Symbol function key. Errors and warnings are displayed in the Check Symbol window by default for each individual check. Figure 6-24 shows an example of a Check Symbol error log after a successful symbol check. This error log may be diverted to a file by choosing the **Check** > **Set Defaults** pulldown menu item, and specifying a filename in the dialog box that is displayed.

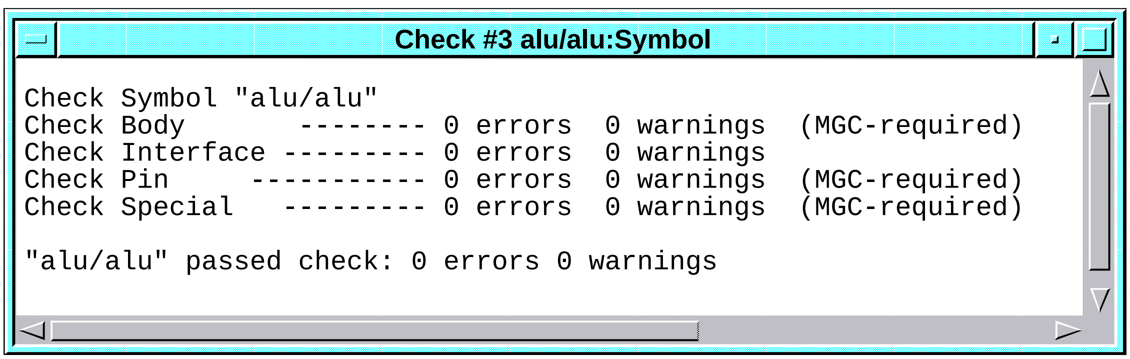


Figure 6-24. Check Symbol Log

Setting Default Symbol Checks

To setup your own default symbol checks, perform the following steps:

1. Activate the Symbol Editor window for the symbol to be checked by placing the cursor in the window and clicking the Stroke mouse button.

2. Select either the **Setup** > **Check** or the **Check** > **Set Defaults** menu item. The Default Symbol Check Settings dialog box appears in the active symbol window.

3. Select the checks you wish to execute by clicking the Select mouse button beside the appropriate check name button. Select one of the three buttons displayed for each check. The label **Errors/Warnings** means display both error and warning messages, the label **Errors only** means display errors only, and the label **No check** means this check is not executed.

4. After the desired checks have been selected, click the OK button.

Note Default check settings you set in this dialog box are effective for this edit session only. When you exit from DA, these settings are lost. The required default checks are set at invocation of Design Architect.

To specify and execute a set of symbol checks, perform the following steps:

1. Activate the Symbol Editor window for the symbol to be checked by placing the cursor in the window and clicking the Stroke mouse button.

2. Choose the **Check > As Specified > Using Current Settings** menu item. The Symbol Check dialog box appears in the active symbol window. The settings in the dialog box appear as they were last set in the current editing session. If this is the first time the dialog box has been displayed, it will show the default settings.

   or

   Choose the **Check > As Specified > Using Default Settings** menu item. The Symbol Check dialog box appears in the active symbol window showing the current internal default check settings.

3. Select the checks you wish to execute by clicking the Select mouse button beside the appropriate check name button. Select one of the three buttons displayed for each check. The label **Errors/Warnings** means display both error and warning messages, the label **Errors only** means display errors only, and the label **No check** means this check is not executed. If desired, the current settings can be saved as default settings by selecting the "Update Default Settings" switch.

4. Press the **OK** button after selection to execute the checks.

Saving and Registering a Symbol

After the symbol is created and ready to be saved, select the **File > Save Symbol** > **Default Registration** menu item. The symbol is now saved and marked as the default symbol for the component. A component interface is created and the default symbol is registered to the component interface. The component interface is also defined as the default component interface for the component. The component interface name is created from the component leaf name. Symbol registration is discussed in detail starting on page 2-73.

To save the symbol and delete the registration, execute the **File** > **Save Symbol** > **Delete Registration** menu item. The symbol is saved, but not registered to a component interface.

To save the symbol and change the registration, perform the following steps:

1. When the symbol is ready to be saved, execute the **File > Save Symbol** > **Change Registration** menu item. The Save Symbol - Change Registration dialog box is displayed.

2. To delete registration from the component interface, click the Select mouse button on the **Delete Registration? Yes** button.

3. To register the symbol to another component interface, click the Select mouse button on the **Change Interface? Yes** button, then enter the new component interface name in the **Register With Interface:** text entry box.

To mark the component interface as the new default interface for the component, click the Select mouse button on the **Mark This Interface As Default? Yes** button.

4. After registration changes are made, click on the **OK** button.

   Symbol registration is discussed in more detail starting on page 2-73.

Registering Multiple Symbols to One Component Interface

To save and register more than one symbol to a single component interface, perform the following steps (This procedure assumes that you have already created one symbol for the component, refer to the procedure on page 6-92 if you have not already saved one symbol for the component.):

1. Choose the "Open Symbol" item from the palette to open the first symbol.

   The existing symbol is displayed in a Symbol Editor window.

2. Choose **File > Save Symbol As** from the main menu bar.

   The Save Symbol As dialog box appears.

3. Enter the pathname to the component that contains the first symbol in the **Component Name** field. For example, if the existing symbol is named "7496" and the pathname to the component is "$CUSTOM_PARTS/7496" enter "$CUSTOM_PARTS/7496".

4. Click the **Options? YES** button.

   The ***Symbol Name*** field is displayed on the dialog box.

5. Enter a new symbol name in the ***Symbol Name*** text box. For example, to create an alternate symbol for rotated instances of a 7496 shift register, you could enter "7496_rot" for the alternate symbol name.

6. Choose the "Open Symbol" item from the palette to open your alternate symbol.

   The alternate symbol is displayed in a Symbol Editor window.

7. Make any required changes to the alternate symbol. For example, you may want to rotate the symbol body and reposition property text.

8. Choose **Check > With Defaults** from the main menu bar to check the alternate symbol.

   A report window is displayed with a summary of the check. Fix any problems reported and repeat this step.

9. Choose **File > Save Symbol > Default Registration** from the main menu bar to register the alternate symbol with the default component interface.

   CAUTION: If the symbol is not valid for the component interface (for example, the number of pins on the symbol do not match the number of pins in the component interface), the **File > Save Symbol > Default Registration** menu item will query you as to whether you want to save the symbol and update the component interface. If you choose to save the symbol, any other model registered to that component interface is invalidated.

   The symbol is now saved and registered to the default component interface. The default symbol label remains on the original symbol.

10. Execute steps 1 through 10 until all alternate symbols are created and registered to the same component interface.

11. To check that the proper symbol registration occurred, activate the Symbol Editor window for one of the new symbols and execute the **Report > Interface > This Design** menu item. This displays a report about all component interfaces for the specified component, and all models registered with each component interface.

    Conceptual information related to the registration of multiple symbols is discussed in more detail starting on page 2-81.

Assigning Properties and Property Owners

Assigning properties to a design is important if you intend to use the design with other Mentor Graphics applications. Some properties are required for specific downstream applications, others are optional.

Setting Up Property Text Attributes

The following procedures let you set the appearance of properties on a symbol or schematic sheet. Refer to " Changing Property Attributes" on page 6-105 for a procedure to override selected attribute settings. For further reference, Table 2-4 on page 2-45 lists all object attributes and the associated commands and functions used to set and change attributes.

To set up property text attributes in a Schematic Editor window, perform the following steps:

1. Choose the **Setup** > **Property Text** menu item. This displays the Setup Property Text dialog box.

2. Specify text font name in the **Set Font** text box. To make font selection simpler, click the ***Menu...*** button to display a list of suggested fonts.

   If you want to use an unregistered font, you must enter a complete pathname to the font; the pathname must begin with a slash (/).

3. Specify text height by entering a number in the **Set Height** text box. The default height is .1875 user units.

4. Specify text orientation by entering "0" or "90" in the **Set Orientation** text box. These numbers represent the angle of orientation, measured in degrees at which the text is placed on the sheet.

5. Specify text transparency (on/off) by clicking the Select mouse button on the **Set Transparency** button **On** or **Off**.

6. Specify whether text should be visible or invisible on the schematic sheet by clicking the Select mouse button on the **Set Visibility** button On or Off.

7. Specify the vertical text justification by clicking the Select mouse button on the **Set Vertical Justification** button Top, Center, or Bottom.

8. Specify the horizontal text justification by clicking the Select mouse button on the **Set Horizontal Justification** button Left, Center, or Right.

To set up property text attributes in a Symbol Editor window, perform the following steps:

1. Follow steps 1-8 in the previous procedure. In a Symbol Editor window, the Set Property Text dialog box includes two additional attribute fields to be specified. Attributes set with the "Setup" commands change the internal state variable for each attribute.

2. Specify visibility (visible, hidden) by clicking the Select mouse button on the **Set Visibility Switch** button Visible or Hidden. Refer to "Property Visibility Switches," on page 3-12, for a description of how property visibility switches work.

3. Specify the property stability switch by clicking the Select mouse button on the **Set Stability Switch** button Variable, Fixed, Protected, or Nonremovable. Refer to "Property Stability Switches," starting on page 3-11, for a description of how stability switches on properties can protect a property from being changed.

You can also set up property text or comment text in the Schematic Editor, and property text or symbol body text in the Symbol Editor by clicking on the **[Text] Setup** icon. The dialog box has buttons at the top for you to specify the type of text. When you click the Property button, other items in the dialog box are the same as in the Setup Property Text dialog box for each editor.

Adding a Single Property

To add a property name and value to a selected object in a Schematic Editor window, perform the following steps:

1. Select object(s), for example: net, pin, and instance. For information about selecting and unselecting objects, refer to page 6-6.

2. Press the Shift-F5 (Add Property) function key, or click the Select mouse button on the **[Text] Add Property** icon. The Add Property dialog box is displayed.

3. Select a property name from the scrolling list of properties, or type the new property name in the **Property Name** text box.

4. Type the property value in the **Property Value** text box. When entering property values in a dialog box, do not use quotes.

5. Fill in the rest of the dialog box, as appropriate. Refer to "Setting Up Property Text Attributes" for more information about property attributes.

6. When property attributes are set, click the **OK** button. The Add Property prompt bar appears.

7. Move the cursor to the window of the selected object(s). Notice the elastic string attached to the selected object(s) and the property value text. Move the text to the desired location and click the Select mouse button. The property value text is placed at that location.

To add a property name and value to a selected object in a Symbol Editor window, perform the following steps:

1. Select object, for example: symbol body and pin. For information about selecting and unselecting objects, refer to page 6-6.

Note When adding properties to a symbol body, select only one symbol body object. A symbol body can be constructed with a set of symbol body graphics (arcs, rectangles, polylines and so forth). If you select more than one piece of the symbol body, the property will be added to each of the selected pieces. This will create an error when you check the symbol. If an object is not selected when the Add Property command is executed, the property will be added to the logical symbol.

2. Press the Shift-F5 (Add Property) function key, or click the Select mouse button on the **[Text] Add Text** icon. The Add Property dialog box is displayed.

3. Select a property name from the scrolling list of properties, or type the new property name in the **New Property Name** text box.

4. Type the property value (no quotes) in the **Property Value** text box.

5. Fill in the rest of the dialog box, as appropriate (graphics, property type, visibility switch, stability switch). For more information about symbol property switches, refer to "Symbol Properties" on page 3-9.

6. Press the **OK** button when all desired switch settings are set. The Add Property prompt bar appears.

7. Move the cursor to the window of the selected object(s). Notice an elastic string is attached to the selected object(s) and the property value text. Move the property value text to the location you want to place the text, and click with the Select mouse button. The property value text is placed at that location.

Adding Multiple Properties to the Same Object

To add multiple property name/value pairs with the same property attributes to selected objects in a Schematic or Symbol Editor window, perform these steps:

1. Select object(s), for example: net, pin, and instance. For information about selecting and unselecting objects, refer to page 6-6.

2. Execute the **Properties** > **Add** > **Add Multiple Properties** menu item. This is available from the **Instance**, **Net**, and **Draw** Schematic Editor popup menus, and the **Add** and **Symbol Body & Pins** Symbol Editor popup menus. An Add Property dialog box is displayed.

3. Type the property name and value for each pair of properties you wish to add to the selected object(s). Notice that when you type in the **Property Name** text box, another text box is displayed, allowing you to enter as many property name/value pairs as you wish.

4. Fill in the rest of the dialog box, if appropriate. Refer to "Setting Up Property Text Attributes" for more information about setting up property attributes

5. When property attributes are set, click the **OK** button. The Add Property prompt bar appears.

6. Move the cursor to the window of the selected object(s). An elastic string is attached to the selected object(s) and the property value text. Move the property value text to the desired location and click the Select mouse button. The property value text is placed at that location.

7. Repeat Step 6 for each property name/value pair entered.

Repeat Adding Properties to Changing Selection

To add a single property to a selected object(s), select another object(s), add a single property to the newly selected object, and repeat this process as many times as required, perform the following steps:

1. Select object(s), for example: net, pin, and instance. For information about selecting and unselecting objects, refer to page 6-6.
2. Execute the **Properties > Add > Repeat Adding Single Properties > Use Changing Selection** popup menu item. An Add Property dialog box is displayed.
3. Select a property name from the "Existing Property Name" box, or type the property name in the **Property Name** text box.
4. Type the property value in the **Property Value** text box.
5. Fill in the rest of the dialog box, if appropriate. Refer to "Setting Up Property Text Attributes" for more information about setting up property attributes
6. When property attributes are set, click the **OK** button. The Add Property prompt bar appears.
7. Move the cursor to the window of the selected object(s). An elastic string is attached to the selected object(s) and the property value text. Move the property text with the cursor to the location you want to place the text, and click the Select mouse button. The text is placed at that location.
8. After the property value text is placed, the Select Area prompt bar appears. Select another object and repeat steps 3 through 7, or press the **Cancel** button to exit this process.

Deleting Property Name/Value

To delete a visible property name/value pair, perform the following steps:

1. Select properties to be deleted. For information about selecting and unselecting objects, refer to page 6-6.
2. Execute the **Delete** > **Selected** menu item, or click the Select mouse button on the **Delete** palette icon.

To delete hidden property name/value pairs, perform the following steps:

1. Select the objects that own the properties to be deleted.
2. Execute the **Delete** > **Property** popup menu item. The Delete Property dialog box is displayed.
3. Type the property name to be deleted in the **Property Name** text box. Multiple property names can be entered in the dialog box.
4. Press the OK button after the property name(s) is entered.

Setting Property Owners

To define what types of objects can own a particular property on a schematic sheet, perform the following steps:

1. Execute the **Setup** > **Property Owner/Type** > **Property Owner** menu item. The Set Property Owner dialog box (Schematic Editor) is displayed.
2. In the **Property Name** text box, type the property name for which you want to set property ownership.
3. Press the Select mouse button on the object types that can own the property, for example, the Instances or Nets buttons. More than one object type can be specified.
4. Press the **OK** button when object type selection is complete.

For conceptual information about property ownership, refer to "Property Ownership" on page 3-4 in this manual.

Deleting Property Owners

To remove certain object types from the legal owner list of a particular property on a schematic sheet, perform the following steps:

1. Execute the **Delete** > **Property Owner** popup menu item. The Delete Property Owner dialog box (Schematic Editor) is displayed.

2. Type the property name whose owner list you want to modify in the **Property Name** text box.

3. Press the Select mouse button on the buttons associated with the object types you want to remove from the owner list of the specified property name.   More than one object type can be specified.

4. Press the **OK** button when object type selection is complete.

To delete object types from the owner list of a p articular property on a symbol, perform the following steps:

1. Select the **Delete** > **Property Owner** popup menu item to display the Delete Property Owner dialog box (Symbol Editor).

2. Type the property name whose owner list you want to modify in the **Property Name** text box.

3. Click the Select mouse button on the buttons for the object types you want to remove from the owner list of the specified property. More than one object type can be specified.

4. Press the **OK** button, when object type selection is complete.

For conceptual information about property ownership, refer to "Property Ownership" on page 3-4 in this manual.

Listing Property Information

To list property information for specified objects, perform the following steps:

1. Select the properties, or the owners of the properties, for which you wish to extract information. Instead of selecting objects, you can enter the handle names of the objects in the dialog box that is displayed after the next step.

2. Execute the **Report > Object > As Specified** menu item. The Report Object dialog box (Symbol Editor) is displayed.

3. Click the Select mouse button on the buttons associated with the objects for which you want property information. More than one object can be selected. The report generated is, by default, directed to the transcript window, and to a file named "da_report_file" in your current directory.

   If you have selected the object that owns the property, you must ask for a report on both the object and attached properties.

4. Press the **OK** button when object selection is complete.

   Property attributes listed in report windows may include "-Not Visible" and "-Hidden". If both of these are listed, the property was hidden when added, and the property visibility has not been changed.

   If "-Hidden" is listed without "-Not Visible", the property visibility was changed to visible on the sheet.

Changing Property Values

To change a single property text value, perform the following steps:

1. Position the cursor on the piece of text to change, and press the Shift-F7 (Change Text Value) function key.

2. Enter the new value in the prompt bar, then press the Return key, or click the Select mouse button on the **OK** button.

To change the values of selected properties on a sheet or symbol, follow these steps:

1. Select the properties to change, either by setting the select filter, or by choosing the **Select > Area > Property** or the **Select > Area > Property** menu item.

2. Choose the **Properties > Change Values** menu item or click the Select mouse button on the **Property/Text > Change Value** palette icon. This displays the Change Property Value By Handle prompt bar with the current value, name, type, and object handle.

3. Enter the new property value in the text entry box; click the **OK** button. Another prompt bar appears for the next property to change. Repeat this step for each selected property.

To change the value of the same property attached to several objects, perform the following steps (this example changes the Pintype property value):

1. Click the Select mouse button on the **Unselect All** palette button.

2. Move the cursor close to a pin whose Pintype property you wish to change, and press the Shift-F1 (Select Pin) function key. (Select Pin is in the Symbol Editor; Shift-F1 is the Select Vertex function key in the Schematic Editor.) Be sure that only the pin is selected. If the line connected to the pin is highlighted, unselect everything, and move the cursor slightly further away from the pin to select it. Repeat for each pin whose Pintype property value you wish to change. The select count in the status line shows how many objects are selected.

3. Choose the **Properties > Modify** popup menu item. This displays the Modify Properties dialog box.

4. Click the Select mouse button on the "PINTYPE - Multiple Occurrences" entry, then click the **OK** button.

5. Click on the Replace button to the right of the Property Value entry. Enter the new Pintype property value. You can also change the property type and some attributes in this dialog box. Click the **OK** button. The property values are changed for the selected pins.

The following steps show another method of changing various pieces of unselected text:

1. Choose the **Property/Text > Change Values** popup menu item to display the dialog box.

2. Enter a new text value for one you want to replace. When you begin entering a value, another text entry box appears in the dialog box. Enter new values, one per text entry box, for all the values you wish to change.

3. Click on the **OK** button. The first value entered in the dialog box is displayed in the message area. Click the Select mouse button on the text you want replaced by the new value.

4. The old value is replaced by the new value shown in the message area, and the next value is shown in the message area. Continue specifying the text to replace with the new value shown in the message area, until all specified values are placed.

Changing Property Attributes

To change property attributes for a specified property on a schematic sheet, perform the following steps:

1. Select the property owners (nets, instances) for which you want to change property attribute information. Execute the **Properties > Modify** popup menu item. The Modify Properties dialog box is displayed.

2. Select the property name you want to change by clicking the Select mouse button on the property name. You can select more than one property name by holding down the Ctrl key while selecting the property names.

3. Click the **OK** button when the property name selection is complete. A Modify Properties dialog box is opened for the first property name selected.

4. Make the desired property attribute changes.

5. Click the **OK** button when the property attribute selection is complete. The next Modify Property dialog box is displayed for the second property that was selected. Repeat steps 5 and 6 for each property selected.

To change property attributes for a specified property on a symbol, perform the following steps:

1. Select the property owners for which to change property attributes. Execute the **Properties** > **Modify** popup menu item. A dialog box appears that includes a list of property names for the selected objects.

2. Click the Select mouse button on the property name you want to change. You can select more than one property name by holding down the Ctrl key while selecting the property names.

3. Click the **OK** button when the property name selection is complete. A Modify Properties dialog box is opened for the property name selected.

   In the Symbol Editor window, the Modify Properties dialog box has two additional property settings (stability switch and visibility switch) that are not available in a Schematic Editor window.

4. Make the property attribute changes.

5. Click the **OK** button when the property attribute selection is complete. The next Modify Property dialog box is displayed for the second property that was selected. Repeat steps 5 and 6 for each property selected.

For information about text attributes, refer to "Text Attributes" starting on page 2-43 in this manual.

Reporting on Objects

The following topics include procedures for reporting on various schematic objects.

Reporting on Component Interfaces

To list all models, labels, and component interfaces for the component you are currently in, perform the following steps:

1. Activate the Schematic or Symbol Editor window for the component you wish to report on by clicking the Stroke mouse button in that window.

2. Execute the **Report** > **Interfaces** > **This Design** menu item. The contents of the report is displayed in either a popup window, a transcript window, and/or a file, as specified in the previous Setup Report command.

   Figure 6-25 shows an example of an interface report for a component "dff" with a component interface and symbol name "latch", a symbol pin count of 5, and a label of "default_sym" specifying the symbol as the default symbol for the component.

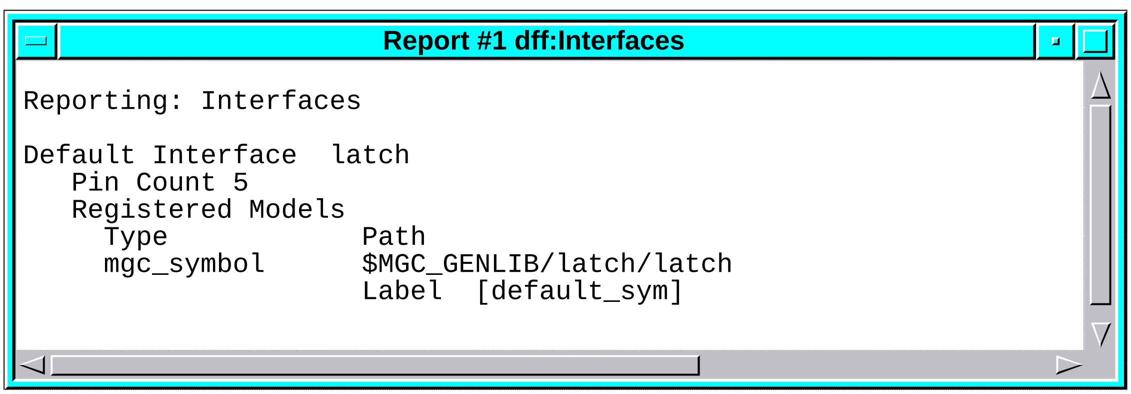


Figure 6-25. Report Interfaces Example

To list all models, labels, and component interfaces for a selected instance on a schematic sheet, perform the following steps:

1. Select the instance for which you want component interface information.

2. Execute the **Report > Interfaces > Selected** menu item. The contents of the report is displayed in either a popup window, a transcript window, and/or a file, as specified in the previous Setup Report command.

To list all models, labels, and component interfaces for a specified component, and set the type of report, perform the following steps:

1. Activate a Schematic or Symbol Editor window. Execute the **Report > Interfaces > Other** menu item. The Report Interfaces prompt bar appears.

2. Type the component name in the **Component Name** text entry box. If you want to report on a specific component interface, enter the component interface name in the **Interface Name** text entry box.

3. If you want the report to be displayed in a window, move the cursor to the **Window** button and click the up arrow until the "window" text appears. If you want the report to be displayed in a transcript, move the cursor to the **Transcript** choice stepper button until the "transcript" text appears .

4. If you want the report to be directed to a file, move the cursor to the **File Mode** button. Select one of the file mode switches. The "add" switch specifies that the report is appended to the specified filename.

   The "replace" switch specifies that the new report replaces the contents of the file. The "nofile" switch specifies that no file is created. If **File Mode** is not set to "nofile", you can specify a new filename in the **File Name** text box.

Note The arguments specified in the Report Interfaces prompt bar override the arguments specified by the **Report > Set Report Defaults** menu item, but do not replace them.

Reporting on Schematic and Symbol Objects

To list all schematic and symbol object information for selected objects on a symbol or schematic sheet, perform the following steps:

1. Select the objects for which you want to gather information.

2. Execute the **Report** > **Object** > **Selected** > **All** menu item. This menu item reports information for all selected objects. The report generated is, by default, directed to a Design Architect window; it can also be sent to a file. Refer to the "Report Object" command in the *Design Architect Reference Manual* for information reported about each object.

To list information for specified object types on a symbol or schematic sheet, perform the following steps:

1. Select the objects for which you wish to obtain information. Instead of selecting objects, you can type the handle names of the objects in the Report Object dialog box.

2. Execute the **Report** > **Object** > **As Specified** menu item. The Report Object dialog box appears.

3. Click the Select mouse button on the buttons corresponding to the objects for which you want information. More than one object type may be selected. The Report generated is, by default, directed to a Design Architect window, and to a file named "da_report_file" in your current directory.

   When listing property information, if you have selected the object that owns the property, you must ask for a report about both the object and the attached properties.

4. Click the **OK** button when object type selection is complete. Figure 6-26 illustrates the type of information found on a report of a schematic sheet when instance, net, pin, and property text attribute object types are specified.

   Property attributes listed in report windows may include "-Not Visible" and "-Hidden". If both of these are listed, the property was hidden when added, and the property visibility has not been changed.

   If "-Hidden" is listed without "-Not Visible", the property visibility was changed to visible on the sheet.

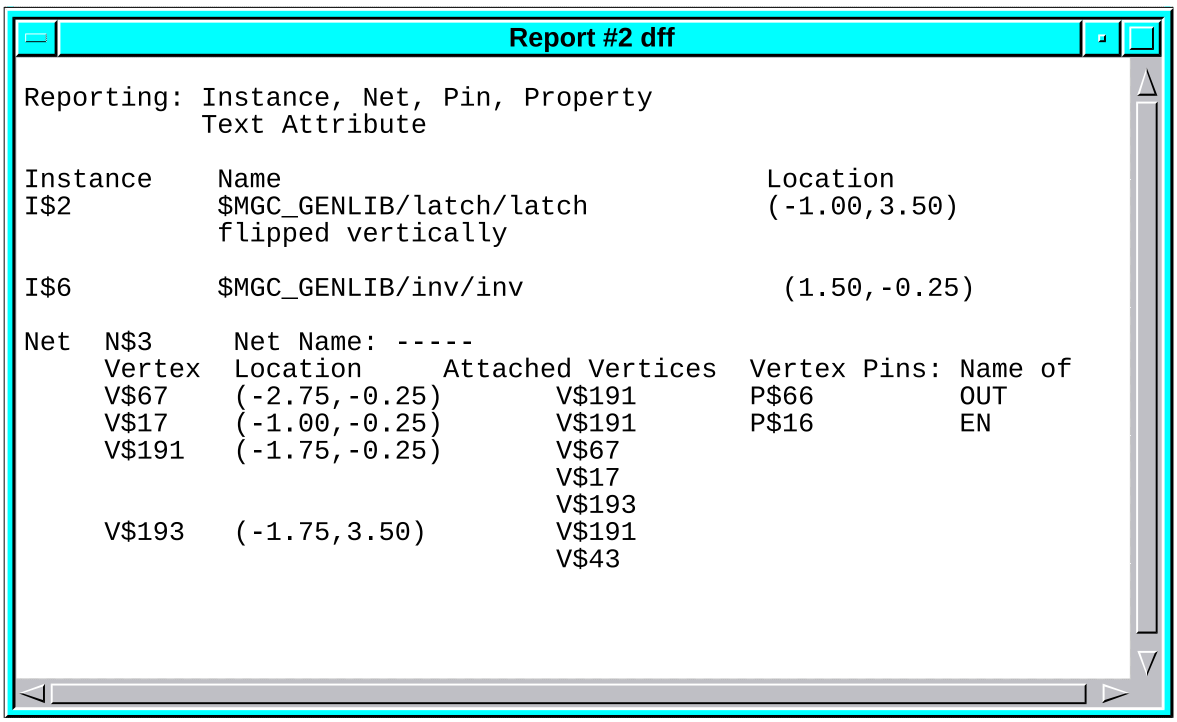


Figure 6-26. Report Object Example

Reporting on Check Status

To report the status of all schematic or symbol checks, perform the following steps:

1. Place the cursor in the Symbol or Schematic Editor window for the symbol or schematic check status you want to report on, and click with the Stroke mouse button.

2. Execute the **Report > Check > All** menu item. This menu item reports the status of all check categories for the schematic sheet or symbol in the active window. The report generated is, by default, directed to a Design Architect window, and a file named "da_report_file" in your current directory. Refer to Appendix A, "DA Design Checks," for a description of individual checks performed.

To report the status of specified check types on a symbol or schematic sheet, perform the following steps:

1. Place the cursor in the Symbol or Schematic Editor window for the type of check status you want to report on, and click the Stroke mouse button.

2. Execute the **Report > Check > Specified** menu item. A Report Object dialog box appears.

3. Click the Select mouse button on the buttons corresponding to the checks for which you want a status report. More than one check can be selected. The Report generated is, by default, directed to a Design Architect window, and a file named "da_report_file" in your current directory.

4. Click the **OK** button when check types are selected.

Editing DA Models in a Design Hierarchy

The following topics contain some of the procedures you need for schematics having multiple sheets and/or multiple levels of hierarchy.

Creating a Functional Block

Functional blocks are helpful when creating top-down designs. A functional block is just a symbol (usually rectangular) representing a high level of functionality. After creating functional blocks, you can create lower-level descriptions for each block.

To create a functional block in the Schematic Editor, perform the following steps:

1. Create comment graphics by clicking the Select mouse button on the **[Draw] Add Rectangle** icon. Press the Select mouse button to specify one corner of the rectangle; hold the button down as you move the cursor to the diagonally opposite corner of the rectangle, then release the mouse button.

2. Add pins by choosing the **[Draw] Add Pin** icon.

3. Add properties to the comment graphics.

4. Select the comment graphics, property text, and pins.

5. Execute the **Edit > Make Symbol** pulldown menu item. The Make Symbol dialog box is displayed for you to enter a component name, and, optionally, a symbol name and interface name. After you click the **OK** button, the newly-created symbol is checked. If it passes the required checks, the symbol is saved and automatically registered with the default interface. The symbol is then instantiated on the sheet, replacing the comment graphics and symbol pins. Make Symbol is described in the *Design Architect Reference Manual*.

Creating a Sheet for a Symbol

The following procedures describe two of the methods by which Design Architect can automatically create a partial sheet for your existing symbol.

In the Schematic Editor, perform the following steps:

1. Select the symbol instance for which you want to create a sheet.

2. Choose the **File > Open Down > Choose Model** pulldown menu item. This displays the Open Down dialog box. Click on the **New Sheet** button; the dialog box now contains text entry boxes for schematic and sheet names.

3. The default names for the schematic and sheet are automatically displayed in the dialog box for you to change, if you wish. In this example, "sheet1" was changed to "sheet2" because this symbol already has a sheet.

   You can specify a border by clicking the **Sheet Border Yes** button, and clicking the stepper button until the name of the desired size is displayed. If you don't remember the sizes, or you do not want a title block, click the Set button. This displays the Add Sheet Border dialog box, which lists the standard sheet sizes and lets you choose not to create a title block. Creating a sheet border and title block for an existing sheet is described on page 6-125.

4. Design Architect will automatically create I/O ports from the pins on the symbol. If you do not want this option, click the appropriate **No** button. You can specify a startup file for this sheet by clicking **Yes** and entering the pathname to the startup file in the text entry box that appears.

5. After you click the **OK** button, Design Architect opens an editing window on the new sheet. If you requested a sheet border and title block, the border is drawn, and a dialog box is displayed for you to enter your title block information. Enter the information and click the **OK** button.

If you requested I/O ports, there will be a portin, portout, or portbi symbol instance on the sheet for each pin on the symbol. The Net property value attached to each of these instances is the same as the Pin property value on the corresponding pin.

6. Now the sheet is ready for you to add nets and other instances.

To create a sheet for a symbol you have opened in the Symbol Editor, perform the following steps:

1. If the symbol has not been checked, you need to check and save it before creating a sheet for it.

2. Choose the **Miscellaneous > Create Sheet** pulldown menu item. This displays the Create Sheet dialog box.

3. You can change the default schematic and sheet names, if desired. Specify whether to replace an existing sheet of the same name, the sheet size, orientation, and whether you want a border on the sheet. If you want to specify a sheet size other than one of the standard sizes, click the Specify button. The dialog box expands so you can enter the width and height in text entry boxes and click the appropriate button for units of measurement.

4. When you click the **OK** button, a sheet is generated with portin and portout symbols corresponding to the pins on the symbol.

Creating Additional Sheets in a Schematic

To create a second sheet on the same hierarchical level of a schematic, perform the following steps:

1. Choose one of the Open Sheet methods (palette icon, function key, popup menu item, or popup command line) from the Design Architect Session window.

2. In the Open Sheet dialog box, enter the component name, and change the default sheet name from "sheet1" to "sheet2". If you want a border and title block, click the options button and supply the appropriate information, then click the **OK** button on each dialog box.

3. A new sheet is displayed in a Schematic Editor window. You will need to place *$MGC_GENLIB/offpage.in* and *$MGC_GENLIB/offpage.out* connector symbols on the sheets to establish electrical connectivity.

Using Off-Page Connectors

Off-page connectors are used to intentionally connect nets having the same name on different sheets in a schematic. Mentor Graphics supplies off-page connectors in *$MGC_GENLIB*. Generally, *offpage.in* connectors are on the left side of the sheet, and *offpage.out* connectors are placed on the right side of the sheet. There is also an *offpage.bi* symbol for bi-directional nets.

Suppose you have a net named "DATA" that begins on sheet1 and extends beyond the right side of the sheet. "DATA" continues on the left side of sheet2. Follow these steps to connect the nets:

1. Open sheet1. Press the Ctrl-H keys to display the symbol history list. Click the Select mouse button on "offpage.out" in the list to activate the symbol.

2. Click the Select mouse button in the Active Symbol window. Click on the end point of the net named "DATA" near the right side of the sheet.

3. Check and save sheet1.

4. Open sheet2. Press the Ctrl-H keys to display the symbol history list. Click on "offpage.in" in the list.

5. Click the Select mouse button in the Active Symbol window. Click on the end of "DATA" near the left side of the sheet to place the symbol instance.

6. Check and save sheet2. Choose the **Check > Schematic > With Defaults** menu item. This will flag any mismatched off-page connectors and any nets having the same name, but no connectors.

Using Portin and Portout Symbols

Ports connect Net names on a sheet to Pin names on the symbol that represents that sheet. Mentor Graphics supplies *portin*, *portout*, and *portbi* components in *$MGC_GENLIB* for input nets, output nets, and bi-directional nets, respectively. To add port symbol instances to the sheet you are editing, perform the following steps:

1. Press the Ctrl-H keys to display the active symbol list. Click on "portin" in the list to activate the symbol.

2. Position the cursor at the beginning of an input net, and press the F5 (Place Symbol) function key. Repeat for each input net. Notice that each portin symbol instance has a Net property attached, and all have a value of NET.

3. Click the Select mouse button on the **[Text] Name Net** icon. This displays the Select Area prompt bar. Using the mouse, enclose the Net property text in a dynamic rectangle. The objects within the rectangle are selected, then unselected, and the top-most, left-most Net property text is selected.

4. For each piece of selected property text, the Change Property Value prompt bar is displayed for you to enter a new value. When you press the Return key, or click the **OK** button on the prompt bar, the selected property text is changed to its new value. The newly changed property text is unselected, and the next piece of property text is selected.

Use the same procedure for adding portout or portbi symbol instances and changing Net property values.

Editing the Sheet of a Symbol

After you have opened a schematic sheet, you can select an instance on the sheet and choose one of the models registered to the component instance to edit or view.

To open a model for a selected instance, perform the following steps:

1. Select the instance you want to open down into. For information about selecting and unselecting objects, refer to page 6-6.

2. Execute the **File > Open Down > Choose Model** menu item. The Open Down dialog box appears with a list of registered models. In this case, a symbol model, schematic model, VHDL source, VHDL Entity, and a VHDL Architecture can be chosen.

3. Click the Select mouse button on the model you wish to open, then click on the **OK** button. An editing window that matches the type of model you selected is opened.

Creating a Symbol for a Sheet

You can generate a symbol for the sheet you are currently editing, or for another sheet, by performing the following steps:

1. Choose the **Miscellaneous > Generate Symbol** pulldown menu item.

   The Generate Symbol dialog box is displayed.

2. Enter the pathname to the component that will contain the generated symbol in the **Component Name** field.

3. Enter the name of the symbol to generate in the **Symbol Name** field.

4. Choose radio buttons that effect the symbol to be created. The following list explains your choices:

   - You can choose to replace an existing symbol that has the same name.
   - You can choose to how the generated symbol is initially saved.
   - You can choose to make the symbol the active. You must choose either the **Save Symbol** or **Save and Edit** radio buttons under **Once Generated...** to make the new symbol active.

5. Click the **Schematic** button.

   The **Component Name** and **Schematic Name** fields are displayed.

6. Enter the pathname to the component that contains the schematic in the **Component Name** field.

7. Enter the name of the schematic in the **Schematic Name** field.

8. If desired, adjust the values in the Pin Spacing, Sort Pins, Component Shape fields. For information on possible values for these fields, refer to the "$generate_symbol()" function description in the *Design Architect Reference Manual.*

9. Click the **OK** button when you have completed your entries in the dialog box.

The generated symbol will have whiskers from the pin to the symbol body. The Pin property text will be placed at the end of the whisker inside the symbol body. Pin locations are determined by the port instances on the schematic sheet.

Creating a Pin List

You can create a pin list for a sheet using the following procedure:

1. Choose the **Miscellaneous** > **Create Pin List** item from the main menu bar.

   The Create Pin List dialog box appears.

2. Enter the pathname to the schematic.

3. Enter the pathname to the pin list to be created.

4. If you want to replace an existing pin list file with the same name, click the **Yes** radio button under **Replace existing pin list file?**.

5. If you want to edit the pin list, click the **Yes** radio button under

   Edit pin list file?.

   This opens a Notepad window on the generated pin list after you click the **OK** button.

6. If you want the pin information sorted in alphabetical order in the pin list file, click the **Yes** radio button under **Sort Pins?**.

7. Click the **OK** button when you have completed your entries in the dialog box.

For detailed information on the constructs used in the pin list file, refer to the "Pin List File Format" appendix in the *Design Architect Reference Manual*.

Creating a VHDL Entity for a Symbol

You can create a VHDL entity for a symbol by following these steps:

1. Open the Symbol Editor on the desired symbol.

2. Choose the **Miscellaneous** > **Create VHDL Entity** menu item.

A VHDL entity file is created in the working directory, as specified by $MGC_WD. The entity is given the symbol name with "_entity" appended. Body properties, other than the Model property, are placed in an example generic statement that is commented out. The new entity is displayed in a VHDL Editor window for you to edit or compile.

Creating a Symbol From a VHDL Entity

A symbol may be created before or after the VHDL model. To create a VHDL model and generate a symbol for that model, perform the following steps:

1. Open the VHDL Editor by clicking the Open VHDL icon in the Session palette, and entering the component name and the VHDL source name in the Open VHDL dialog box.

2. Write and compile your VHDL model.

3. Open the Symbol Editor using the same component name as you did when you opened the VHDL Editor. A system-generated symbol is displayed in a Symbol Editor window. The symbol is a simple block with the correct number of pins with port names and Pintype properties assigned.

4. To verify the properties and settings, select the entire symbol and choose the **Report** > **Object** > **Selected** > **All** pulldown menu item.

5. Close the report window. Check the symbol by choosing the **Check** > **With Defaults** menu item.

6. Save the symbol by choosing **File** > **Save Symbol** > **Default Registration**. Click on the **Yes** button when asked if the interface should be updated.

Viewing Design Hierarchy

You can view the hierarchy of your design by performing the following steps:

1. Choose the **MGC > Design Management > Open Hierarchy Window > Specify** pulldown menu item.

   The Open Hierarchy Window dialog box is displayed.

2. Enter the pathname of the component whose hierarchy you want displayed, or use the navigator button to bring up the dialog navigator to find the component.

3. Click the **OK** button when you have completed the form. The hierarchy is displayed in an IDW Hierarchy window.

4. Select a component in the IDW Hierarchy window by clicking the Select mouse button on the component name.

5. Press the Menu mouse button in the IDW Hierarchy window to display the associated popup menu.

For more information on the IDW Hierarchy window, refer to "“my_design” Design with COMP Property" in this manual.

Adding Comment Text and Graphics

Comment objects are used for adding non-electrical information to a design. These objects have no electrical significance. Comment objects cannot be instantiated.

You can add comment text and graphics directly to a sheet in the Schematic Editor. In the Symbol Editor, you create symbol graphics and text, then convert selected objects to comment objects.

Setting Comment Text and Graphic Drawing Attributes

Before you begin drawing comment objects, you can set up how text and graphical shapes are graphically represented. For more information about comment text and graphics attributes, refer to "Object Attributes" starting on page 2-44 in this manual.

To set up comment text and graphical drawing attributes, perform the following steps from the Schematic Editor:

1. Execute the **Setup** > **Net/Comment/Page** > **Comments** menu item. The Setup Comment dialog box appears in the active Schematic Editor window.
2. Click the Select mouse button on the line width you want (1 pixel, 3 pixels, 5 pixels, 7 pixels).
3. Click the Select mouse button on the fill type you want (Clear, Solid, Stipple).
4. Click the Select mouse button on the text transparency you want (On, Off).
5. Click the Select mouse button on the text vertical justification you want: (Top, Center, Bottom).
6. Click the Select mouse button on the text horizontal justification you want: (Left, Center, Right).
7. Click the Select mouse button on the line style you want: (Solid, Dotted, Long Dash, Short Dash).
8. Enter the desired font name. The default is the "stroke" font. Fonts and font registry files are located in *$MGC_HOME/registry/fonts*.
9. Enter the desired text height. The default height is 0.1875 user units.
10. Enter the desired text orientation: (0 or 90 degrees). The default is 0 degrees (horizontal).

11. Click the **OK** button when comment attribute selection is complete.

You can also set up comment text attributes in the Schematic Editor by clicking the **[Text] Setup** icon.

Creating Comment Objects on Schematic Sheets

You can access comment object functionality through the **[Draw**] palette and the **Draw** > **Add** and the **Add** > **Draw** popup menu items. Click the Select mouse button on the **Draw** palette button to display the Draw palette. The following list describes how to create various comment objects on a schematic sheet.

- Click the Select mouse button on the **[Draw] Add Polyline** icon. Click the Select mouse button at the beginning of the line, and at each vertex. Each time you click and move the mouse, a line stretches from the vertex to the cursor. Double-click to end the line.

- Click the Select mouse button on the **[Draw] Add Rectangle** icon. Specify the location of one corner of the rectangle by pressing the Select mouse button. Hold the mouse button down and move the cursor to the desired location of the diagonally opposite corner, then release the mouse button.

- Click the Select mouse button on the **[Draw] Add Circle** icon. Specify the center of the circle by pressing the Select mouse button. Hold the mouse button down and move the cursor to define the perimeter, then release the mouse button. A ghost image of the circle moves with the cursor.

- Click the Select mouse button on the **[Draw] Add Polygon** icon. Click the Select mouse button at each vertex of the polygon. Double-click at the last vertex. Design Architect automatically draws a segment between the last and first vertices to close the figure.

- Click the Select mouse button on the **[Draw] Add Arc** icon. Click at the desired location for one end of the arc, then click at the other end of the arc. A ghost image moves as you move the cursor to define the arc point. When the arc is the desired size, click the Select mouse button to place it.

- Choose the **Draw > Add > Two Point Line** popup menu item. Press the Select mouse button at one end of the line, hold the mouse button down as you move the cursor to the other end of the line, then release the mouse button.

- Choose the **Draw > Add > Dot** popup menu item. Click the Select mouse button at the point you want the dot.

- Click the Select mouse button on the **[Text] Add Comment Text** icon. Enter the comment text you want to add in the prompt bar that appears, then press the return key. As you move the cursor, a ghost image of the text appears and moves with the cursor. Move the text to the desired location and click the Select mouse button.

Making a Symbol From Comment Objects

Creating a symbol from comment objects is the same as creating a functional block, described on page 6-112. The basic steps are as follows:

1. In the Schematic Editor, create a rectangle for the symbol body.

2. Add pins to the symbol body.

3. Add other property text, as needed.

4. Select the symbol body, pins, and associated text.

5. Choose the **Edit > Make Symbol** pulldown menu item. The symbol is checked and, if it passes all checks, Design Architect creates a symbol, registers it (using default registration), and instantiates it in the location of the original comment objects.

Adding a Sheet Border and Title Block

If you did not create a sheet border and title block when you created a sheet, you can perform the following steps to create the border:

1. You can choose either **MGC STD** or **ANSI STD** from the **Edit > Add Sheet Border** pulldown menu to display a dialog box. Design Architect supports 10 different sizes of MGC sheet borders. The default is size D.

   The sizes offered in the Add ANSI Sheet Border dialog box are:

   - A Horizontal 11 x 8.5 in.
   - A Vertical 8.5 x 11 in.
   - B 17 x 11 in.
   - C 22 x 17 in.
   - D 34 x 22 in.
   - E 40 x 28 in.
   - F 44 x 34 in.

   The Logic Symbol Pin Spacing indicator is set to **Half Size** which is the default. 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 the **OK** button on the dialog box. The Add Sheet Border dialog box disappears from the screen, a border is added to the sheet, and the Title Block Information dialog box is displayed.

   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 example is **add_det**. The Page Number entry box is filled in with 1 because this is sheet1 of the schematic.

3. Enter the remaining information for your sheet, then click the **OK** button.

   The Title Block Information dialog box disappears from the screen and the title block is added to the sheet border.

   You can also customize your own sheet borders. Refer to the *$add_sheet_border()* function description and Appendix A, "Custom Userware" in the *Design Architect Reference Manual* for information about how to customize your own sheet borders.

Converting Electrical Objects to Comments

You can select electrical objects and convert them to comment objects by clicking on the **[Draw] Convert to Comment** icon in the Symbol Editor, or choosing the **Edit > Convert to Comment** menu item in the Schematic Editor.

Create comment objects from symbol objects by performing the following steps:

1. Select the symbol graphics and text you want to convert.

2. Click the Select mouse button on the **[Draw] Convert to Comment** icon.

Selected symbol graphics become comment graphics; selected property text attached to the symbol body becomes property text attached to the graphics, symbol text and other property text become comment text, and are placed at their current locations.

Comment graphics and text cannot be instantiated and, therefore, do not appear when an instance of the symbol is placed on a sheet.

To convert schematic objects to comments, perform the following steps:

1. Select the objects and text to convert.

2. Choose the **Edit > Convert to Comment** pulldown menu item.

Selected nets become lines, selected instances become graphic objects, property text attached to the symbol body remains property text, now attached to the graphics, and visible property text becomes comment text.

Removing Comment Status

To remove comment status from comment objects that were created by converting selected symbol objects, perform the following steps in the Symbol Editor:

1. Select the comment graphics and text.

2. Choose the **Edit > Remove Comment Status** pulldown menu item.

The objects may now be instantiated on a schematic sheet. This function does not restore electrical information that was previously on the symbol.

Viewing the Contents of a Sheet

Changing the view of a sheet is useful when large schematics are edited. It allows you to see the schematic sheet or symbol in adequate detail. You can change the sheet view any time to see a small portion of the sheet, or zoom out to see the entire sheet.

Viewing a Portion of the Sheet

To view a portion of the sheet, perform the following steps:

1. Press the F8 (View Area) function key or select the **View > View Area** menu item. The View Area prompt bar appears on the screen, with the location cursor on "Area".

2. Place the cursor at one corner of the rectangular area you want to view.

3. Press and hold down the Select mouse button. While the Select mouse button is depressed, move the cursor to the opposite corner of the rectangular area. Notice that as you move the cursor, a rectangular box is displayed. This rectangle is the boundary of the area that will be viewed.

4. When the area you want to view is within the rectangle, release the Select mouse button.

The area you specified is enlarged to fill the active window. View Area is also available from the popup menu in a scroll bar, or by defining the view area within the Context window.

Viewing the Entire Sheet

To view the entire design sheet, perform the following steps:

1. Press the Shift-F8 (View All) function key or select the **View** > **View All** menu item.

2. The entire design sheet is displayed in the active sheet window.

You can also view the entire sheet by double-clicking the Select mouse key in the Context window.

Other Viewing Capabilities

You can also view different aspects of the design by choosing one of the following menu items:

- **View** > **View Centered.** This view option centers the view around the specified location. After choosing this menu item, the View Centered prompt bar appears in the active window with the location cursor on "Center of View". As you move the mouse into the active window, the moving cursor appears. Click the Select mouse button at the desired center of view. The view of the design is now centered around the location specified.

  Another method of centering the view is to double-click the Stroke mouse button in the edit window.

- **View** > **View Selected.** This view option centers the view around the selected object(s).

- **View** > **Zoom In** > **2.0 | 3.0 | As Specified.** This view option expands the image size in the active window to show more detail in the window. The image is zoomed-in by a factor of 2.0, 3.0, or the factor you specify in a prompt bar, with respect to the center of the image.

- **View > Zoom Out > 2.0 | 3.0 | As Specified.** This view option shrinks the image size in the active window to show less detail in the window. The image is zoomed out by a factor of 2.0, 3.0, or the factor you specify in a prompt bar, with respect to the center of the image.

Printing in Design Architect

Design Architect gives you a variety of ways to print your design. Each Design Architect window has specific menu items that define different printing capabilities.

From the DA Session window you can execute menu items to print:

- The entire Design Architect session, including all editor windows and the contents of the windows.
- All the schematic sheets that comprise a schematic.
- All design sheets and their back annotations, specified by the current design viewpoint.

From a Symbol Editor window you can print the contents of the Symbol Editor window.

From a Schematic Editor window you can print the contents of a schematic sheet.

From the VHDL Editor window you can print a VHDL document.

From Design Architect Session Window

To save the entire DA session in postscript format, perform the following steps:

1. Place the cursor in the Design Architect Session window, and click the Stroke mouse button.
2. Choose the **MGC > Export Screen:** menu item.

   The Export Screen dialog box is displayed.
3. Enter the pathname to the output file in the **Output file path** field.
4. Click the **OK** button to execute the dialog box.
5. Click the left mouse button in the session window.

For information on sending the resulting file to a printer from the shell, refer to "From an Operating System Shell" on page 6-134.

To print all sheets in a design with back annotations displayed, perform the following steps:

1. Place the cursor in the Design Architect Session window, and click the Stroke mouse button.
2. Execute the **File** > **Print** > **Design Sheets** menu item.

You can change the default printer settings by executing the **MGC** > **Setup** > **Printer** menu item. Refer to the *Printer Interface Reference Manual* for a description of all required and optional arguments.

NOTE: If a design sheet window is not open when the **File** > **Print** > **Design Sheet***s* menu item is executed, the last design viewpoint set for edits will identify the design sheets printed. You can manually set the current design viewpoint by executing the **Setup** > **Set** > **Viewpoint** menu item from the session window.

From the Symbol Editor

To print the contents of a Symbol Editor window, perform the following steps:

1. Activate the edit window for the symbol you wish to print. Choose the **File > Print Symbol** menu item to display the Print Object prompt bar.

2. Type the printer name in the "Printer name" text box.

3. If you want to override the default printer options, click the "Options" button. The Print Design Object dialog box is displayed. You can specify the printer name, the site name, the number of copies, a job configuration file, the orientation, the priority, notification level, magnification, the scale, and the panel name (if you want to plot only a portion of the window). For a procedure describing how to create panels, refer to "Adding, Viewing, and Deleting Panels" on page 6-135.

   You can change the default printer settings by specifying any or all of the printer attributes. This overrides the default printer settings for this job only. If you want to change the printer attributes for all subsequent print jobs, click the **Keep options** button. This changes the default settings to the values specified in the Print Screen dialog box.

You can change the default printer settings by changing the **MGC > Setup > Printer** menu item. Refer to the *Printer Interface Reference Manual* for a description of all required and optional arguments.

From the Schematic Editor

To print a schematic sheet, perform the following steps:

1. Place the cursor in the Schematic Editor window of the sheet you wish to print, and click the Stroke mouse button.

2. Execute the **File > Print Sheet** menu item. The Print Object prompt bar is displayed.

3. Type the printer name in the "Printer name" text box.

4. If you want to override the default printer options, click the Options button. The Print Design Object dialog box is displayed. You can specify the printer name, the site name, the number of copies, a job configuration file, the orientation, the priority, notification level, magnification, the scale, and the panel name (if you want to plot only a portion of the window). For a procedure describing how to create panels, refer to "Adding, Viewing, and Deleting Panels" on page 6-135

   You can change the default printer settings by specifying any or all of the printer attributes. This overrides the default printer settings for this job only. If you want to change the printer attributes for all subsequent print jobs, click the **Keep options** button. This changes the default settings to the values specified in the Print Screen dialog box.

   You can change the default printer settings by changing the **MGC > Setup > Printer** menu item. Refer to the *Printer Interface Reference Manual* for a description of all required and optional arguments.

From the VHDL Editor

To print a VHDL document, perform the following steps:

1. Click the Stroke mouse button in the VHDL Editor window.

2. Execute the **File > Print > Print Document** menu item. The Print Document prompt bar is displayed.

3. Type the printer name in the "printer_name" text box.

4. Use the choice stepper button to choose whether you want to print all VHDL text, or selected VHDL text. Press the **OK** button when complete.

You can change the default printer settings by executing either the **MGC > Setup > Printer** or **File > Print > Setup Printer** menu item. Refer to the *Printer Interface Reference Manual* for a description of all required and optional arguments.

Printing All Sheets in a Hierarchy

To print all sheets in a hierarchy, perform the following steps:

1. Choose the **File > Print All > Sheets** item from the main menu bar.

   The Print All Sheets dialog box appears.

2. Enter the pathname to the top-level sheet in the design in the **Component Name** field.

3. If desired, restrict the sheets that are printed. The following list describes the methods for restricting printing:

   - Enter a level at which to stop printing sheets the hierarchy in the ***Stop Level*** field. The default value of zero prints the entire hierarchy.

   - Enter a series of strings in the ***Filter*** fields. If the reference pathname to a sheet in the hierarchy contains one of the strings, the sheet it is not printed.

   - Choose the **Yes** button beneath **Preview**. This causes a second dialog box to appear after you execute the current dialog box. A list of all sheets that met the criteria specified in the ***Stop Level*** and ***Filter*** fields is displayed. You then select sheets from the list to be printed.

4. Click the **OK** button to print the sheets.

From an Operating System Shell

You can also print Design Architect graphics from an operating system shell. The following shell-level commands print a design called "my_design" on a printer named "pr2":

- On a Sun, Solbourne, or any other supported system which uses the BSD 4.3 printing environment:

```
$ /idea/bin/ilpr -pr pr2  -idea  -type  mgc_schematic \
                                      my_design/schematic
```

- On an HP/Apollo workstation:

```
$ /idea/bin/iprf -pr pr2  -idea  -type  mgc_schematic \
                                      my_design/schematic
```

- On HP-PA, DEC, Sony, NEC, or any other supported system which uses the SysV printing environment:

```
$ /idea/bin/ilp -pr pr2  -idea  -type  mgc_schematic \
                                     my_design/schematic
```

Printer Configuration

You may want to adjust your printer configuration for plotting Design Architect data. Depending upon how your network printers are set up, you may want to use a separate printer configuration file for Design Architect, so that it will not affect printing from other applications.

Add the following lines (or modify them, if they already exist) to your printer configuration file to adjust the page offset and the line weight for buses, borders:

```
tray_page_offset_top      1         0.25
tray_page_offset_left     1         0.25
##                      <tag>    <weight>
line_weight               1         1
line_weight               3         7   #default=5
line_weight               5         9   #default=7
line_weight               7        11   #default=9
```

Adding, Viewing, and Deleting Panels

You define panels to plot particular areas of symbol or schematic windows. The panel area is defined by the coordinates of a rectangular region. Panels can be large or small, and they may overlap.

To create a panel in a Symbol or Schematic Editor window, perform the following steps:

1. Place the cursor in the Symbol or Schematic Editor window in which you wish to create a panel, and click the Stroke mouse button.

2. Execute the **View > Panel > Add Panel** menu item. The Add Panel prompt bar is displayed.

3. Type the panel name in the "Panel Name" text box.

4. If you want to replace a previously defined panel with the same name you specified, click the Select mouse button on the choice stepper button to select the "replace" switch.

5. Click the Select mouse button on the "Panel Area" button.

6. Position the cursor at one corner of the panel. Press and hold the Select mouse button.

7. Move the cursor while still holding the Select mouse button. A dynamic rectangle is created which defines an area of the sheet. Move the cursor until the rectangle is the panel size you want, then release the mouse button.

Alternatively, you can define a panel name for the area currently being viewed by following these steps:

1. View the desired area, as described on page 6-127.

2. Follow steps 2 through 4 in the previous procedure.

3. Either click the **OK** button on the prompt bar, or press the Return key.

To view and center the current panel in a Symbol or Schematic Editor window, perform the following steps:

1. Activate the edit window of the panel you wish to view. Execute the **View > Panel > View Panel** menu item. The View Panel prompt bar is displayed.

2. Type the panel name in the **Panel Name** text box, then click the **OK** button.

To view panel borders in a Symbol or Schematic Editor window, perform the following steps:

1. Place the cursor in the Symbol or Schematic Editor window in which you wish to view a panel and its border, and click the Stroke mouse button.

2. Execute the **View > Panel > Show Panel Border > All Panels On Sheet** menu item to view all panel borders on the sheet. Execute the **View > Panel > Show Panel Border > By Panel Name** menu item to view a panel by name.

3. Type the panel name in the **Panel Name** text box, then click the **OK** button.

To hide panel borders, perform the following steps:

1. Execute the **View > Panel > Hide Panel Border > All Panels On Sheet** menu item to view all panel borders on the sheet. Execute the **View > Panel > Hide Panel Border > By Panel Name** menu item to view a panel by name.

2. Type the panel name in the **Panel Name** text box, and click the **OK** button.

To delete a panel definition in a Symbol or Schematic Editor window, perform the following steps:

1. Place the cursor in the Symbol or Schematic Editor window from which you wish to delete a panel, and click the Stroke mouse button.

2. Execute the **View > Delete Panel** menu item.

3. Type the panel name in the **Panel Name** text box, and click the **OK** button.

This deletes the definition of the panel; it does not delete objects in the panel.

Using the Dialog Navigator

You can navigate through your directory and select Design Architect objects with the dialog navigator. The dialog navigator is invoked from dialog boxes within Design Architect that request object names. The requested object names are entered in the requesting dialog box text fields when selected.

For example, when you execute the Open Symbol command, the Open Symbol dialog box appears with a button labeled **Navigator**. You can type the full component name in the "Component Name" text box, or invoke the dialog navigator, and navigate through your directory structure until you find the correct object. After you have found the correct object and clicked the "OK" button, the correct object name is automatically entered in the dialog text field.

When you first invoke the dialog navigator, it lists the contents of the working directory in alphabetic order, with an icon preceding each design object name. You select a name in the list by clicking the Select mouse button on the item. If you have set the navigation filter to exclude certain types of objects, those objects that meet the filter requirements for exclusion are not visible when you explore the contents of a directory.

The buttons to the right of the list are the navigation buttons. They let you explore and move through the directory structure. These buttons have the following meanings:

- **Explore Contents** (down arrow). After you have selected an item from the list, clicking the Select mouse button on the **Explore Contents** button navigates you down one level of hierarchy, and displays the contents of that directory, if hierarchy exists.

- **Explore Parent** (up arrow). Clicking the **Explore Parent** button navigates one level up the hierarchy to the parent directory, and displays the contents of that directory.

- **Explore References** (right arrow). Clicking the **Explore References** button replaces the current display with the references of the selected design object.

- **Explore Back to Parent** (left arrow). Clicking the **Explore Back to Parent** button navigates back to the design object that holds the references currently displayed. That is, you return to the design object from which you originally explored references. This button is only activated when you have selected an object and explored its references ("@" is the right-most character in the title bar).

- **Go To** (multi-directional arrows). Clicking the **Go To** button displays a dialog box in which you can enter a soft or hard pathname for the file system destination to which you want to navigate.

Editing in the Context of a Design Viewpoint

The following procedures describe specific capabilities of editing a schematic sheet in the context of a design viewpoint. If you are unfamiliar with the concepts related to design viewpoints and editing in the context of a design, read "Editing in the Context of a Design", beginning on page 4-1, before you begin.

Opening a Design Sheet

From Design Manager

To invoke the Design Manager and open a design sheet, perform the following steps:

1. Invoke the Design Manager by typing "dmgr" at a shell prompt.

2. The Design Manager displays a Tools window, which contains icons representing each of the applications you can invoke, and a Navigator window, which shows the contents of the working directory. With the Navigator window active, use the directional arrows to navigate to the component that contains the design viewpoint you want to open.

3. Select the viewpoint you want to open by clicking the Select mouse button on its icon.

4. Press the Menu mouse button to display the popup menu. Choose the **Open > Design Architect** popup menu item. This opens a new shell window for the Design Architect Session, then opens the design in the context of the selected viewpoint.

From Design Architect

To open a design sheet window from Design Architect, execute the **Session > Open Design Sheet** popup menu item or click the Select mouse button on the **Open Design Sheet** palette icon. This displays the Open Design Sheet dialog box and prompts you for the name of the component and viewpoint you wish to edit, and provides a default viewpoint name ("default"), instance name ("/"), and sheet name ("sheet1").

To help you select the component or viewpoint you wish to use, click the **Navigator** button. The dialog navigator appears on the screen, allowing you to traverse your directory structure to select a Design Architect component or viewpoint. Refer to page 6-137 for a description of how to use the dialog navigator.

You can replace the default instance name and sheet names by clicking the Options button. This opens the expanded Open Design Sheet dialog box. Type the new names in the respective text entry boxes.

Also, from the expanded Open Design Sheet dialog box, you can open the sheet as **Editable** or **Read Only**, and enter a startup filename that can execute internal state functions for setup purposes.

The **Auto Update Mode** specifies whether instances should be updated when the sheet is opened, and if so, how the properties are merged. Click the stepper button to choose between the following:

- **No Auto Update**: Out of date instances are not updated when the sheet is opened.
- **Auto**: Instance-only and Value_Modified properties are not changed; new properties on the current symbol are added to the instance.
- **Symbol**: Instance-only properties are not changed; all other properties are reset to the current symbol values.

- **Instance**: All existing properties are unchanged; new properties on the current symbol are added to the instance.
- **Clear**: Instance-only properties are deleted; all other properties are reset to the current symbol values.

You can control the visibility of existing properties by using a startup file when opening a sheet. Enter the file pathname in the Sheet Specific Startup Script text entry field in the Open Design Sheet dialog box. After the argument selections are complete, press the **OK** button.

For more information about how properties are updated, refer to "Updating Properties on an Instance of a Symbol" on page 3-13.

Viewing Back Annotations

To view back annotations, perform the following steps:

1. With the cursor in the design sheet window, click the Stroke mouse button.
2. Type "show annotations" in the window area, or execute the **Setup** > **Annotations/Evaluations** > **Toggle Annotations**. This menu item turns the display of annotations on and off.

Editing Back Annotations

To edit back annotations, perform the following steps:

1. Move the cursor to the design sheet window and click the Stroke mouse button. Turn on the display of back annotations.

2. Set the editing mode to Off by executing the **File > Set Edit Mode Off** menu item**.** If the **File > Set Edit Mode On** menu item is displayed, the editing mode is already set to Off.

   With the editing mode set to Off, only back annotation properties can be modified or deleted. Also, when annotations are displayed, properties added to the sheet are added to the back annotation object connected to the viewpoint.

Viewing Evaluated Properties

To view evaluated properties on your design sheet, perform the following steps:

1. With the cursor in the design sheet window, click the Stroke mouse button.

2. Type "set evaluations" in the window area. The Set Evaluations prompt bar is displayed. Click the up arrow until the "Mode" is set to "on". Alternatively, you can toggle the display of evaluations by choosing the **Setup > Annotations/Evaluations > Toggle Evaluations** menu item**.**

   With evaluations on, all properties are displayed evaluated.

Merging Back Annotations

To merge back annotation to the schematic sheet, perform the following steps:

1. Place the cursor in design sheet window and click the Stroke mouse button. Turn on the display of back annotations.

2. Execute the **Miscellaneous > Merge Annotations** menu item. This menu item merges all viewable back annotation properties to the schematic sheet.

   After this menu item is executed, and if you decide to save the sheet, the back annotation objects will no longer contain the property values which were successfully merged into the schematic sheet.

Caution If the schematic sheet is used in more than one place in your design, when you merge back annotations to that one sheet, all other components that use the sheet see the changes. Since all occurrences of the component see the changes, you should not merge to reusable sheets.

Locking Schematic Sheet for Edits

To lock a schematic sheet for edits, perform the following steps:

1. In the design sheet or schematic sheet window, click the Select mouse button on the parent instance for the schematic sheet you want to lock for editing.

2. Add the property name "Source_edit_allowed" with the property value "false" to the instance. Changing source_edit_allowed property value to "true" unlocks the schematic sheet below the parent instance for editing. The "Adding Properties" procedures begin on page 6-95.

Design Manager Operation Verification

The following topics list several methods for verifying the correctness of a design object manipulation.

When referencing a design object, if you provide a relative pathname that does not begin with the dollar sign ($) character, that relative pathname will be converted to an absolute pathname, based on the value of the environment variable MGC_WD. You must ensure that the value of MGC_WD is set to the correct value for your current working directory. If is not set properly, an incorrect pathname for the reference may be stored.

Reference Checking

Compare references before and after the Design Manager operation. The following discussion describes the process to ensure that references have been manipulated correctly:

1. Activate a navigator window in the Design Manager. Use the navigator buttons to move to the directory that contains the component container that you will manipulate through some Design Manager operation.

2. Click on the specified component container. Click the **Explore Contents** (down arrow) button to display the contents of the selected container. You will see the model icons associated with the component, in addition to the part icon.

3. Select all the icons at that level by depressing the Select mouse button, dragging it so all icons are within the specified selection area, then releasing the Select mouse button.

4. Choose **Report > Show References** from the pulldown menu bar. A report window for each selected object is displayed containing the current references of each object.

5. Click on the schematic model icon. Click the **Explore Contents** button to view the sheet icons associated with the schematic.

6. Select all the sheets. Choose **Report > Show References** from the pulldown menu bar. A report window for each selected sheet is displayed, containing the current references of each object.

7. When you have completed the Design Manager operation on the specified object, check the references of the manipulated object at all levels to verify that the manipulation was successful.

This method of verification is recommended when you have a design that is completely self-contained. If you have a design that references external objects, this method can become time-consuming. In that case, use the configuration build method, described in "Configuration Build" on page 6-146.

Object Checking

To determine if any objects were mistakenly included or excluded, check for the existence or non-existence of files by performing the following steps:

1. Activate a navigator window in the Design Manager.

2. Use the navigator buttons to move to the directory that contains the component container that you will manipulate through some Design Manager operation.

3. Click on the specified component container.

4. Click the **Explore Contents** button to move into the contents of the container. You will see the model icons associated with the component, in addition to the part icon.

5. Click on the schematic model icon.

6. Click the **Explore Contents** button to view the sheet icons associated with the schematic.

7. When you have completed the Design Manager operation on the specified object, check to make sure that all the object's icons, at all levels, are displayed in the navigator to verify that the manipulation was successful.

This method of verification is recommended when you have a relatively small design that is completely self-contained. If you have a design that references external objects, this method can quickly become time-consuming. In that case, use the configuration build method described in "Configuration Build."

Configuration Build

For some scenarios, such as copy and move, creating a configuration from the results and doing a build can check that all the references can be resolved. This method of verification is recommended when you have a relatively large design that is either self-contained and/or references external objects.

To do a configuration build, perform the following steps:

1. Activate a navigator in the Design Manager.

2. Use the navigator buttons to move to the directory that contains the top-level design container that you manipulated through some Design Manager operation.

3. Open a configuration window by choosing the **Session** > **Open Configuration** > **New** pulldown menu item.

4. Drag the design container into the configuration window.

5. Choose **Configuration** > **Build** from the configuration window popup menu. The build operation begins with the primary entry, traverses its contents and its references, and adds secondary entries to the configuration.

   When the build is complete, the configuration window displays the pathnames of all primary and secondary entries, and the pathnames to all the references associated with the entries.

Application Invocation

The simplest method of verifying that a design has been manipulated correctly is to invoke the appropriate application on the manipulated design. If you have manipulated a design that contains symbol and schematic models, invoke Design Architect on that design. If you have manipulated a design that contains design viewpoints, invoke QuickSim II on that design. If you have manipulated a design that contains symbol and schematic models and also contains design viewpoints, invoke both Design Architect and QuickSim II (or DVE) on the design.

CAUTION: The application invocation is not a bullet-proof check. A copy of the design could contain references to the original. If the original is still available, invocation on the copy will still appear to work fine. However, when the original is moved/deleted, the copy will not run. A visual reference check is good insurance.

Updating Parts on all Sheets in a Design

When you install an new parts library, you may want to update all instances of parts on all sheets in a design. Perform the following steps to update an entire design:

1. Choose the **File > Update All > Sheets** item from the main menu bar.

   The Update All Sheets dialog box appears.

2. Enter the pathname to the top-level sheet in the design in the **Component Name** field.

3. Click one of the ***Update Type*** buttons to specify how instances should be updated when the sheet is opened. The following list describes the update action for each button:

   - **Auto**: Instance-only and Value_Modified properties are not changed; new properties on the current symbol are added to the instance.

   - **Instance**: All existing properties are unchanged; new properties on the current symbol are added to the instance.

- **Symbol**: Instance-only properties are not changed; all other properties are reset to the current symbol values.
- **Clear**: Instance-only properties are deleted; all other properties are reset to the current symbol values.
- **Noupdate**: Out of date instances are not updated when the sheet is opened.

4. If desired, restrict the sheets that are updated. The following list describes the methods for restricting the update:

   - Enter a level at which to stop updating sheets the hierarchy in the ***Stop Level*** field. The default value of zero updates the entire hierarchy.
   - Enter a series of strings in the ***Filter*** fields. If the reference pathname to a sheet in the hierarchy contains one of the strings, the sheet it is not updated.
   - Choose the **Yes** button beneath **Preview**. This causes a second dialog box to appear after you execute the current dialog box. A list of all sheets that met the criteria specified in the ***Stop Level*** and ***Filter*** fields is displayed. You then select sheets from the list to be updated.

5. Click the **OK** button to update the sheets.

Appendix A
DA Design Checks

Design Architect design checks are separated into the following four major groups:

- **Schematic sheet checks**, beginning on page A-1
- **Optional schematic sheet checks**, beginning on page A-7
- **Symbol checks**, beginning on page A-12
- **Optional schematic design (all sheets) checks**, beginning on page A-14

Each major check group is broken down into smaller groups which map to individual switches used with the Check command. Refer to page 5-3 for information about how to execute these specific checks.

Schematic Sheet Checks

These checks are for individual schematic sheets. The required schematic sheet checks are listed below with the proper switch setting for each check category.

Required Instance Checks

The following checks are required for instances. Error messages are generated if the checks are not passed. The Check command with the "-INstance All" switch specified executes the individual error checks listed below:

- Does an Inst property value (instance name) have valid syntax?
- Is an Inst property value (instance name) unique within the sheet?

- Does an instance reference a version of a part which exists and is current?
- Do the instance pins match pins of a referenced symbol?
- Does a symbol model exist for the instance?
- Do instance property values have valid syntax?
- Does a Pin property value have valid pin name syntax?

The following checks generate warning messages if they are not passed:

- Can an instance name (Inst property value) be evaluated?
- Can a pin name (Pin property value) be evaluated?
- Can a property value on an instance or pin be evaluated?

Required Special Instance Checks

The following checks are required for special instances, such as ports, connectors, globals, and bus rippers. Error messages are generated if these checks are not passed. The Check command with the "-SPecial All" switch specified executes the individual error checks listed below:

- Does a port connector (Class "P" property value) have only one pin?
- Does an off-page connector (Class "O" property value) have at least one pin?
- Does a net connector (Class "C" property value) have at least two pins?
- Does a global (Class "G" property value) have one pin?
- Does a bus ripper (Class "R" property value) have one pin with pin property "Bundle"?
- Does a bus ripper (Class "R" property value) have at least two pins?
- Does a null instance (Class "N" property value) have no pins.

- Does a pin of a port connector (Class "P" property value) connect to a named net?
- Do all nets attached to the pins of a net connector (Class "C" property value) have the same width?
- Does a global (Class "G" property value) have a Global property value with valid net name syntax?
- Does a bus ripper (Class "R" property value) have a Rule property attached to an instance or an output pin?
- Does a Rule property value of a bus ripper (Class "R" property value) have a valid subscript syntax?
- Is the output pin of a bus ripper (Class "R" property value) attached to a named net whose width matches the width specified by the "Rule" property value?
- Is an input pin of a bus ripper (Class "R" property value) attached to a bus?
- Is a pin of an off-page connector (Class "O" property value) connected to a named net?
- Does the signal name of an implicit ripper exactly match the name of a corresponding signal in the net or net bundle?

The following checks generate warning messages if they are not passed:

- Does a net connector (Class "C" property value) connect two nets with the same name?
- Do pins of a net connector (Class "C" property value) connect to a named net?
- Does a Global property value (Class "G" property value) contain a subscript?
- Can a Global property value (Class "G" property value) be evaluated?

Required Net Checks

The following checks are required for nets. Error messages are generated if these checks are not passed. The Check command with the "-NEt All" switch specified executes the individual error checks listed below:

- Does a property value assigned to a segment of a net conflict with values on different segments of the same net?
- Does a Net property value have valid net name syntax?
- Does a range specified in the net name (Net property value) conflict with the range of a connected pin?
- Does a pin connected to an unnamed net have conflicting range specifications?
- Does a property value have valid expression syntax?

The following checks generate warning messages if they are not passed:

- Can the net name (Net property value) be evaluated?
- Can the pin name (Pin property value) be evaluated?
- Can all property values be evaluated?
- Are two globals shorted together?

Required Net Bundle Checks

The following checks are required for net bundles. Error messages are generated if these checks are not passed.

- Are the members of a net bundle listed in at least one occurrence of the net bundle in a schematic?
- Do all occurrences of a named net bundle in a schematic contain the same signal names in the same order?

- Does the combined width of the nets and bus bits in a net bundle match the width of a connecting pin bundle or wide pin?
- Does a net that is ripped by name from a net bundle actually exist in the net bundle?
- Does a net bundle name contain a parameterized expression?
- Does a net bundle have the same name as an individual net or bus?

Required Frame Checks

The following checks are required for frames. Error messages are generated if these checks are not passed. The Check command with the "-FRame All" switch specified executes the individual error checks listed below:

- Does an instance or its pins overlap a frame border?
- Does a frame border overlap the border of another frame?
- Does a frame have a frame expression?
- Does a frame expression have valid syntax?

The following checks generate warning messages if they are not passed:

- Can the frame expression (Frexp property value) be evaluated?
- Does a frame contain an instance?
- Can all property values on a frame be evaluated?

Required Symbol Pin Check

The following symbol pin check is performed on schematic sheets. Error messages are generated if it is not passed. The Check command with the "-PIns All" specified executes the individual error check listed below:

- Are there symbol pins left on a schematic sheet?

Required Pin Bundle Checks

The following checks are required for pin bundles. Error messages are generated if these checks are not passed.

- Do all pins occur only once within a pin bundle?
- Is there an individual pin by itself on the symbol that is also contained in a pin bundle?
- Is a pin contained in more than one pin bundle?

Optional Schematic Sheet Checks

The optional schematic sheet checks extend beyond the required schematic checks. They are not required by Mentor Graphics applications, but if they are activated in the Check command and are capable of producing errors, they must be passed like the required checks.

Property Ownership Checks

The following checks are performed on properties; error messages are generated if they are not passed. The Check command with the "-OWner All" switch specified executes the individual error checks listed below:

- Is the Pin property attached to a pin?
- Is the Inst property attached to an instance?
- Is the Net property attached to a net?
- Is the Global property attached to an instance, not of type Class "G" or Class "N"?
- Is the Rule property attached to an instance not of type Class "R" or Class "N", or attached to a pin of a ripper instance?
- Is the Frexp property attached to a frame?

Init Property Checks

The following Init property checks are performed; error messages are generated if they are not passed. The Check command with the "-INItprops All" switch specified executes the following individual error checks:

- A net has two different global components attached to it; for example, both Vcc and Ground attached to the same net.
- A net has a forcing Init property value "xxF", but has no global attached to it. This can result from adding a global such as Vcc to a net, then deleting the global.
- A net has an Init property value that does not match the Init property value on the pin of the attached global instance.

  This can result from adding a global Vcc to a net (causing the Init property on the net to have a value of 1SF), then adding a global Ground to the same net (causing the Init property value to change to 0SF), then deleting the Ground global. The result would be a net with Init = 0SF, but with a Global Vcc which specified Init = 1SF.

Parameter Analysis

The following informational check is performed on parameters, and causes a parameter listing to be generated. The Check command with the "-PArameter All" switch specified executes the individual informational check listed below:

- Identify parameters which are required to evaluate property values and object names in the sheet.

Expression Analysis

The following informational check is performed on expressions, and causes an expression listing to be generated. The Check command with the "-EXpression All" switch specified executes the individual information check listed below:

- Identify expressions in the sheet that require evaluation and the parameters they require.

Instance Overlap Check

The following informational check is performed on instances, and causes an instance listing and an error to be generated if not passed. The Check command with the "-OVerlap All" switch specified executes the individual informational check listed below:

- Identify the position of two instances where the bounding box of one instance overlaps the bounding box of the other.

- Class instances are positioned such that their bounding boxes may overlap those of other class or non-class instances. Each instance type is grouped separately within the warning message.

Not-dots Check

The following informational check is performed on not-dots, and causes a not-dot listing to be generated. The Check command with the "-NOtdots All" switch specified executes the individual informational error check listed below:

- Identify all points where not-dots exist on the schematic sheet.

Close Dot Check

The following informational check is performed on close dots, and causes a close dot listing to be generated. The Check command with the "-CLosedot All" switch specified executes the individual informational check listed below:

- Identify all points where different vertices are visually difficult to distinguish (where the close dot symbol is displayed on the sheet).

Dangling Net and Pin Checks

The following informational checks are performed on dangling nets and pins, and cause a net and pin listing to be generated. The Check command with the "-Dangle All" switch specified executes the individual informational checks listed below:

- Identify all dangling nets. A dangling net is a net vertex with no attached pin, and which is not marked as a legal dangling net by the user (net with Class "dangle" property value).
- Identify all dangling vertices.
- Identify all dangling pins. A dangling pin is a pin which is not attached to a net and has not been marked as a legal dangling pin by the user (pin with Class "dangle" property value).

Valid dangles can be marked as such by adding a Class property with value of "dangle" to any vertex on the net or pin.

Annotations

The following informational checks are performed on back annotations when Design Architect is invoked on a design in the context of a design viewpoint. The Check command with the "-Annotations All" switch specified executes the individual informational checks listed below:

- Identify all annotations to fixed or protected properties.
- Identify all annotations that are unattached. When an unattached annotation is found, the design pathname to the object which no longer exist in the design is reported along with a list of annotated properties on the object.

  These unattached annotations can be reattached to another design object using the pulldown menu item **Miscellaneous >Reconnect Annotations**.

Note

The annotation checks are only performed when DA is invoked on a design viewpoint. Otherwise, this option is ignored.

Symbol Checks

For a symbol to pass the required checks, a set of required checks is executed on symbol bodies, special symbols, and pins. The required symbol checks must be passed in order for the symbol to be instantiated.

Required Symbol Pin Checks

The following checks are required for symbol pins; error messages are generated if they are not passed. The Check command with the "-SYMbolPin All" switch specified executes the individual error checks listed below:

- Does each symbol pin have a Pin property?
- Do pin properties on a symbol have valid pin name syntax?
- Does a symbol have at least one pin (unless the symbol has a Class "N" property value)?
- Does a property value on a pin have an invalid expression syntax?

Required Symbol Body Checks

The following checks are required for symbol bodies; error messages are generated if they are not passed. The Check command with the "-SYMbolBody All" switch specified executes the individual error checks listed below:

- Does a symbol body have a graphical representation?
- Is the same property value assigned different values on different pieces of the symbol body?
- Do property values on the symbol body have valid expression syntax?

Required Special Symbol Checks

The following special checks are required for special symbols. Error messages are generated if these checks are not passed. The Check command with the "-SYMbolSpecial All" switch specified executes the individual error checks listed below:

- Does a port connector (symbol with Class "P" property value) have only one pin?
- Does an off-page connector (symbol with Class "O" property value) have at least one pin?
- Does a net connector (symbol with Class "C" property value) have at least two pins?
- Does a global (symbol with Class "G" property value) have one and only one pin?
- Does a bus ripper (symbol with Class "R" property value) have one pin with Pin property value "Bundle"?
- Does a bus ripper (symbol with Class "R" property value) have at least two pins?
- Does a null instance (symbol with Class "N" property value) have no pins?

Optional Schematic Design Checks

The optional schematic design checks extend the checking function of the required schematic sheet checks. They are not required by Mentor Graphics applications, but if they are activated in the Check command and are capable of producing errors, the sheet will not be marked as having passed Check successfully if any errors are reported. The -SCHematic switch must be selected if the optional schematic checks are to be activated.

Each optional schematic check is listed below with its proper switch setting.

Pin and Port Interface Checks

The following checks are performed on pin and port interfaces. Error messages are generated if they are not passed. The Check command with the "-SCHematicINTerface All" and -SCHematic switches specified executes the individual error checks listed below:

- Does a pin on the symbol match a net on the schematic?
- Does a port on the schematic have a matching pin on the symbol?
- Does a pin on a symbol have a matching port on the schematic?

Instance Check

The following check is performed on instances and causes an error message to be generated if it is not passed. The Check command with the "-SCHematicInstance All" and "-SCHematic" switches specified, executes the individual error check listed below:

- Is the instance name (Inst property value) unique within the schematic?

Special Instance Checks

The following special checks are performed on instances. Warning messages are generated if they are not passed. The Check command with the "-SCHematicSpecial All" and "-SCHematic" switches specified executes the individual checks listed below:

- Does an on/off-page connector have a matching on/off-page connector on the schematic?
- Are two nets with the same name on different sheets of the schematic connected through on/off-page connectors?

Net Checks

The following checks are performed on nets; warning messages are generated if they are not passed. The Check command with the "-SCHematicNet All" and -SCHematic switches specified executes the individual checks listed below:

- Does a net and a global have the same name in a schematic?
- Are global nets shorted?

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