Getting Started with HP VEE

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About this Manual

This manual is a *quick start* introduction to graphical programming with HP VEE. No previous knowledge of HP VEE, or of graphical programming, is necessary. However, you should be familiar with your computer and its operating system.

NOTE

Using this manual assumes you have installed HP VEE. If you have not done this, follow the instructions in the documentation that came with your installation media.

This manual has two chapters and an abbreviated glossary.

Chapter 1, Quick Start	Takes you through hands-on exercises that show you how to work with HP VEE and create HP VEE programs. To learn how to use HP VEE, follow along, doing the exercises on your computer. Stop for a break at any time.
Chapter 2, Some HP VEE Programming Techniques	Illustrates selected HP VEE programming techniques such as mathematically processing data and performing instrument I/O.
Glossary	Describes major terms used in this manual. It does not contain all terms related to HP VEE.

Conventions Used in this Manual

This manual uses the following typographical conventions:

Example	Represents
HP VEE Advanced Programming Techniques	Italicized words are used for book titles and for emphasis.
`File`	Computer font represents text you will see on the screen, including menu names, features, buttons, toolbar button names, or text you have to enter.
`dir` *filename*	In this context, the word in computer font represents text you type exactly as shown, and the italicized word represents an argument that you must replace with an actual value.
`File` ⟹ `Open`	The "⟹" is used in a shorthand notation to show the location of HP VEE features in the menus. For example, "`File` ⟹ `Open`" means to select the `File` menu and then select `Open`.
`Flat` | `Sunken` | `Raised`	Choices in computer font, separated with a bar (|), indicate that you should choose one of the options.
Return	The keycap font graphically represents a key on the keyboard.
Press Ctrl+O	Represents a combination of keys on the keyboard that you should press at the same time.
Dialog Box	Bold font indicates the first instance of a word defined in the glossary.

Contents

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Quick Start

Quick Start

HP VEE is Hewlett-Packard's *Visual Engineering Environment*, a graphical programming language for creating test systems and solving engineering problems.

HP VEE has two parts; namely, a development environment that lets you use all HP VEE features and a run-time environment that lets you run HP VEE programs that were created via the development environment. Both environments ship on the media you received for installing HP VEE.

During installation, an initial screen might have given you a choice; namely, to install the run-time environment or install the development environment. To work through this manual, you must have installed the development environment. If you did not do this, repeat the installation to install the development environment. Do *not* also install the runtime environment (it is automatically included with the development environment).

How to install the run-time environment (which you need not do until you run HP VEE programs on PCs that do not have HP VEE) is discussed in the HP VEE online help. To get the information, select `Help` and then select `Contents`. Then, double-click on `Installing the Run-Time Environment`. If desired, you can print the information.

This chapter takes you through some simple exercises to help you become familiar with using the HP VEE graphical programming language. Also, you'll learn some key HP VEE concepts and create some simple HP VEE programs.

Interacting with HP VEE

This section explains how to use the HP VEE graphical programming language; for example, it explains how to manipulate objects, create programs, save files, and print screens. A good procedure is to work through the book, doing the exercises on your computer.

The Mouse and the Menus

You're probably familiar with your computer's mouse- and menu-driven interface; the pull-down menus, toolbars, and dialog boxes that you control with the mouse and keyboard. HP VEE uses your computer's interface. If you need help in this regard, the documentation that came with your computer and its operating system includes information about topics such as:

- Choosing commands on the menu bar.
- Selecting and dismissing menu items.
- Using toolbars.
- Understanding title bars and status bars.
- Clicking on icons and buttons.
- Working with dialog boxes.
- Working with various types of windows.
- Using online help.

To get help on these topics, refer to the documents and online help for your system.

Supported Systems

HP VEE is supported on the following systems:

- Windows 95 on a PC.
- Windows NT (Versions 3.51 and 4.0) on a PC.
- HP-UX Workstation (Versions 9.x, 10.01, and 10.02 on Series 700). HP VEE does not run on Version 10.0.

Mouse Techniques

At times, you get instructions about using the mouse to operate menus, icons, buttons, and objects. Here are the common techniques:

- When we say to "click on" an item, you should place the mouse pointer on the desired item and quickly press and release the *left* mouse button.
- When we say to "double-click", you should place the mouse pointer on the desired item and click the left mouse button twice, in rapid succession.
- When we say to "drag", place the mouse pointer on a desired item, *hold the left mouse button down*, and move the item to the appropriate location. Then, release the button.

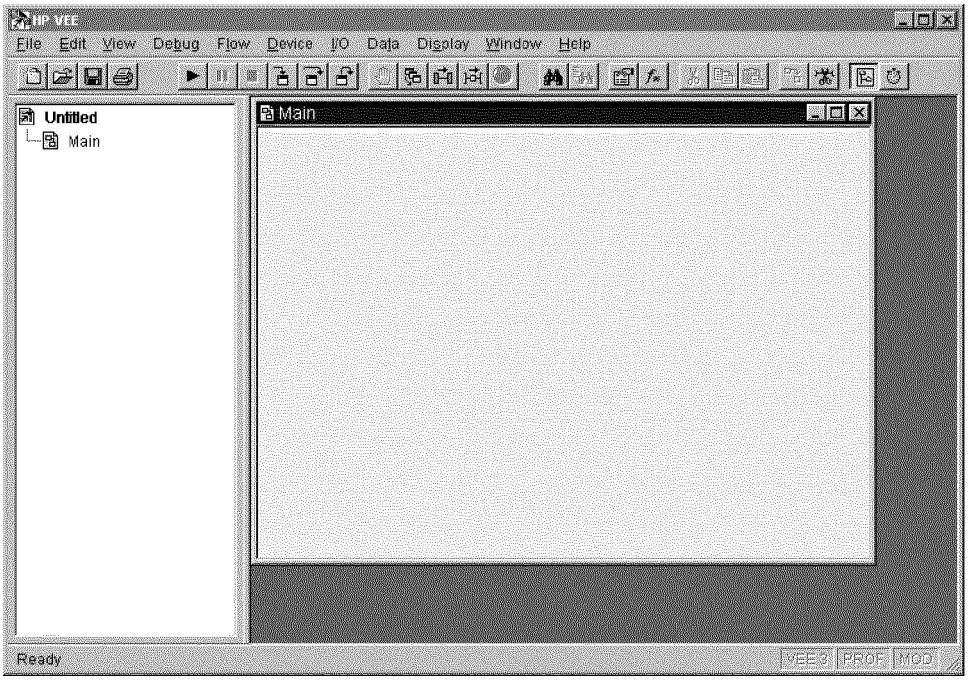
The right mouse button is used less frequently, and only for special purposes. If you are to click the right mouse button, we'll say so. If your mouse has a middle button, you will not use it for HP VEE.

Starting HP VEE

Windows 95 or Windows NT 4.0	Click the `Start` button, then point to `Programs` ⟹ `HP VEE`, and click on `HP VEE`.
Windows NT 3.51	In the `HP VEE` group window, double-click on `HP VEE`.
HP-UX	From a shell prompt in an HP VUE or X11 window, type: `veetest` (Return). (The `PATH` variable must include `/usr/bin`.)

The HP VEE Window

The following figure shows the HP VEE window. Your window might vary slightly.



For the above figure, the following items describe the parts of the HP VEE window.

Title bar	The top line in the window contains the HP VEE icon, the window name, and the minimize, maximize, and close buttons. Move the window by dragging the title bar. Click on the HP VEE icon to get a menu of items for manipulating HP VEE.
Menu bar	The second line contains menu items, each of which provides HP VEE commands or objects.
Toolbar	The third line contains icons that provide direct access to commonly used menu commands.
Work space	A region in the HP VEE window that contains edit windows such as `Main`, `UserObject`, or `UserFunction`.
Work area	A region in a programming (edit) window such as `Main`, `UserOjbect`, or `UserFunction` in which you place objects and wire them together.
Program Explorer	A region on the left side of the HP VEE window that shows the structure of your HP VEE program. The upper corner shows the name of the current program (file), for example, `myprog.vee`; or it displays `Untitled`. The Program Explorer lets you move among your programming windows. To resize the Program Explorer, move the normal pointer on the right boundry until it changes to a vertical splitter. Move the splitter to resize the Program Explorer.
Main window	A window in the work space that contains a work area in which you develop and edit HP VEE programs. There can be other programming/editing windows; for example, `UserObject`.
Status bar	The bottom line displays messages about the state of HP VEE. There are three status indicators on the right side. • The left one displays the execution mode compatibility. • The middle one shows the state of the profiler. • The right one displays `Mod` when the current program has been modified.

Quitting HP VEE

The following items offer suggestions for quitting HP VEE and continuing to work through this document.

- Provided a program is not running, you can quit HP VEE at any time via the usual windows operations (for example, clicking on the **X** button at the right end of the title bar).
- Before you quit, you may want to save the contents of the windows in your work space. (The "Save Your Program" section, later in this chapter, explains how.)
- While doing the exercises in this chapter, you can save your file and quit whenever you want to take a break.
- You can restart HP VEE later, open your file, and continue where you left off. (The "Open a File" section, later in this chapter, explains how.)

Working with Objects

An HP VEE program consists of connected objects:

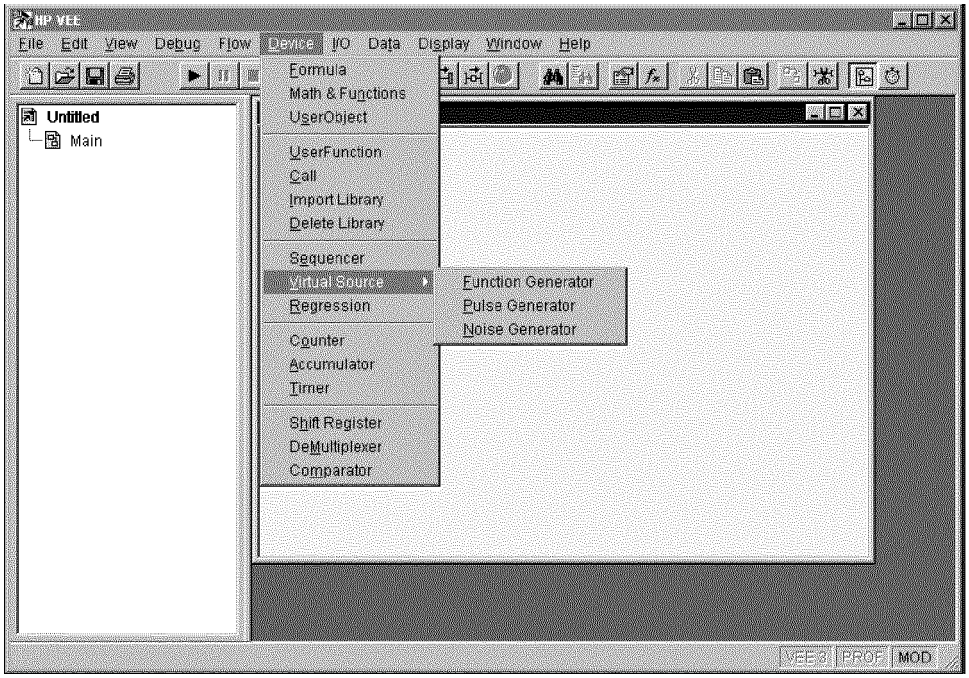
- You select *objects* from HP VEE's menus; for example, *Flow*, *Data*, and *Display*.
- You connect the objects via lines that attach to the object's pins (more on pins later).
- A group of objects and how they are connected makes up a program.

Let's begin by learning how to use objects to create a program.

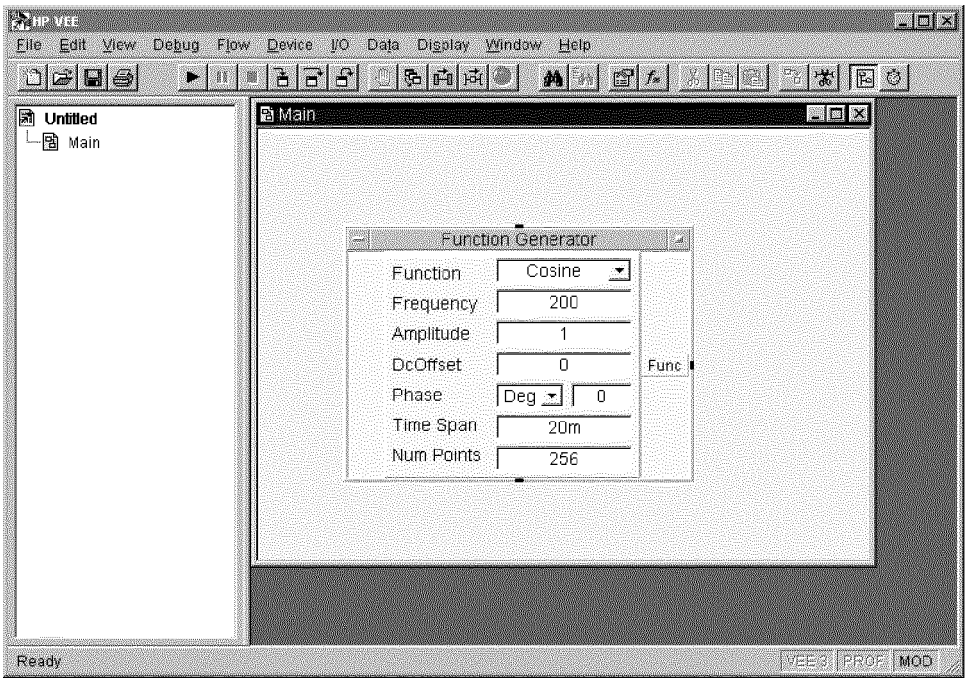
To Add Objects to the Work Area

Pull down an appropriate menu, click on the desired object, drag the object to an appropriate location in the work area, and click (the outline will disappear and the object will appear).

For example, to select the `Function Generator` object, click on `Device` in the menu bar. Then, click on `Virtual Source` in the `Device` menu. An additional menu of virtual source objects appears, as shown in the following figure.



To add the `Function Generator` to the work area click on it. An outline of the object appears in the work area. Move the outline to where you want the `Function Generator` and click the mouse button. The next figure shows this.



Having placed an object in the work area, you can move it by dragging its title bar, just as you move a window.

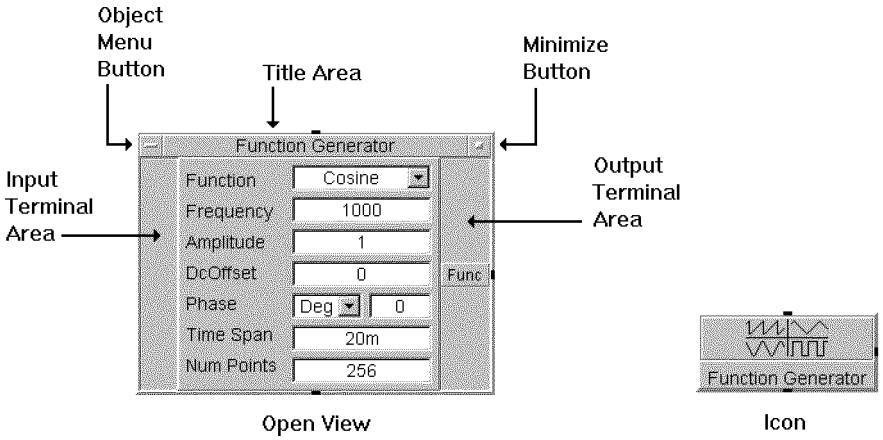
NOTE

Hereafter, a shorthand notation is used to explain how to select an object. For example, selecting the `Function Generator` object is expressed as:

`Device` ⟹ `Virtual Source` ⟹ `Function Generator`

To Change Object Views

Every HP VEE object has at least two **views** — an *open view* and an *icon view*. The two views of the `Function Generator` object are shown below:



By default, the `Function Generator` object appears in its open view. You will see, later, that some objects appear initially in their icon views.

You can always change the view. Click once on the object's open view minimize button to get the icon view, and double click on the object's icon view to get the open view. Using the icon view helps you save space in the work area.

In the open view, all parts of the `Function Generator` object are visible, and you can edit them.

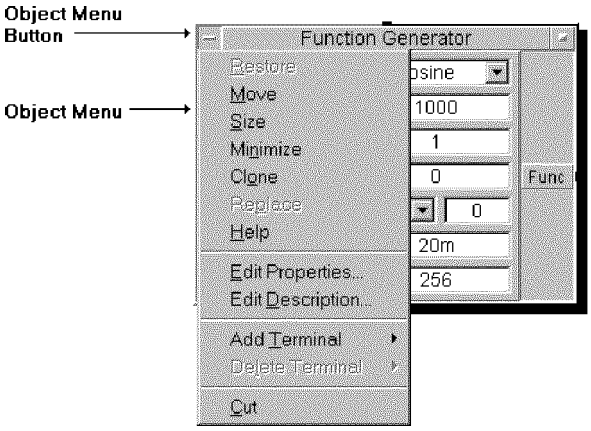
- The object menu button, title area, and minimize button appear at the top of the object.
- The input terminal and output terminal areas appear on the left and right sides.
- The parameters associated with the `Function Generator` object appear in the middle.

As you will see, not all objects have the same structure or parts, but you can edit objects in their open views and save space in their icon views.

To Select an Object Menu

Each HP VEE object has an **object menu** that lets you perform actions on the object; for example, `Clone`, `Size`, `Cut`, `Move`, and `Minimize`. Most objects have similar attributes, but there are differences, depending on the functionality of the object. You can get online help for the specific object from the object menu.

To select the popup object menu, click *once* on the object menu button. The object menu appears, as shown below. (Don't double-click on the object menu button — that's a shortcut for deleting the object.)



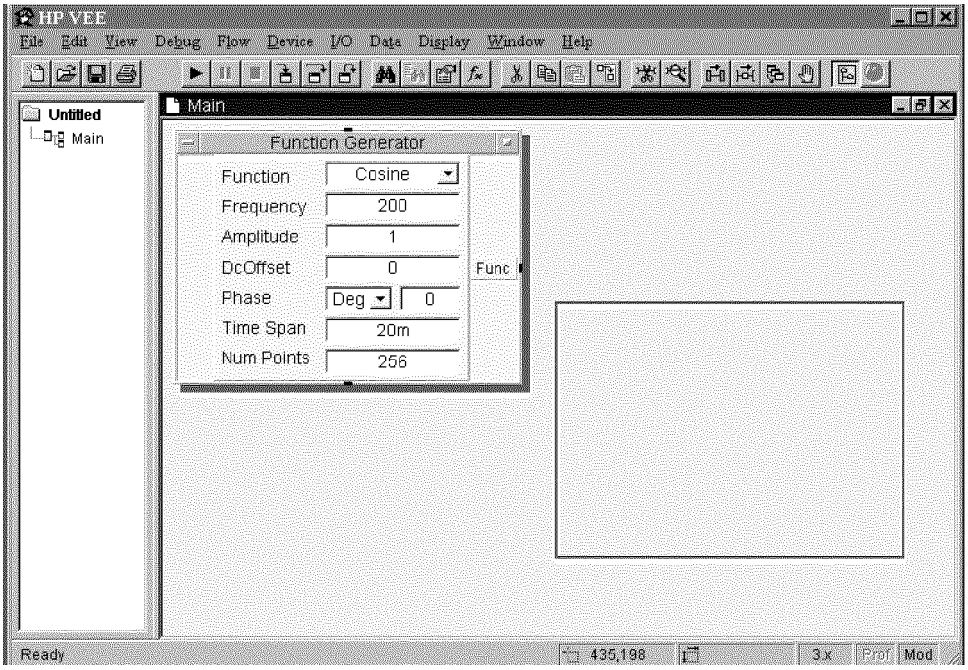
Now you can click on one of the object menu choices to perform the action you desire. Or, to dismiss the object, click on an empty area *outside* the menu.

Shortcut

You can also select the object menu by placing the mouse pointer anywhere on the object body and clicking the *right* mouse button. This works for the open and icon views.

To Move an Object

To move the `Function Generator` object, click on `Move` in the object menu, then click and hold the left mouse button. An outline of the object appears. Move the outline to the new location while continuing to hold the mouse button down, as shown in the following figure.



Release the mouse button — the object jumps to the new location.

Shortcut

You can also move an object as follows:

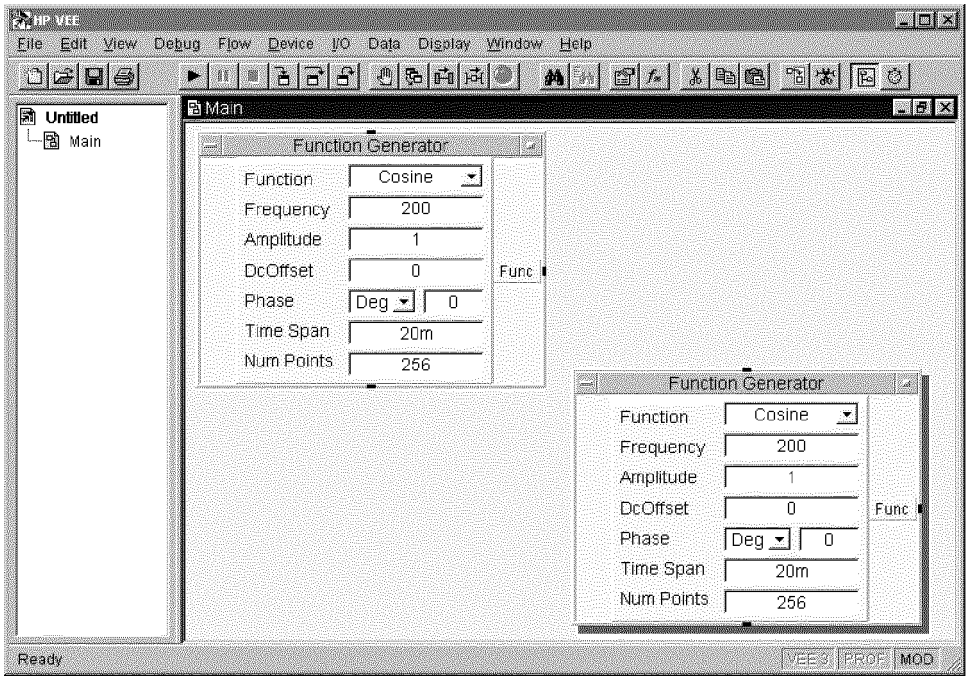
- Click on the title area of the open view of an object and drag the object to a new location.
- *Except* for buttons, entry fields, pins, terminals, or the bottom right corner (which resizes the object), click on any part of an open view object and drag the object to a new location.
- Click on any part of an icon view object *except* the bottom right corner (which resizes it) and drag the icon to a new location.

Object Location Information

The status bar, at the bottom of the work space, gives the X and Y position, in pixels, of the upper-left corner of the outline relative to the upper-left corner of the work space. Use this information when you need to place an object in an exact position.

To Clone (Duplicate) an Object

To clone the `Function Generator` object, get into the object menu and click on `Clone`. An outline of the object appears. Move the outline to the desired location.



Now click the mouse button and the cloned object appears, while the original object remains.

To Delete an Object

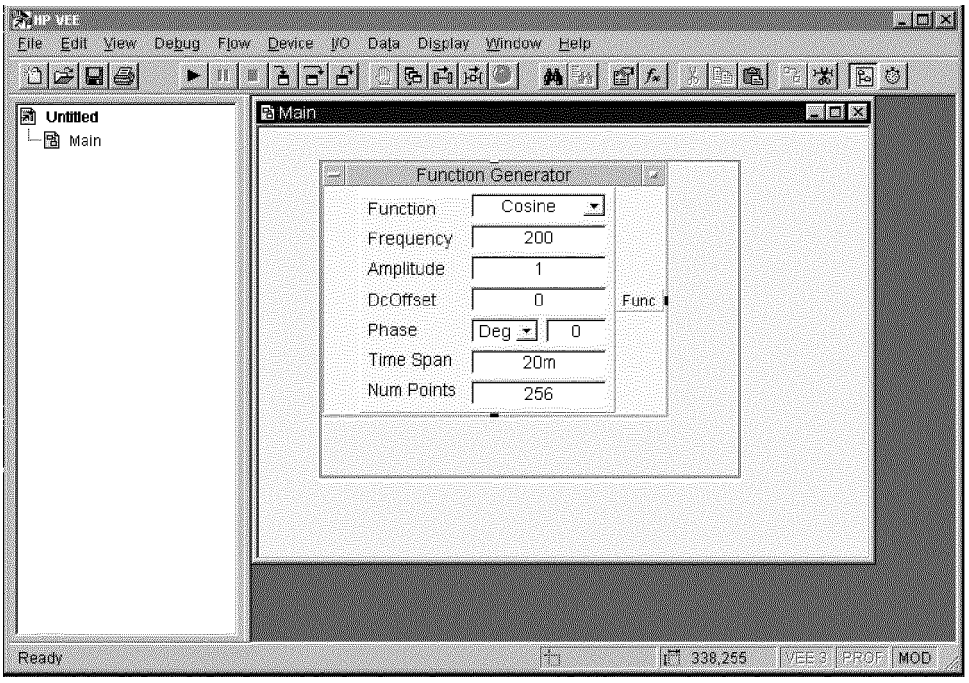
To delete an object from the work area, get into the object menu for the object you want to delete and click on `Cut`. For example, get into the object menu for the `Function Generator` on the right and click on `Cut`. The object disappears from the work area, but it is saved in the **cut buffer.**

To paste a deleted (cut) object back into the work area, click the `Paste` button on the toolbar, or use `Edit` ⟹ `Paste`. The object's outline appears. Move the outline to the desired location and click the mouse button.

> **Shortcut**
>
> You can also delete an object by *double-clicking* on its object menu button. Be careful, this is easy to do by accident. If you do delete an object by accident, use `Edit` ⟹ `Paste` to recover the object and all connections to it.

To Change the Size of an Object

To change the size of an object, get into the object menu and click on `Size`. The mouse pointer becomes a "bottom-right-corner" bracket. Move this bracket to define the size that you want, as shown below:



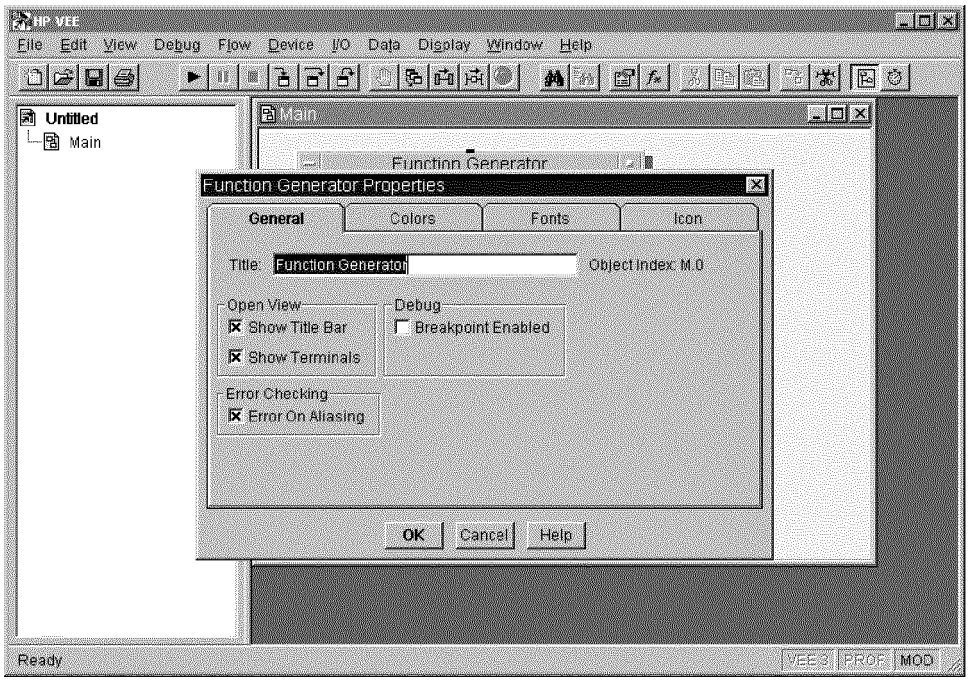
Then, click the mouse button again, and the object is resized.

Try resizing the object a few times on your own. You can enlarge the object or reduce it as much as you want.

> **Shortcut**
>
> You can also resize an object (either the open view or icon) by dragging on its bottom right corner.

To Change the Title of an Object

To change the title, get into the object menu and click on `Properties`. A dialog box appears in which you can edit the object's title.



Just start typing to enter the new title. The old title is replaced automatically. When you click on `OK`, the new title appears in the title area. If you minimize the object, the new title appears in the icon.

You can save time by using standard keyboard and mouse editing techniques. For example, if you click at the extreme left edge of the edit area, the cursor will appear there. You can then add new text without deleting the existing title.

Shortcut

You can change the title of an object by double-clicking on the title in the current object's open view. The `Properties` dialog box appears. Type in the new title and press Enter.

For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

To Clear the Work Area

You have some options for clearing the work area.

- Use `Edit` ⟹ `Select All` and then click on the `Cut` button on the toolbar. This deletes (or cuts to the cut buffer) all objects in the active window and you can begin programming anew in that window. Later, if you want a new work area, HP VEE will ask if you want to save changes.
- Click the `New` button on the toolbar, or use `File` ⟹ `New`. HP VEE asks if you want to save changes.
- You can clear individual objects by clicking on an object to make it current and then clicking on the `Cut` button on the toolbar. This lets you clear any of several objects.

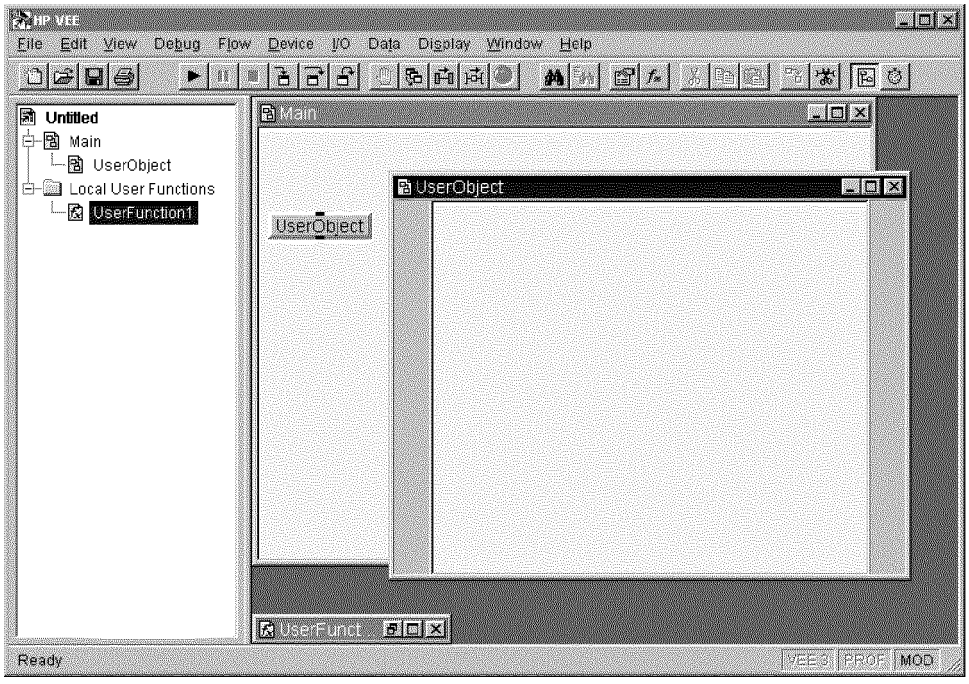
You might want to practice clearing the work area, using the above methods. When HP VEE asks about saving changes, click on `No` (unless you want to save them, of course).

To Manage the Work Space

So far, most discussion focused on the work area in the Main window. In a larger context, HP VEE contains a work space that contains your windows. You can manage these windows.

Each window has an icon (which provides menu commands), a title, and three buttons; minimize, maximize, and close. Maximizing a window makes it occupy the entire HP VEE work space. Minimizing a window makes its icon appear along the bottom of the HP VEE work space. Closing a window removes it from the work space, but you can retrieve it by clicking on its entity in the Program Explorer. (By the way, the Program Explorer appears in the HP VEE window when it is checked in the `View` menu. If you remove the check, the Program Explorer will not appear the next time you start HP VEE. The default is for it to appear.)

The following figure illustrates a situation for having windows in the work space.

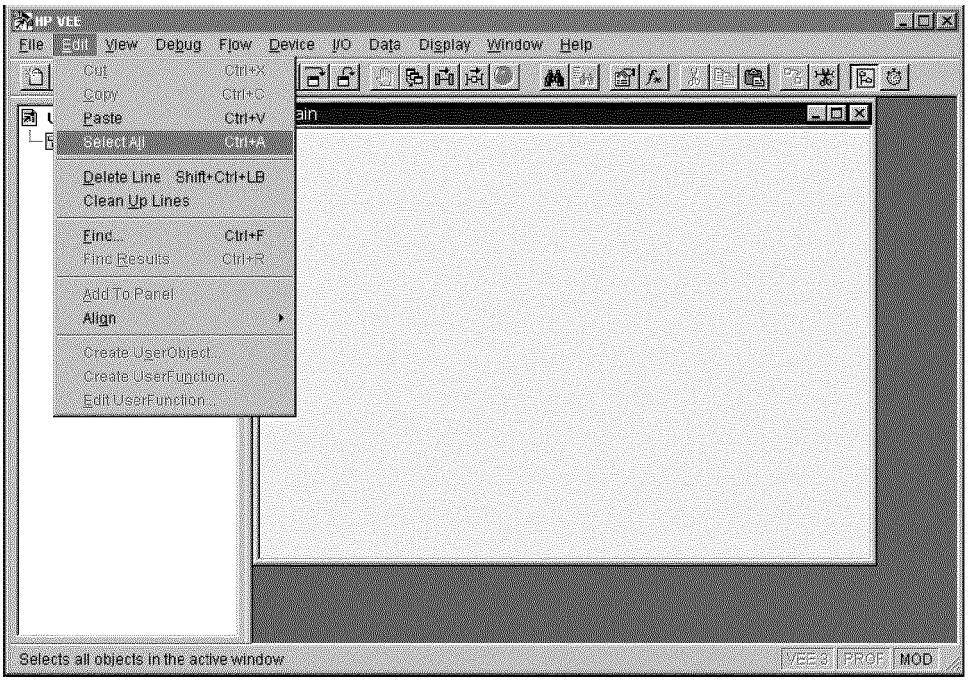


To Select the Edit Menu

There are several contexts for edit menus.

- HP VEE provides a generic edit menu in the menu bar. Those commands are the same for all of HP VEE.
- The HP VEE toolbar contains often-used editing commands; for example, `Cut`, `Copy`, and `Paste`.
- Each object has a menu for editing (the object's object menu). This menu can vary among objects.

You can select the common `Edit` menu in either of two ways. If you select `Edit` from the menu bar, the `Edit` menu appears, as shown next.

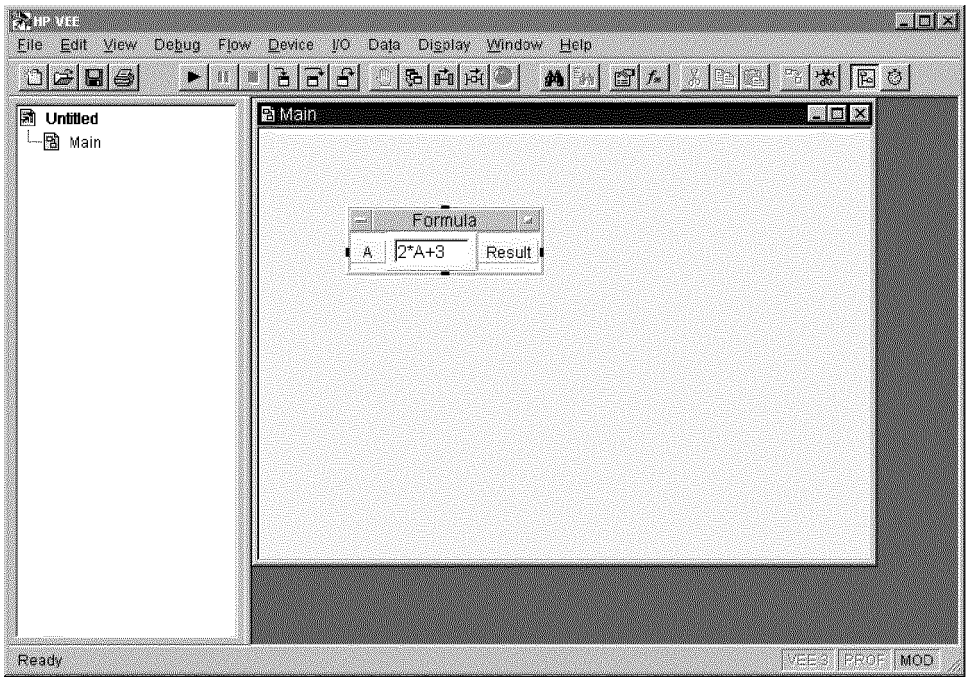


Or, you can select the common `Edit` menu by clicking the *right* mouse button in any *blank* area of the work space. In either case, click the left mouse button anywhere outside the menu to dismiss it.

> **NOTE**
>
> `Edit` menu selections such as `Cut`, `Copy`, `Clone`, remain inactive ("grayed out") until at least one object has been selected. You'll see how this works in the next section. (The selection `Edit UserFunction ...` is also inactive unless UserFunctions are present.)

To Cut and Paste Objects

The `Edit` menu lets you cut and paste objects. For example, add a `Formula` object to the work area by selecting `Device` ⟹ `Formula`. Place the object in a convenient place as shown next.



The shadow around the object indicates that the `Formula` object is *selected*. You can remove a selected object by selecting `Edit` ⟹ `Cut`, or by clicking on the `Cut` button on the toolbar. (The `Cut` command becomes active when you select the object. It is inactive until at least one object is selected.)

Now paste the object back into the Main window. Use `Edit` ⟹ `Paste` or click the `Paste` button on the toolbar. Move the outline to the desired location and click the mouse to paste the `Formula` object. When an object is in the cut buffer, you can paste it as many times as you want.

NOTE

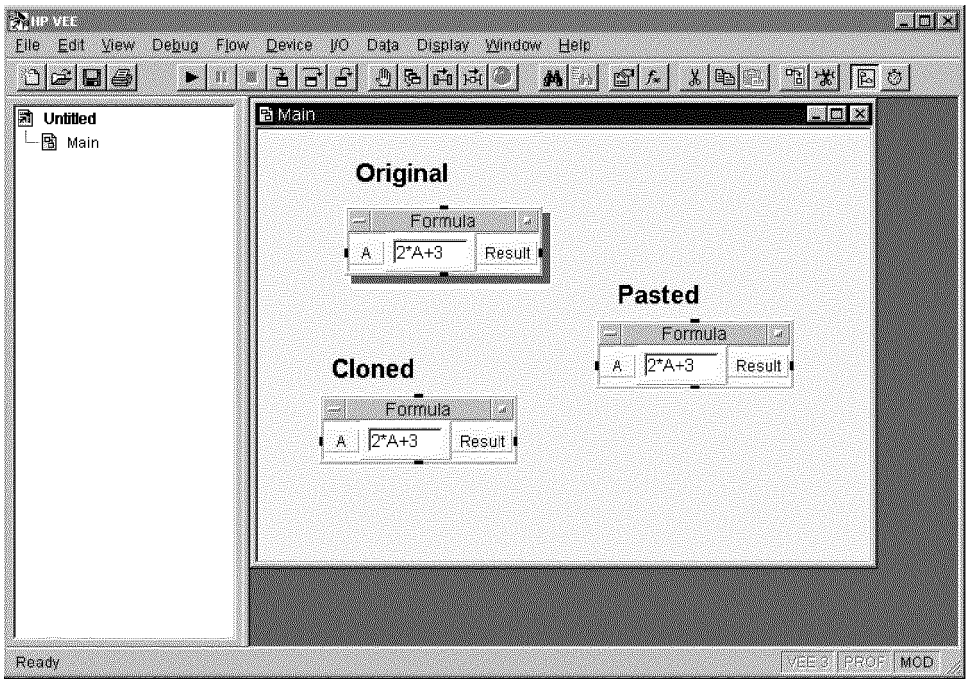
Whenever you cut an object (either from the `Edit` menu, the object menu, or the toolbar), the object is removed from the work space, but it is saved in the cut buffer. However, only the most recently cut object is saved in this buffer.

To Copy or Clone Objects

The **Copy** command copies the selected object into the cut buffer. Then, you can **Paste** the object in desired locations. The **Clone** command clones the selected object directly, and you can then drag the object to a desired location.

To try this for **Copy**, click on the **Formula** object to select it. Then, use **Edit** ⟹ **Copy** (or click on the **Copy** button). Now, click on the **Paste** button on the toolbar (or use **Edit** ⟹ **Paste**). Move the object outline to the desired location and click. You can repeat the **Paste** operation as desired. The copy-paste operations deselect the copied and pasted objects (no shadowed objects).

To try this for **Clone**, click on the **Formula** object to select it. Then, click on the object with the right mouse button to obtain the object menu. Select **Clone**, move the object outline to the desired location, and click. The clone operation leaves the original object selected (shadowed). This is shown below.

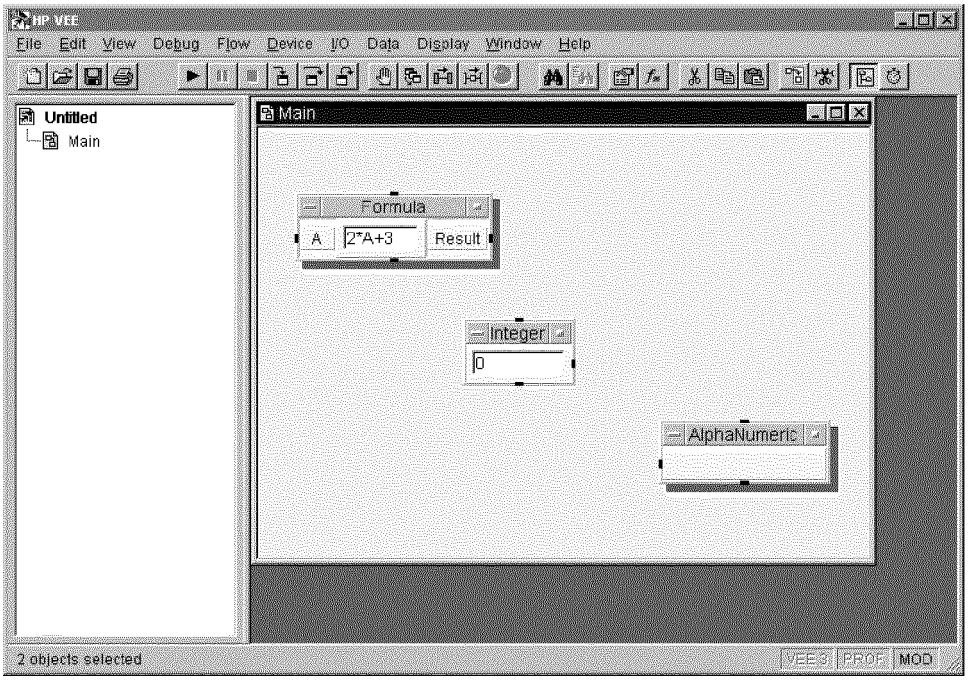


To Select Multiple Objects

The easiest way to select an object is to click on it, but this selects only one object. When you select a another object, the previous one is deselected (its shadow disappears).

To select all objects, use `Edit` ⟹ `Select All`. All objects become shadowed. Clicking the left mouse button in an empty part of the work area deselects all selected objects.

You can select certain objects by pressing and holding Ctrl, and then clicking on each object you want to select. (Ctrl+*left mouse button*.) The selected objects become shadowed. The following figure shows selected and deselected objects.

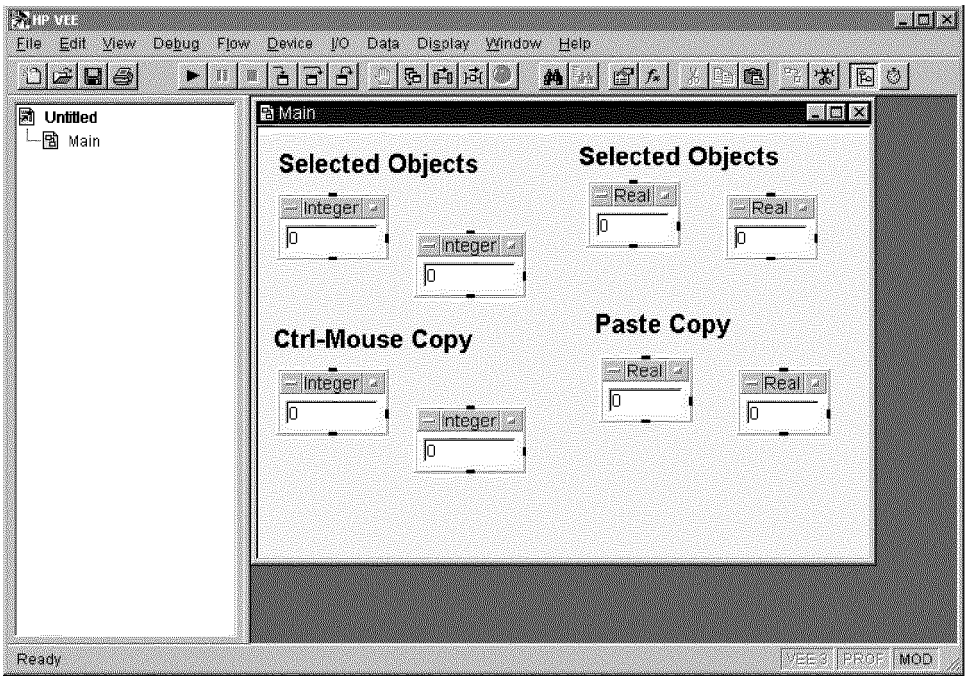


To Copy Multiple Objects

There are two methods for copying several, selected objects.

- Copy the selected objects by placing the cursor on an object. Press and hold Ctrl while using the left mouse button to drag the multiple objects (outlines) to a desired location.
- Or, use `Edit` ⟹ `Copy` to copy the selected objects to the cut buffer. Click on `Paste` (in the `Edit` menu or on the toolbar), move the objects (outlines) to a desired location, and click the left mouse button.

The following figure shows this.



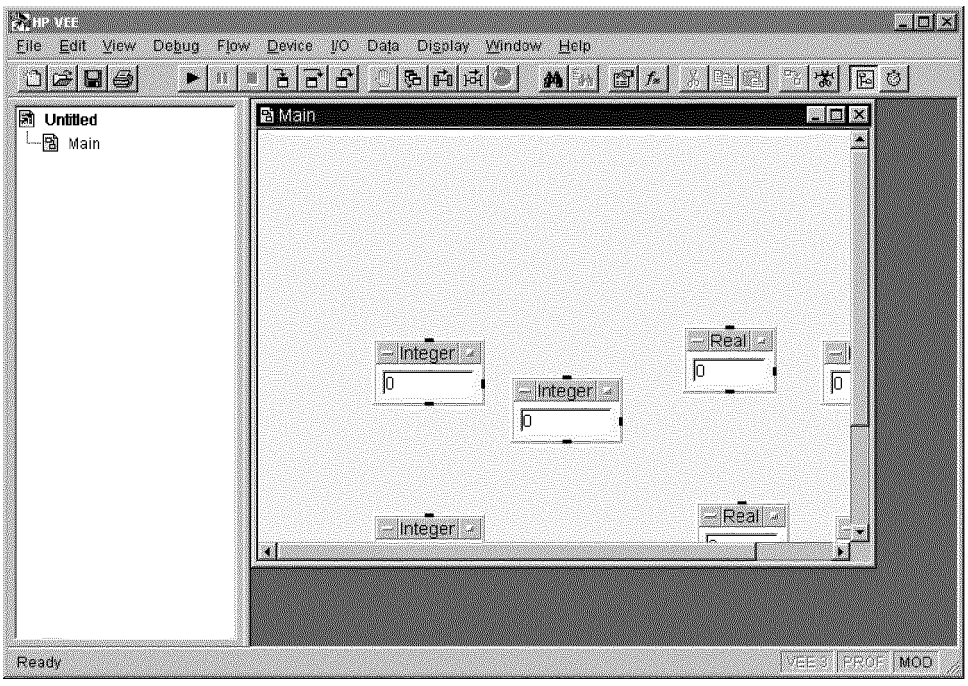
Try experimenting with these commands on your own.

To Move the Work Area

Besides moving objects, you can move the entire work area.

- One way is to click on an empty area and drag the work area in any desired direction.
- If your program size (collection of objects) exceeds the size of the visible work area, the window will have one or more scroll bars (vertical and/or horizontal). To "move" the work area, use the scroll bar (or bars).

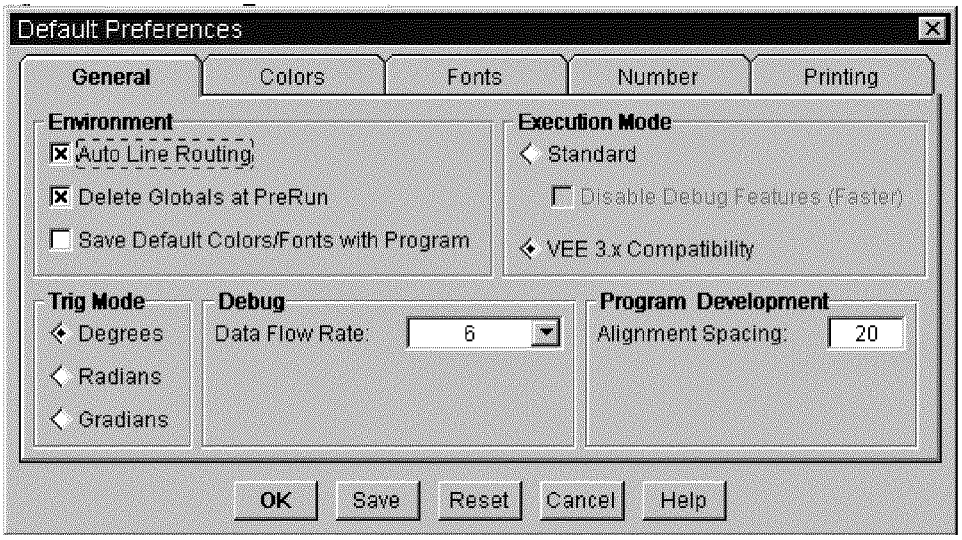
Using the first method, click on an empty area, drag the work area so that objects are outside both the vertical and horizontal boundaries, and click. Note the scroll bars. (If you click near a terminal, a line or "wire" may appear. If this happens, move the pointer to an open area and double-click.) The next figure shows this.



In the previous example, when you released the mouse button, the scroll bars and scroll arrows shown in the figure appeared. As a reminder, you use the usual windows methods to reposition the visible work area.

To Change Default Preferences

To change the default settings in your HP VEE environment, click the `Default Preferences` button on the toolbar, or use `File` ⟹ `Default Preferences`. The `Default Preferences` dialog box appears.



This dialog box has *tabs* that let you select options to edit.

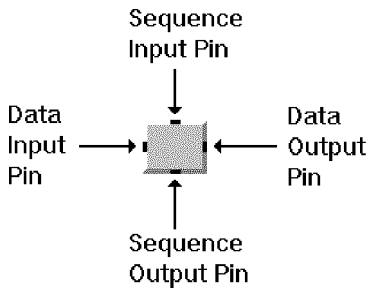
`General`	The default tab when the `Default Preferences` dialog box appears (shown previously). You can change the values of the displayed parameters; for example, `Environment` and `Execution Mode`.
`Colors`	Lets you customize the colors in your HP VEE environment.
`Fonts`	Lets you customize the fonts in your HP VEE environment.
`Number`	Lets you change the default number format.
`Printing`	Lets you set the values of the parameters for your printer.

For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

Understanding Pins and Terminals

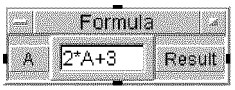
An HP VEE program *is* the objects in the work area *and* the lines that connect them. The lines connect HP VEE objects at points that are called *pins*. The `Note Pad` object has no pins; otherwise, objects have one or more of the following types of pins.

Data Input Pin	The pin (or pins) on the left-hand side of an object.
Data Output Pin	The pin (or pins) on the right-hand side of an object.
Sequence Input Pin	The pin on the top of an object.
Sequence Output Pin	The pin on the botton of an object.

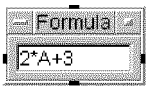


In an object's open view, the data input and output pins can appear as input and output **terminals**. This way, the pins display their terminal labels. The terminal labels are visible only in the open view, and only if the `Show Terminals` option is turned on for that object (see `Properties ...` in the object's menu).

Let's look at an example. Add a `Formula` object to the work area (`Device` ⟹ `Formula`). By default, the `Formula` object shows its terminals (the left-hand item in the next figure).



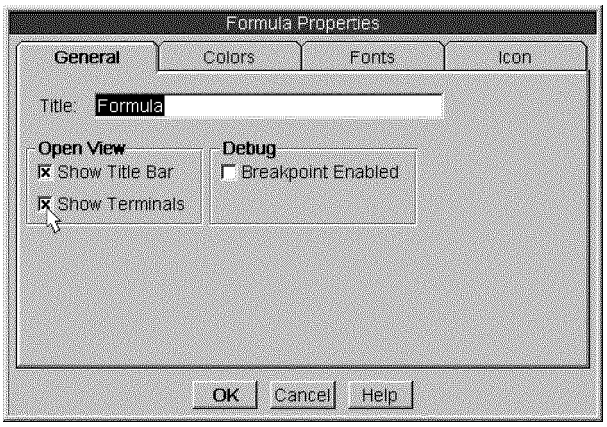
Show Terminals
Is Active



Show Terminals
Is Not Active

If you turn off `Show Terminals`, the `Formula` object does not show its terminals (the right-hand item in the figure above).

To turn `Show Terminals ON` or `OFF`, select `Properties` from the object menu. The properties dialog box displays a checkbox in front of `Show Terminals`.



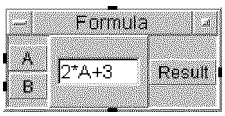
Click on the checkbox, if checked, to turn `Show Terminals OFF`. Click on the checkbox again to turn `Show Terminals` back on. Click on `OK` after you have made your selection.

For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

To Add a Terminal

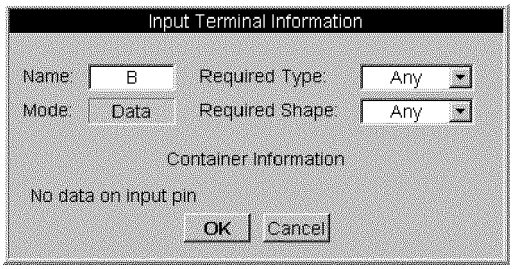
You can add a second data input terminal to the `Formula` object. In the object menu, select `Add Terminal` ⟹ `Data Input`. Or, provided `Show Terminals` is active, you can place the mouse pointer in the "terminal area"

(the left margin of the open view object) and press Ctrl+A (press the Ctrl and A keys simultaneously). In either case, a second data input terminal, `B`, appears as shown below.



To Obtain Terminal Information

To obtain information about a terminal, double-click on the label area. For example, double-clicking on `B` makes the following dialog box appear.

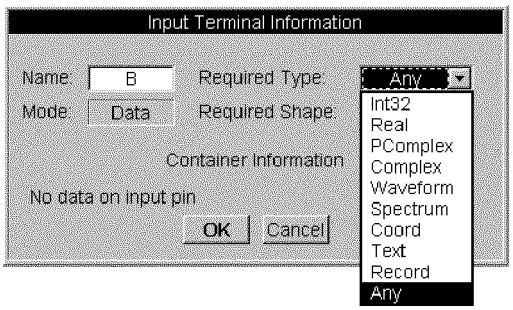


You can now edit the terminal. The dialog box has three kinds of fields:

entry field — A field with a white background, but no arrow. It becomes a *type-in* field when you click on it. For example, you can click on `B` in the `Name` field and rename the terminal; for example, `Base`.

status field — A field with a gray background that cannot be edited. For example, the `Mode` field cannot be edited.

selection field — A field with a white background that has an arrow on its right-hand side. Clicking on the field or its arrow displays a **drop-down list**. For example, if you click on `Any` (or the arrow) in the `Required Type` field, you can select another data type from the list by clicking on it. The following figure shows this.



If you select a data type other than `Any` for a data input terminal, only the specified type of data, or data that can be converted to that type, will be accepted by the terminal. Most of the time it is best to leave the `Required Type` and `Required Shape` fields set to `Any`. For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

To Delete a Terminal

To delete a terminal (input or output), you can use the object menu:

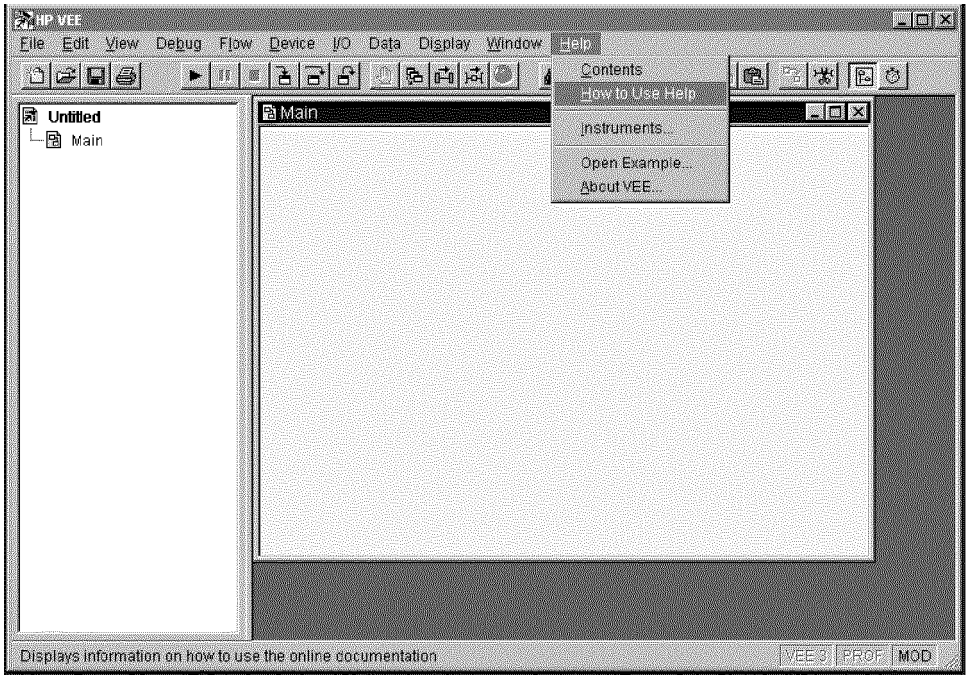
Input Terminal — Select `Delete Terminal` ⟹ `Input`.

Output Terminal — Select `Delete Terminal` ⟹ `Output`.

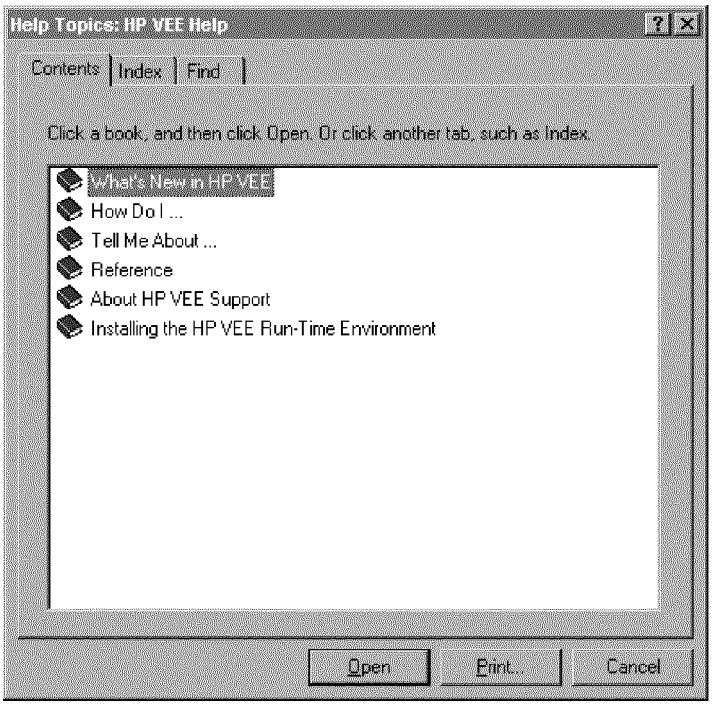
(As a shortcut, you can place the mouse pointer over the terminal you want to delete and press Ctrl+D.)

Getting Help

HP VEE uses an online help viewer that is designed for your operating system. Click on `Help` and the following menu appears.



Selecting `How to Use Help` provides information on the help system. Selecting `Contents` starts *HP VEE Help* as shown in the next figure. (The UNIX screens are slightly different.)



The help window is **hypertext** driven. `Contents` has the following topics.

`What's New in HP VEE`	Explains new features.
`How Do I ...`	Provides "how to" information.
`Tell Me About ...`	Explains concepts.
`Reference`	Provides reference information.
`About HP VEE Support`	Explains getting support.
`Installing the HP VEE Run-Time Environment`	Installs an environment for running HP VEE programs.

To quit help and close the help window, click on the `X` in the title bar.

Programming with HP VEE

Having learned to work with objects and the HP VEE user interface, this section shows you how to connect objects to create HP VEE programs. You will also see how HP VEE graphical programs work.

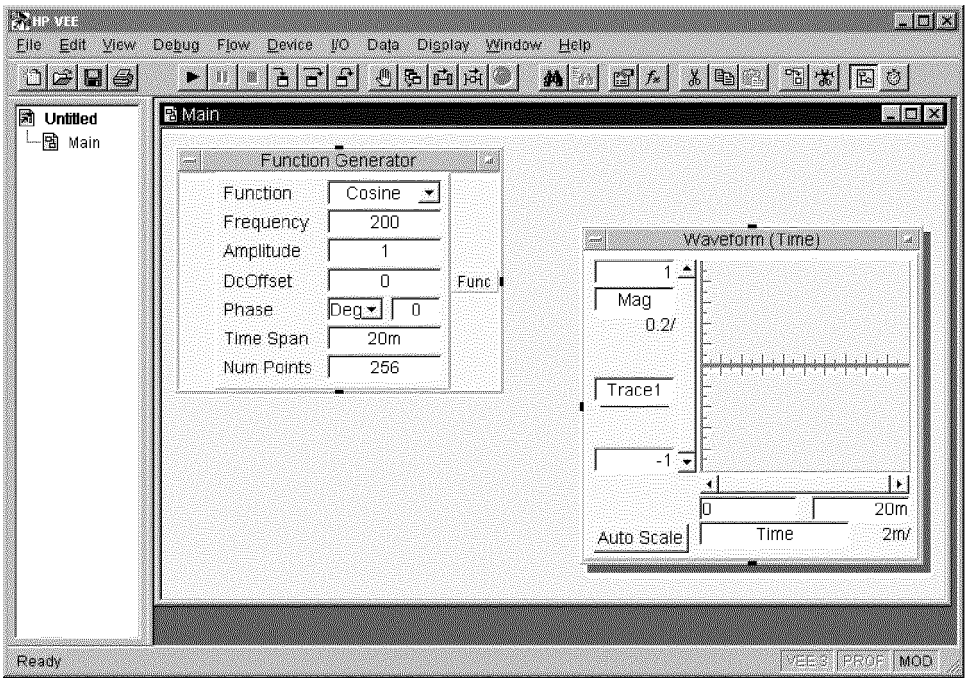
A Simple Program

You create an HP VEE program, print the HP VEE screen, and save the program to a file.

To Create a Simple Program

An HP VEE program consists of HP VEE objects that you connect to form an executable *object diagram*. Let's create a very simple program that displays a waveform. (If HP VEE is running, clear the work space by clicking the `New` button on the toolbar, or use `File` ⟹ `New`. Otherwise, start HP VEE and continue.)

Add the `Function Generator` object (`Device` ⟹ `Virtual Source` ⟹ `Function Generator`) and the `Waveform (Time)` object (`Display` ⟹ `Waveform (Time)`) to the work area as shown in the following figure.



In the previous figure, the `Func` label on the `Function Generator` object denotes a **data output pin**, and the `Trace1` label on the `Waveform(Time)` object denotes a **data input pin**. In HP VEE programming, you connect such pins to connect objects; and this determines the flow of execution of your program.

Complete the program by connecting the data output pin on the `Function Generator` (next to `Func` on the right side) to the data input pin on the `Waveform (Time)` display (next to `Trace1` on the left side). To do the connecting, move the cursor to one of the pins. The cursor shape changes when it is near a pin where a connection is allowed. Click the left mouse button, move the mouse cursor to the other pin, and click again. A line is automatically routed between the two pins, and your program is complete.

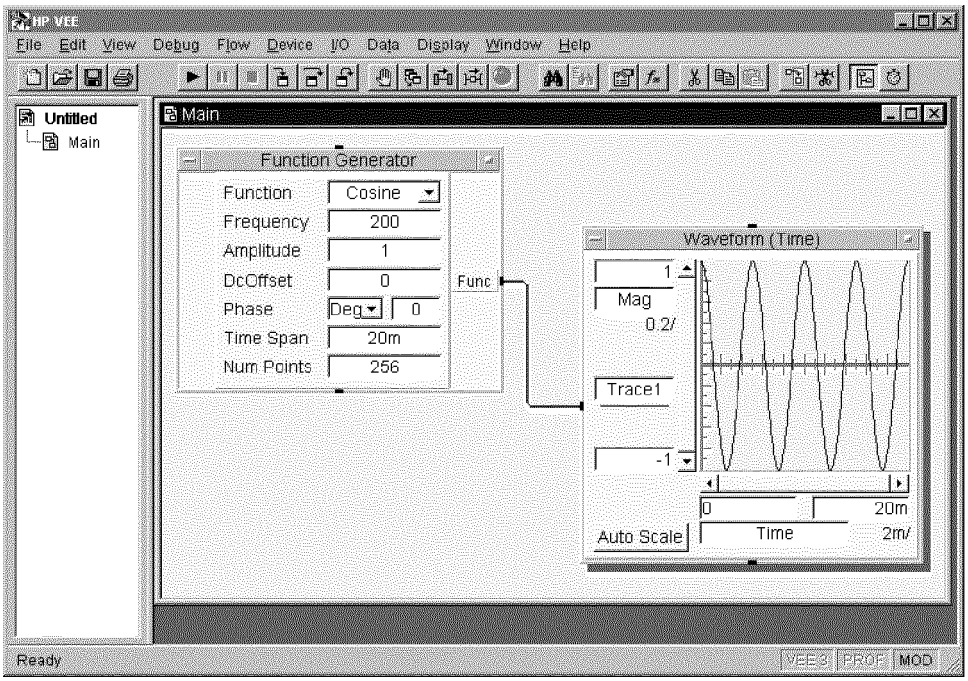
Try moving one of the objects by dragging on its title bar. (Don't drag on a pin or terminal — a line will appear if you do.) Note that the line automatically reroutes to the logical path between the two objects. The routing works best when you construct an HP VEE program according to accepted programming practices.

NOTE

If your lines appear to be scrambled, use `Edit` ⟹ `Clean Up Lines` to reroute the lines in your program.

To Run Your Program

To run your program, click the **Run** button on the toolbar, or use **Debug ⟹ Run**. The program displays a 200 Hz Cosine wave in the **Waveform (Time)** display, as shown in the next figure. (Your object might have a different frequency, which is not important to the example.)



In addition to the **Run** button, you can use the **Stop**, **Pause**, and **Step** buttons to control the program. If you pause a running program, use the **Resume** button to resume. You can use the **Step** button to run a program one-object-at-a-time.

NOTE

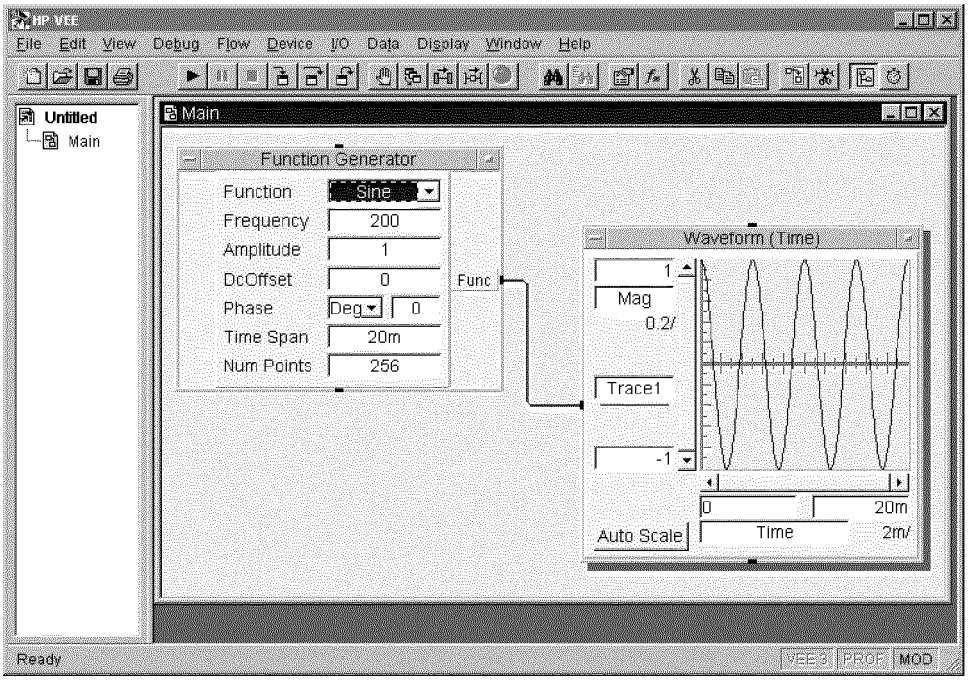
From now on, when we say to "run" your program, just click on the **Run** button on the toolbar, or press Ctrl+G. Accelerator keys for other program control buttons are:

- Pause Ctrl+P
- Resume Ctrl+G
- Step Ctrl+T

To Change Object Parameters

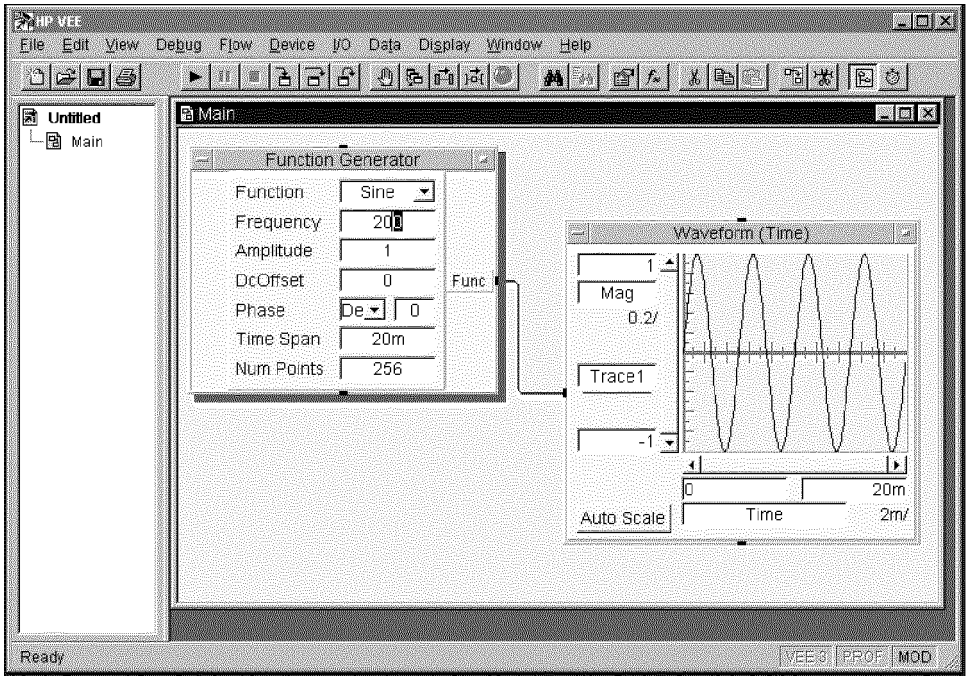
You can change the parameters of an object in its open view. You may have noticed that the `Function Generator` object has two kinds of fields. A field with an arrow on its right-hand side is a selection field. For example, click on `Cosine` (or the arrow) in the `Function` field. A drop-down list of selections appears.

Click on `Sine` to select the Sine function as shown in the following figure, noticing that the `Function` field has changed from `Cosine` to `Sine`.

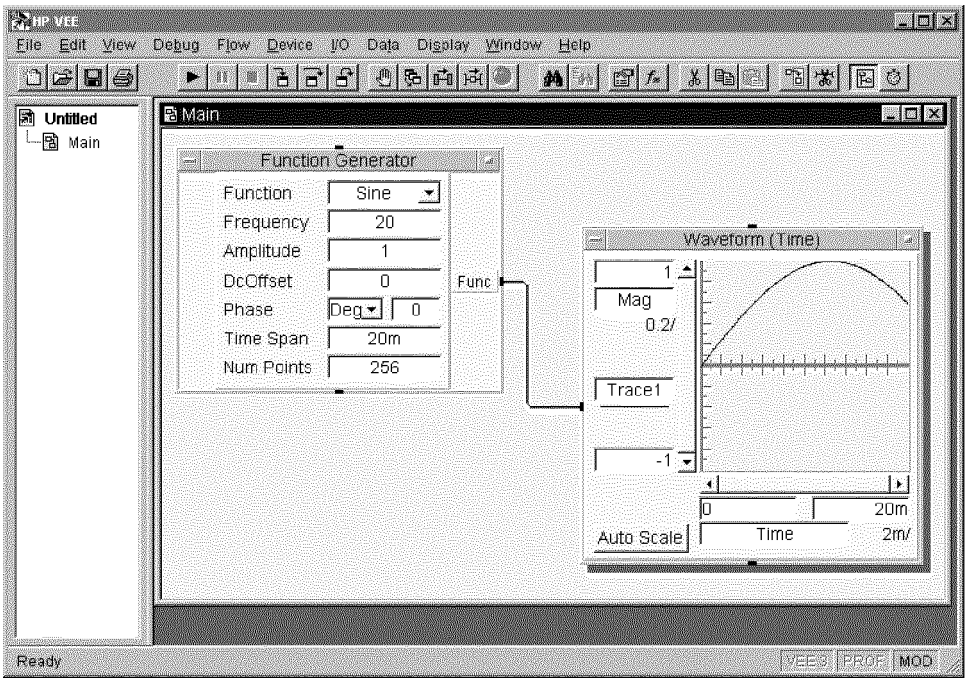


Other fields have no arrows. These are entry fields, which become *type-in* fields when you click on them. Just click on a field and a cursor appears. You can use standard keyboard and mouse editing techniques to move the cursor and enter a desired value.

For example, click on the `Frequency` field to the right of the value `200` and, while holding the mouse button down, move the mouse to the left to highlight the last `0`, then release the mouse button. The following figure shows this.



Now, press Delete to delete the last `0`, changing the `Frequency` value to `20`. Run the program (click the `Run` button) and you should get the following result.



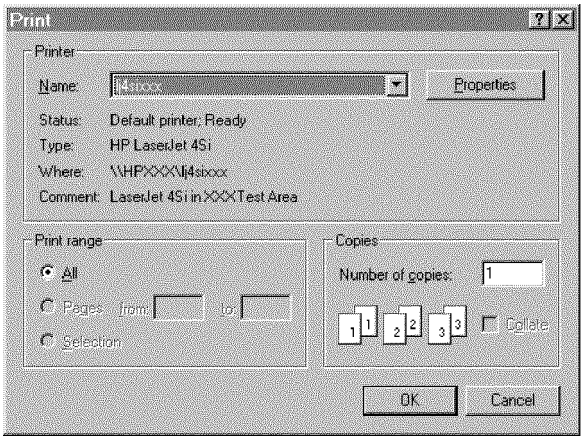
The displayed waveform is now a 20 Hz sine wave. Try changing a few object parameters on your own as follows:

1. Click on `Deg` (or the arrow) in the `Function Generator` object and change the phase units to `Rad`. Now click on the `Phase` value field and enter the value `PI`. Run the program and note the phase shift in the displayed waveform. Now change the `Phase` value back to `0` and the units back to `Deg`.
2. The y-axis limits of the `Waveform (Time)` object are preset to `-1` through `1`. Click on each value field and change the limits to `-2` through `2`. You'll see the waveform displayed within the new limits. Now click on `Auto Scale` and the waveform will be automatically scaled back to `-1` through `1`.

To Print the Screen

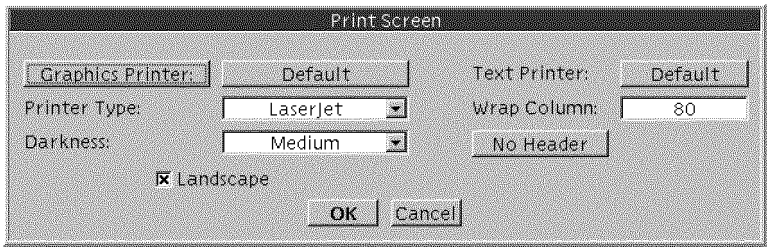
To print the screen, select `File` ⟹ `Print Screen`.

For HP VEE for Windows, the following dialog box appears.



When you click on `OK`, HP VEE prints the screen on the default printer named in the dialog box. You can select another printer, change the print range, and enter the number of copies. Click on the `Properties` button for more selections. Different print drivers may use different dialog boxes. For further information about using Windows dialog boxes, refer to the *Microsoft Windows Help*.

For HP VEE for UNIX, the following dialog box appears.



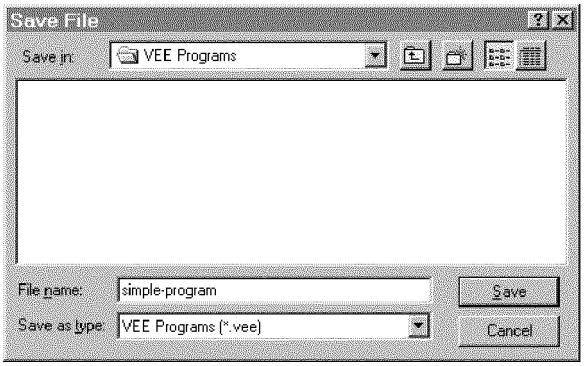
When you click on `OK`, HP VEE prints the screen on the selected printer. This dialog box lets you select a graphics printer or text printer. It also lets you change the configuration of these devices before you print.

As a shortcut, click the `Print Screen` button on the toolbar to print the screen directly.

To Save Your Program

You can save your program at any time (whatever is in the work area, whether a complete program or not). Click the `Save` button on the toolbar, or use `File` ⟹ `Save`.

For HP VEE for Windows, the following dialog box appears.

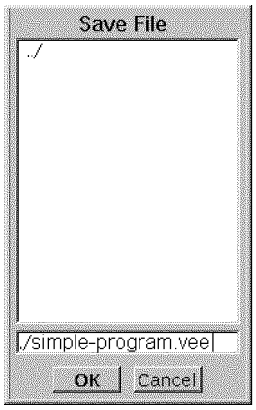


By default, HP VEE for Windows saves your files in the `VEE Programs` folder. To save the current program, just type in a name in the `File name` field (for example, `simple-program`) and click on `Save`. HP VEE for Windows automatically adds the extension `.vee` to the file name, saving the program as a `VEE Programs` type.

NOTE

In HP VEE for Windows, you can use the long file names allowed by Windows 95 and Windows NT.

For HP VEE for UNIX, the following dialog box appears.



By default, HP VEE for UNIX saves your files to the directory from which you started HP VEE. To save the current program, just type in a name (for example, `simple-program.vee`) and click on `OK`.

> **NOTE**
>
> To re-save your program to the same file name click the `Save` button or press Ctrl+S at any time (`File` ⟹ `Save`). It is a good idea to save your file frequently while you are developing a program. If you want to save your changed program to a different file name, press Ctrl+W or `File` ⟹ `Save As`.

To Open a File

You can open a program file by clicking the `Open` button on the toolbar or press Ctrl+O (`File` ⟹ `Open`). The `Open File` dialog box is essentially the same as the `Save File` dialog box, but you'll be given a list of available files from which to choose. Just click on the desired file name (or type in the name in the `File name` field), and then click on `Open` (`OK` in UNIX) to open the file.

How HP VEE Programs Work

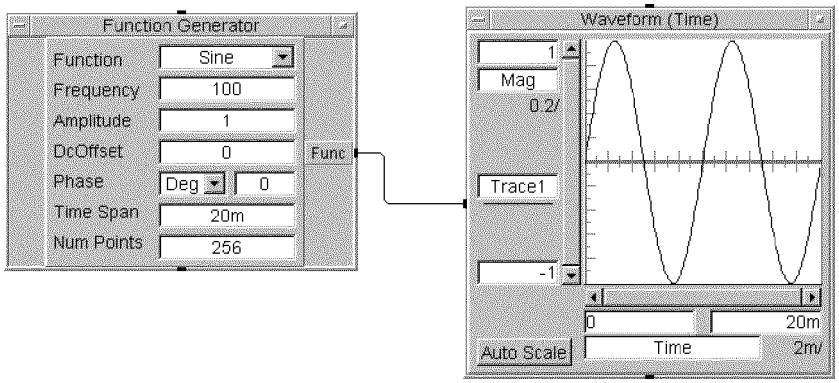
In conventional programming languages such as C, BASIC, or Pascal, the order in which program statements execute is determined by a set of sequence and selection rules. Generally, statements execute in their order of appearance in the program unless certain statements cause execution to branch to another statement or thread of code.

In HP VEE the general flow of execution through a program is called **propagation**. Propagation through a program is not determined by the geographic locations of the objects in the program, but rather by the way the objects are connected. Propagation is primarily determined by **data flow**, which is determined by how the data input and output pins of the objects are connected. Here are the rules of data flow:

- *Data flows from left to right through an object.* This means that on all objects with data pins, the left data pins are inputs and the right data pins are outputs.
- *All of an object's data input pins must be connected.* Otherwise an error will occur when the program is run.
- *An object will not execute until all of its data input pins have received new data.*
- *An object finishes executing only after all connected and appropriate data output pins have been activated.*

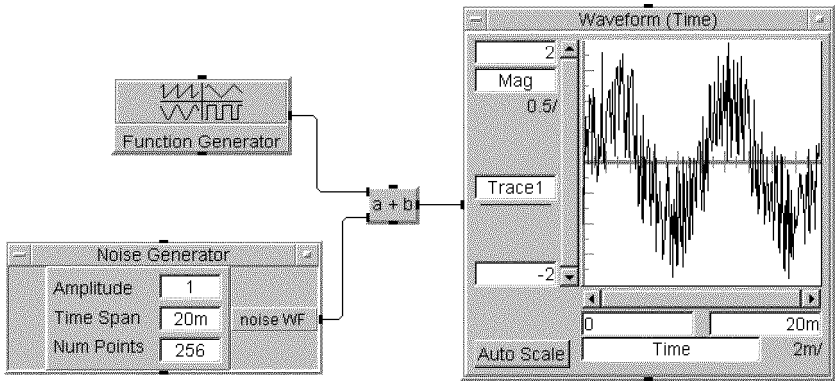
In HP VEE you can change the order of execution by using sequence input and output pins. You do not normally need to use sequence pins, except to ensure the order of execution when controlling external devices such as instruments. For internal HP VEE operations, it is generally best to avoid using the sequence pins. *If possible, let data flow control the execution of your program.*

To see how data flow works, let's take another look at the program you created earlier. Open the program (`simple-program.vee`) that you saved in the previous section (click the `Open` button on the toolbar) and run it. It should appear as follows, allowing that you might have some different values for parameters.



Note that the data output pin of the `Function Generator` object is connected to the data input pin of the `Waveform (Time)` object. When you run the program, the `Waveform (Time)` object won't execute until it receives data from the `Function Generator` object. This is a simple example of data flow.

Now let's create a "noisy sine wave" by adding a `Noise Generator` object to our program, as shown below.



To create this program you first need to delete the line connecting the `Function Generator` and `Waveform (Time)` objects in the original program.

You can use the Delete Line button on the toolbar to do this; click on the Delete Line button, and then click on the line. Or you can use a shortcut; press and hold Shift+Ctrl and click on the line.

Now work as follows:

1. Minimize the Function Generator to its icon.
2. Add the Noise Generator object (Device ⟹ Virtual Source ⟹ Noise Generator).
3. Add the A+B object. (Use Device ⟹ Math & Functions. Then, from the Select Function dialog box, for Type, select Operators. For Category, select Arithmetic. For Name, select +.) Then, minimize the A+B object.
4. Connect the input and output pins as shown in the previous figure.

Run the program, and then click on the Auto Scale button on the Waveform display.

Note that the Waveform (Time) object won't execute until it has received data from the A+B object. The A+B object won't execute until *both* of its inputs have been satisfied by the Function Generator and Noise Generator objects.

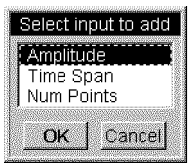
This leaves a question; namely, which object executes first, the Function Generator object or the Noise Generator object? The answer is that *it doesn't matter.* The result is the same. The A+B object doesn't execute until both generator objects execute. Once both of the A+B input data pins receive data, the A+B object executes, summing the two signals and outputting the result to the Waveform (Time) object. Thus, the program operates just fine. The data flow determines the execution.

To see the order of execution, turn on the Debug commands Show Execution Flow and Show Data Flow by clicking on their respective buttons on the toolbar. Now run the program. Each object highlights when it executes, and a small, square marker moves down the lines to show data flow.

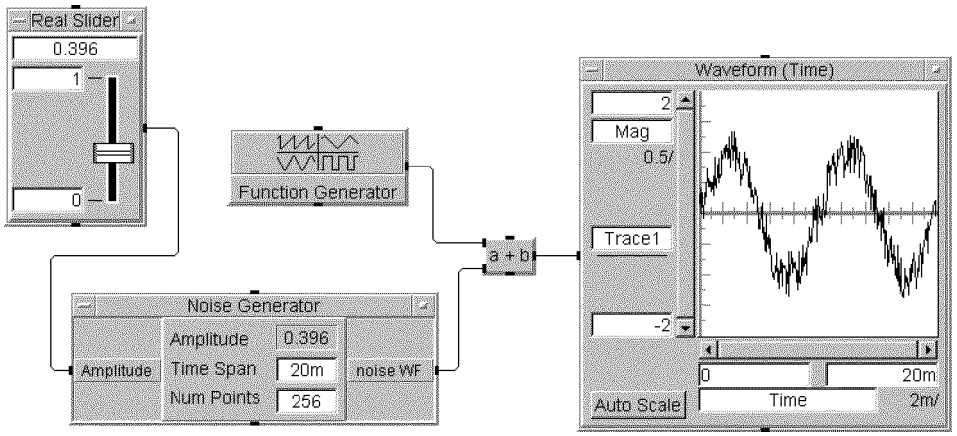
NOTE

`Show Execution Flow` and `Show Data Flow` can be enabled together or individually by clicking on their toolbar buttons or on their commands in the `Debug` menu. Normally, you'll want to turn these commands off because they slow down your program.

Now, add an `Amplitude` input for the `Noise Generator`. Use the object menu, or just press Ctrl+A with the mouse pointer in the "terminal area" at the left side of the `Noise Generator`. A dialog box asks you to select an input to add.



Select `Amplitude` by clicking on `OK` — an `Amplitude` input terminal appears. Now add a `Real Slider` object (`Data` ⟹ `Continuous` ⟹ `Real Slider`) and connect its data output pin to the `Amplitude` terminal, as shown in the following figure. Run the program, and click on the `Auto Scale` button on the `Waveform` display:



Try changing the amplitude of the noise (drag the slide control on the `Real Slider` object). The amplitude of the noise doesn't change until you run the program, and then the noise component of the displayed waveform depends on the `Real Slider` output value.

Again, data flow determines the order of execution. The `Noise Generator` can't execute until the `Real Slider` executes. The `A+B` object can't execute until both the `Function Generator` and the `Noise Generator` execute, but it doesn't matter which one executes first. Finally, the `Waveform (Time)` object executes only after the `A+B` object has executed.

Save your program again (to `simple-program.vee`). You'll add some more features to it in the next chapter.

2

HP VEE Programming Techniques

HP VEE Programming Techniques

In the previous chapter you learned how to interact with HP VEE and create a simple HP VEE program. In this chapter, you will learn selected HP VEE programming techniques that you may find useful in building your own programs. These techniques include:

- Creating `UserObject` objects.
- Creating panel views.
- Using data files.
- Mathematically processing data.
- Communicating with instruments.

General Techniques

This section provides general HP VEE programming techniques that include creating `UserObject` objects, creating a panel view, and using data files.

Creating a UserObject

A `UserObject` object (hereafter just called `UserObject`) is created by placing a logical and customized group of objects in the work area of a `UserObject` window. You wire the objects together as usual.

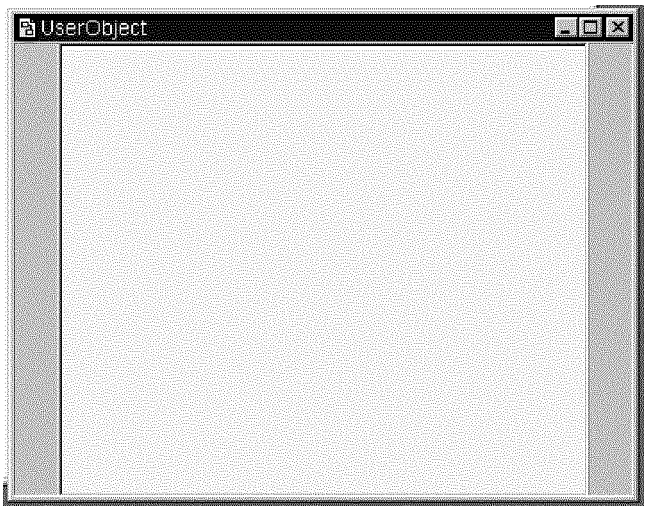
The objects in the `UserObject` window are associated with an icon view of the `UserObject`, which resides in the `Main` window.

You can define input and output pins for your `UserObject` and wire it to other objects in your program.

The idea, in developing a `UserObject`, is to create a unique context that performs a useful purpose within the context of the main program. Besides conserving *real estate* in your main work area, you can make your program more understandable by giving it structure.

Since you might create many user objects, and you might nest them, you should keep track of the icon views of the `UserObject`s, which reside in the main program, and their associated `UserObject` windows, in which you develop the user objects. One way to do this is to name the user objects in their edit windows, which also names them in their associated icon views.

One way to create a `UserObject` is to select `Device` $\Longrightarrow$ `UserObject` from the menu bar. An icon view of the `UserObject` appears in the `Main` window (work area). This icon view of the `UserObject` cannot be edited directly. To create the user object's program, double click on the icon view of the `UserObject`. This calls (pops up) an associated `UserObject` window (work area), which is shown in the next figure.



In this work area, you can add objects to the `UserObject`. After you develop your `UserObject`, you have options for the `UserObject` window as follows:

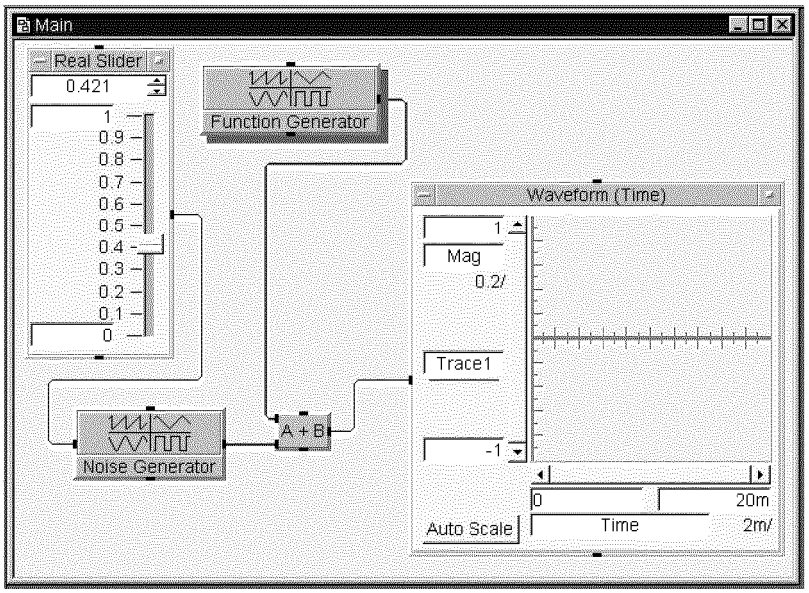
- Close the window by clicking on its close button.
- Maximize the window by clicking on its maximize button. If you do this, the `UserObject` window will occupy the entire HP VEE work space.
- Minimize the window by clicking on its mimimize button. The minimized window will locate along the bottom of the HP VEE work space.

Regardless of what you do with the `UserObject` window, the icon view of the `UserObject` resides in the `Main` window, and you can connect its pins to other objects in that window.

Another way to create a `UserObject` is to select objects within a program, and then create a `UserObject` from them.

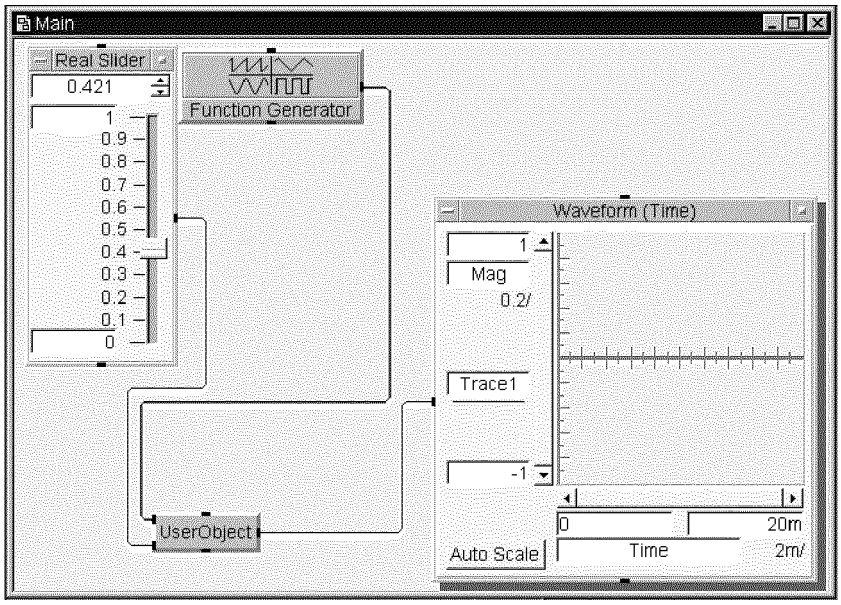
Let's use this alternate method, but, first, close the `UserObject` window you just created so that you have only the `Main` window.

To create the `UserObject`, use the program you created in the last chapter. Open the program (`simple-program.vee`). It should appear in the main work area. Now, minimize the `Noise Generator` object, and rearrange the objects as shown in the next figure.



To make the `UserObject`, select the `Noise Generator` and `A+B` objects. To do this, use the shortcut; Ctrl+*left mouse button*.

To create the `UserObject` from the selected objects, click on `Edit` ⟹ `Create UserObject`. The `UserObject` will contain the `Noise Generator` and `A+B` objects in the `UserObject` edit window, and will be automatically created in the `Main` window with the appropriate input and output pins and connections as shown in the next figure.



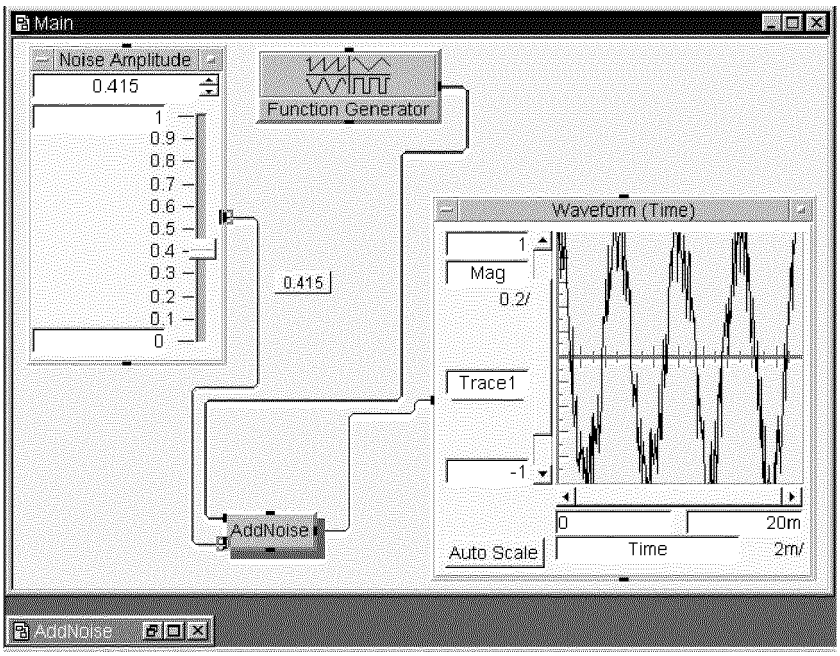
NOTE

Rearranging the positions of the objects before executing `Create UserObject` is one of convenience. If you don't collect the objects to be included into one area, the `UserObject` will size itself to encompass all the selected objects. You can then rearrange and resize the work area of the `UserObject`, and move the `UserObject` to an appropriate place in the work area. But the cleanup is easier if you place the objects logically beforehand.

You can use `Edit ⟹ Clean Up Lines` to clean up the line routing within your program. However, the line is context dependent. To clean up the lines for the `UserObject`, make the user object active. Then, use `Edit ⟹ Clean Up Lines`.

Creating a `UserObject` in its edit window and then using the icon view of the `UserObject` lets you save screen space.

To help you keep track of the `UserObject`, change the title from `UserObject` to `AddNoise`. Double-click on the title and enter the new title in the properties dialog box. While you are at it, change the title of the `Real Slider` to `Noise Amplitude`. The following figure shows how this makes the program easier to follow. Also, in the figure, the small box showing `0.415` shows that the value on the output pin matches the value shown on the real slider (`Noise Amplitude`), and the bottom of the work space shows the minimized `UserObject` window (`AddNoise`).



The key to the proper use of user objects is to make sure the `UserObject` has a logical purpose within the program. Thus, this unique object is not just a space saving device, but rather a way of structuring your program. User objects help you use "top-down" design in your HP VEE programs. For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

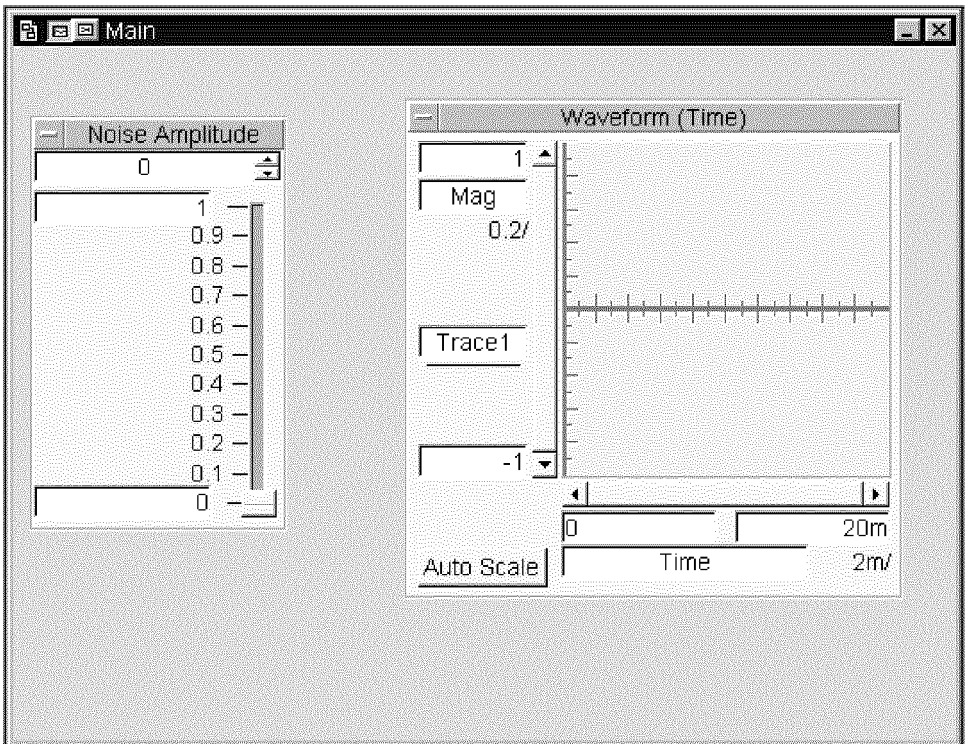
We'll continue with this example in the following section, so if you want to quit now, save your program (`simple-program.vee`).

Creating a Panel View

After you develop a program, you will often want to give it an operator interface. To do this, you can create a **panel view** of the program. Let's continue with our previous example to see how this is done.

1. Open your program (`simple-program.vee`) if it is not already in the work area.
2. Select the `Real Slider` and `Waveform (Time)` objects. To do this, use the shortcut; Ctrl+*left mouse button*.
3. Click the `Add to Panel` button on the toolbar to add the selected objects to the panel (or use `Edit` ⟹ `Add To Panel`). A panel view appears, showing the two objects that you added to the panel.

You can size and move the objects in the panel view to appropriate locations to create a panel similar to the one shown in the next figure.



Try pressing the `Detail` button on the `Main` window title bar to go to the detail view. Then, click on the `Panel` button to return to the panel view.

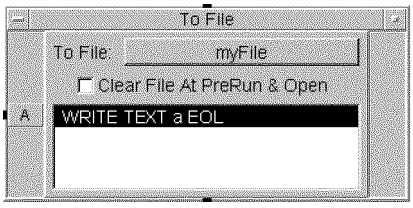
The detail view is the normal window in which you edit your program. You can move, resize, or delete objects in the panel view independently from the detail view; but the idea is to use the detail view to develop a program and use the panel view to provide an operator interface. (For more information, select `Help` ⟹ `Contents`. Then, select `How Do I . . .` . Finally, select `Build an Operator Interface`.)

Again, save your program (`simple-program.vee`) if you want to quit now.

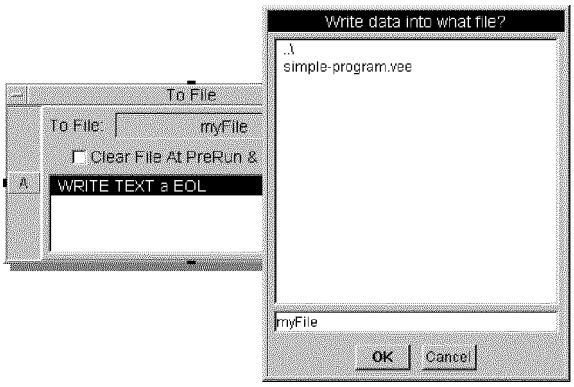
Using Data Files

You can write data from HP VEE to a data file, and read the data in a file into HP VEE, by including the `To File` and `From File` objects in your program. As an example, add a `To File` object to the detail view of the program you've been building (if necessary, click on the icon that switches you from panel view to detail view. It's in the title bar for the Main window).

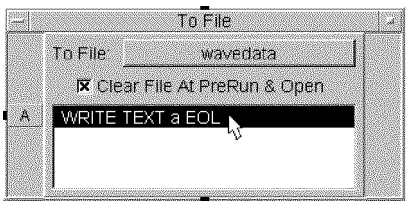
Open the program (`simple-program.vee`), if it isn't already in your work area. (Be in the *detail view*.) Now add a `To File` object to the work area (`I/O` ⟹ `To` ⟹ `File`):



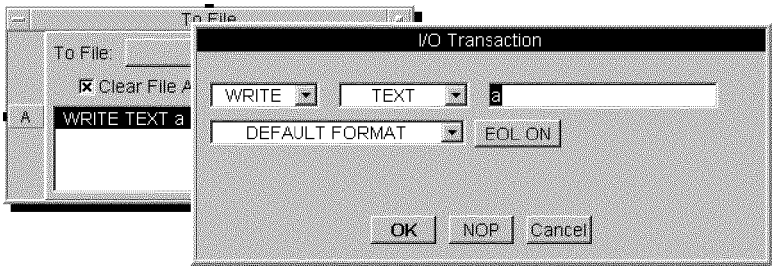
Change the name of the data file (the `To File:` field, which by default is `myFile`) to `wavedata` by clicking on `myFile`. The following dialog box appears.



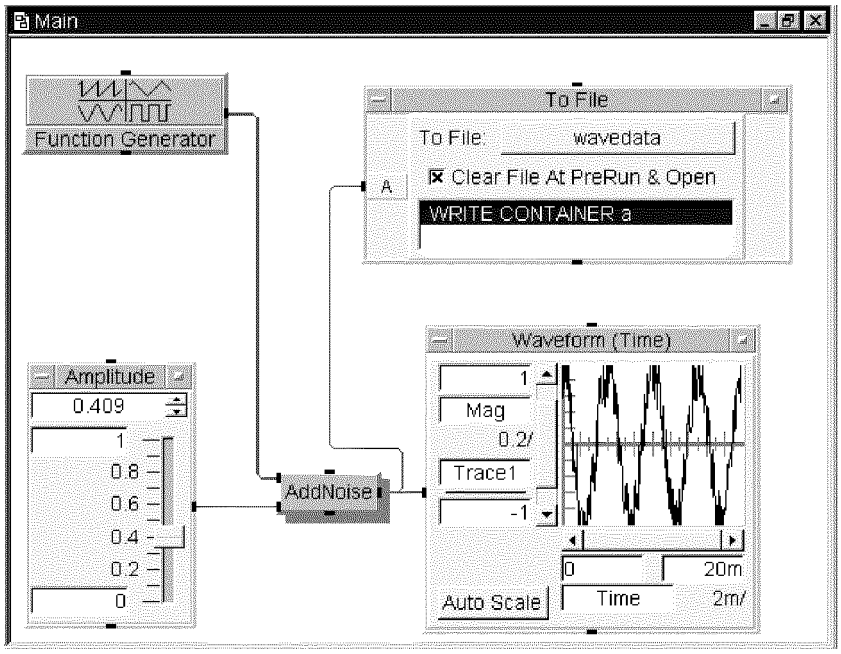
Backspace over `myFile`, type in the new name, and then click on `OK`. Also, click on the checkbox in the `To File` object to activate `Clear File at PreRun and Open` as indicated in the next figure.



Now double-click on the write *transaction* labeled `WRITE TEXT a EOL` as indicated by the mouse pointer (arrow) above. The `I/O Transaction` dialog box appears below.

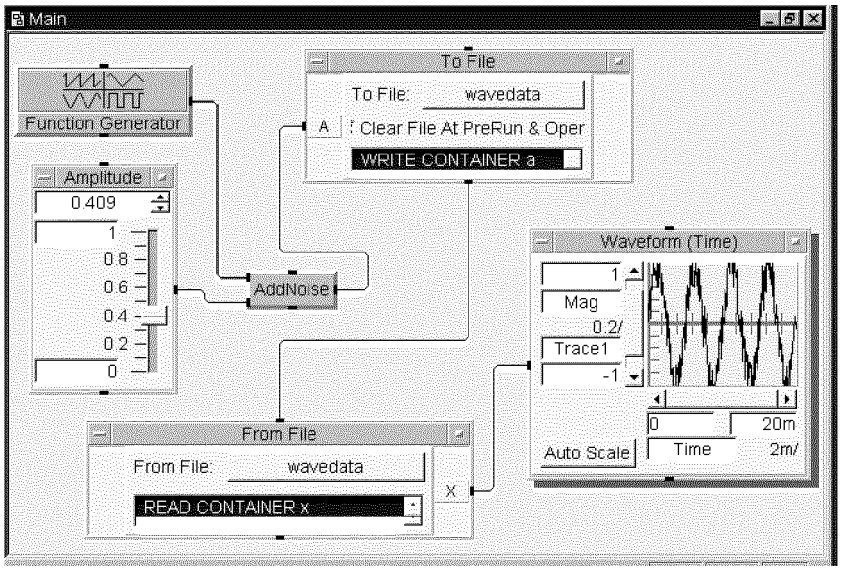


Click on the `TEXT` field (or its arrow) to show the drop-down list of data types. Click on `CONTAINER`, and then on `OK`, to change the transaction to `WRITE CONTAINER a`. Connect the data output pin of the `AddNoise` user object to the data input pin of the `To File` object, as shown in the next figure.



Now the program not only displays the noisy sine wave output by the `AddNoise UserObject`, but also writes a container of waveform data to the file `wavedata`.

Let's add a `From File` object (`I/O` ⟹ `From` ⟹ `File`) to the program to read the data back. You'll need to change the read transaction to `READ CONTAINER x` and the file name to `wavedata` (the procedure is the same as for `To File`). Now delete the line between `AddNoise` and the `Waveform (Time)` object, and connect the objects as shown.



Note that when the `To File` object finishes executing (after it has written to the file `wavedata`) it activates the sequence input pin on the `From File` object, which reads the container of data and outputs the waveform to the display object.

Click on the `Panel` button in the Main window. You'll find that the panel view has not been changed by changes you made to the detail view.

For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

Mathematically Processing Data

HP VEE provides extensive mathematical capabilities and data types, which are documented via browsable items in the `Reference` entity, which you access via `Help` ⟹ `Contents` (the online help).

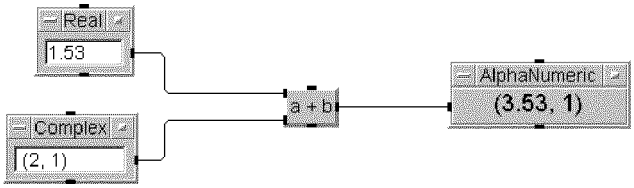
To Use Data Types

HP VEE supports several data types, including text, integer and real numbers, and several types of complex and coordinate numbers. You have already seen how the `A+B` object can add two waveforms together in our earlier examples. In fact, the mathematical operators such as `+` can act on several data types, and can even act on mixed data types. Let's look at an example.

To create the following program, clear the Main window, place the following objects in the Main window, and connect them as shown, noting the following information.

- For the `Real Constant` object, select:
  `Data` ⟹ `Constant` ⟹ `Real`.
- For the `Complex Constant` object, select:
  `Data` ⟹ `Constant` ⟹ `Complex`.
- For the `A+B` object, select:
  `Device` ⟹ `Math & Functions ...` to get the `Select Function` dialog box. Then, in order, select `Type: Operators`, `Category: Arithmetic`, `Name: +`.
- For the `AlphaNumeric` object, select:
  `Display` ⟹ `AlphaNumeric`.

Now type the value, `1.53`, in the data entry field of the `Real` object, and the complex value, `(2,1)`, in the `Complex` object. Run the program and you should get the following result.



HP VEE automatically converts the data as needed, then performs the addition in the `A+B` object. The real value `1.53` is converted to the complex value `(1.53,0)`, which is then added to the complex value `(2,1)`. The result, `(3.53,1)` (a complex number), is displayed in the `Alphanumeric` object.

Normally, HP VEE takes care of all data type conversions for you. For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

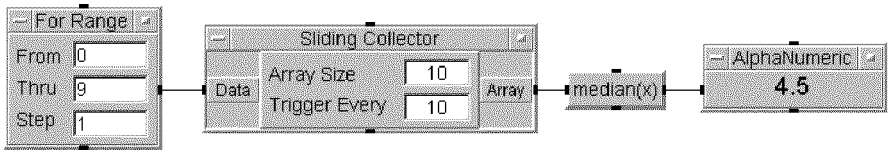
To Use Data Shapes

HP VEE supports a variety of data shapes, such as scalars and arrays. Unlike most programming languages, HP VEE objects can operate on an entire array, rather than on only one element.

The following program creates a one-dimensional, ten-element array, calculates the median of the 10 values, and then displays the median value.

To create the program, clear the Main window, place the following objects in the Main window, and connect them as shown:

- For the `For Range` object, use:
  `Flow` ⟹ `Repeat` ⟹ `For Range`.
- For the `Sliding Collector` object, use:
  `Data` ⟹ `Sliding Collector`.
- For the `median(x)` object, use the following selections; noting that, once you select `median`, click on `OK`. You might need to scroll through some lists. Select `Device` ⟹ `Math & Functions` to get the `Select Function` dialog box. Then, in order, select `Type: Built-in Functions`, `Category: Probability & Statistics`, `Name: median`. (You can shorten this by first clicking on the `Fx` button to get the `Select Function` dialog box.)
- For the `AlphaNumeric` object, use:
  `Display` ⟹ `AlphaNumeric`.



To Use the Formula Object

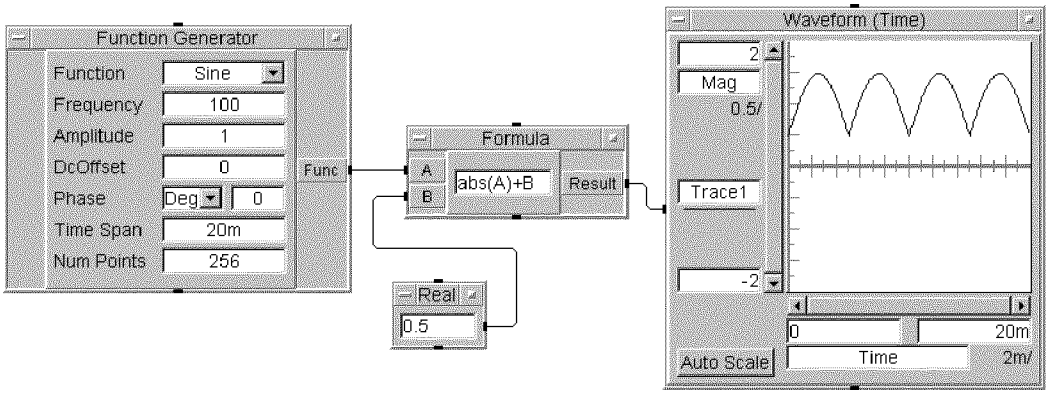
HP VEE provides mathematical operators and functions, all of which are documented in the `Reference` (Select `Help` ⟹ `Contents`. Then, select `Reference` and browse the items as desired).

The predefined operator and function objects are available via `Device` ⟹ `Math & Functions ...` (or `Fx` on the toolbar). You select them from the `Select Function` dialog box by clicking on entities in three lists; `Type:`, `Category:`, and `Name:`. You verity your selected object with `OK`.

Besides using predefined operators and functions, you can create any valid HP VEE mathematical expression within the `Formula` object, which is found under the `Device` menu. This section has you examine `Formula` objects.

To create a program for using a `Formula` object, clear the Main window and follow these steps:

1. Add the `Function Generator` object to the Main window and modify it to produce a 100 Hz sine wave.
2. Add the `Formula` object to the Main window. Add a second input (`B`) to the object (put the mouse pointer in the input terminal area and use Ctrl+A).
3. Type the mathematical expression `abs(A)+B` in the entry field.
4. Add a `Real` constant object to the Main window. (`Data` ⟹ `Constant` ⟹ `Real`), and type in the value `0.5`.
5. Add the `Waveform (Time)` display object and set the y-axis scale to `-2` through `2`.
6. Connect the objects as shown in the next figure.



When you run the program, the `Formula` object takes the waveform input `A` and the real value `B`, and adds `B` to the absolute value of `A`. In effect, the expression `abs(A)+B` "rectifies" the sine wave and adds a "dc offset." You could have produced the same effect by using the `A+B` and `abs(x)` objects, but it is easier to read an expression in a `Formula` object. (This also saves space.)

Try double-clicking on the input and output terminals of the `Formula` object. Note that the real scalar on input `B` is added to each element of the waveform data (a one-dimensional array) on input `A`, and the resulting waveform is output on the `Result` terminal.

Communicating with Instruments

HP VEE provides extensive capabilities to communicate with and control test instruments. There are several types of instrument I/O objects.

- Direct I/O provides a means of direct communication with an instrument without the use of an instrument driver file.
- Panel Driver provides a "front panel" to control a particular instrument. When you change parameters in the HP VEE instrument panel, the corresponding state of the instrument is changed.
- A Component Driver provides similar capabilities to those of an instrument panel, but without the "front panel," and without direct control over the state of the instrument.

This section introduces the use of instrument panels. For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

NOTE

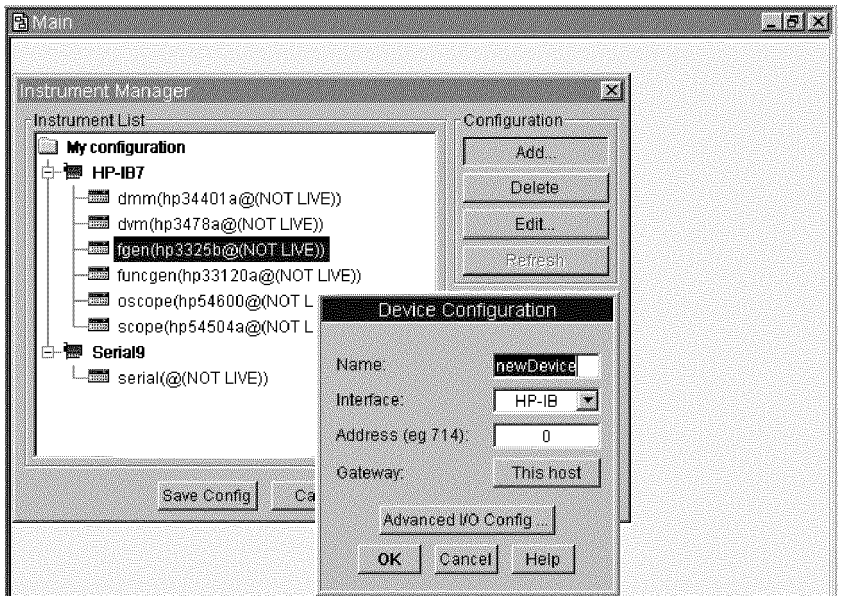
Instrument panel and component driver objects require that an HP Instrument Driver (`.CID`) file be present for the particular instrument. The examples in this section use the HP 3325B Function Generator instrument panel. The instrument driver file for this instrument is installed by default as part of the HP VEE installation.

Configuring Instruments

In the following example you configure an instrument panel for an HP 3325B Function Generator. You probably don't have one hooked up, but don't worry. One of the powerful features of HP VEE instrument I/O is that you can configure an instrument panel and create a program with `Live Mode OFF`. This means that the instrument need not be connected to your computer. Or the instrument can be connected, but in `Live Mode OFF` HP VEE won't communicate with it. This lets you test much of your program before you connect the instrument and communicate with it.

To configure the HP 3325B instrument panel, clear the work area and follow these steps:

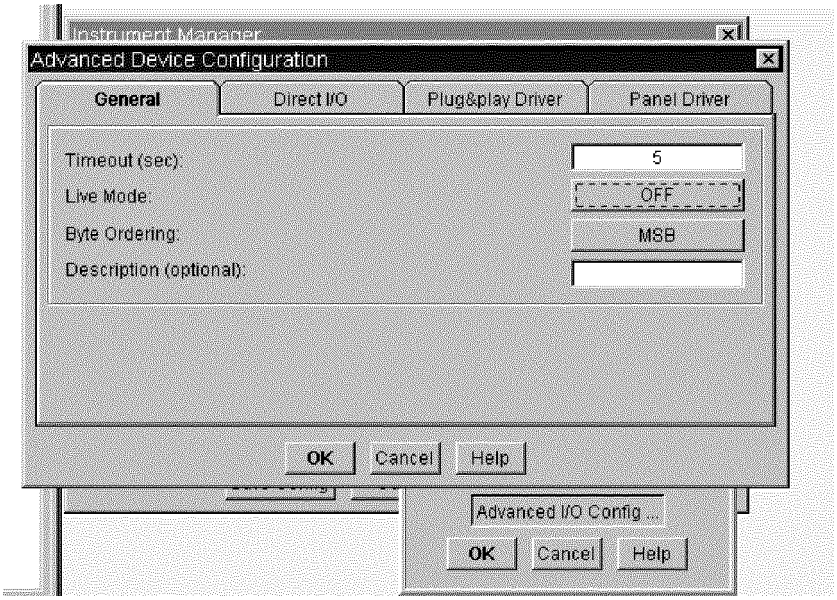
1. Select `I/O` ⟹ `Instrument Manager ...` . The `Instrument Manager` dialog box appears. Several selections appear. *Please don't delete them.* They are used in example programs provided with HP VEE. You might, for example, click on `fgen (hp3325b@(NOT LIVE))`.
2. The dialog box has several parts; `Instrument List`, `Configuration`, and `Get Device`. Configure a new instrument by clicking on the `Add ...` button under `Configuration`. A dialog box appears. Your screen might be slightly different, but the essential parts are present as shown next.



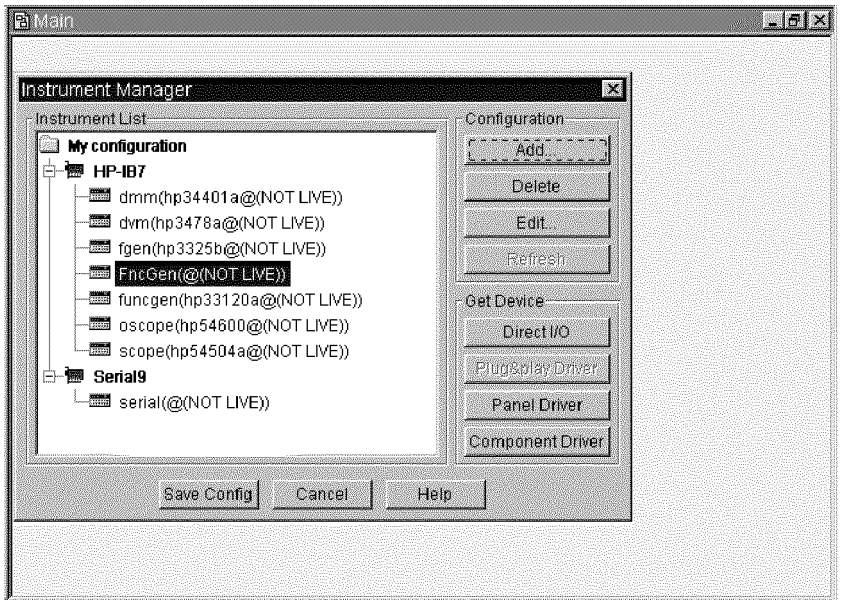
You edit the fields in this dialog box to add a function generator to your list of instruments. However, when you change values, do not press Enter. You might exit the dialog box. Instead, after you edit a field, click on the next field you want to edit, or use the Tab key to advance through the fields.

3. The `Name` field is currently highlighted. Enter a new name (for example, `FncGen`) to start your new configuration.

4. Now click on the `Address` field and enter the address of your instrument. Typically, the address for the HP 3325B Function Generator is `707`. (With real instruments, for information about addressing an instrument, refer to the instrument's documentation.)
5. Click on the `Advanced I/O Config ...` button. The following dialog box appears. The `Live Mode` field in the `Advanced Device Configuration` dialog box shows `ON` at this point because you entered a non-zero address. Click on `ON` to change it to `OFF`.



6. Click on the `Panel Driver` option, and then click on the `ID Filename:` field. This pops up a `Read from what Instrument Driver?` dialog box. From the list, click on `hp3325b.cid`, and then click on `Open`.
7. Click on `General` in the `Advanced Device Configuration ...` dialog box. Note that the `Live Mode:` field should show `OFF`. If it does not, click on the field to get `Live Mode:` to `OFF`. Click on `OK` to return to the `Device Configuration` dialog box, and click on `OK` to return to the `Instrument Manager` dialog box, as shown below.



The new selection, `FncGen(@(NOT LIVE))`, appears in the list of instruments that you can select.

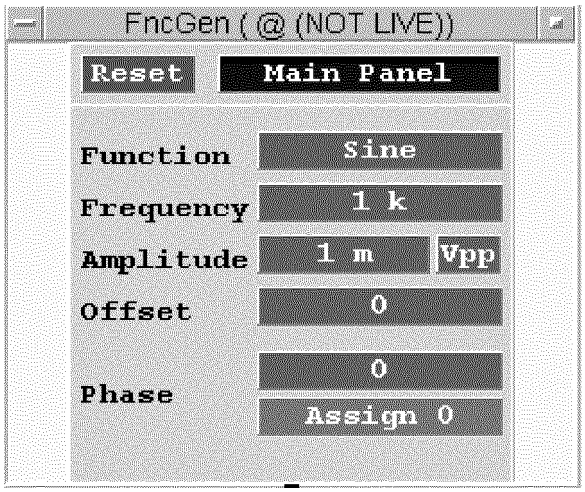
8. Now click on the `Save Config` button. The dialog box disappears and your new instrument configuration has been saved.

Your `FncGen` configuration is complete, and the configuration will be available whenever you start HP VEE. Now let's use this configuration.

Using an Instrument Panel

The open view (constrasted with the minimized view) of an HP VEE instrument panel object represents the front panel of your physical instrument. Just as you can change the settings on your physical instrument's panel, you can change the settings on the instrument panel objects in HP VEE. If your instrument is connected and live mode is `ON`, any valid changes you make on the HP VEE instrument panel will control the physical instrument, just as if you made the changes on that instrument's front panel. Let's continue with our example:

1. Select `I/O` ⟹ `Instrument Manager ...` again. The `Instrument Manager` dialog box appears. Click once, if necessary, to highlight `FncGen(@(NOT LIVE))`.
2. Then, click on the `Panel Driver` button. An outline of the `FncGen` instrument panel object appears in the Main window. Place the outline where you want it, and click the mouse button.



3. Click on `Sine`. A dialog box gives you a series of choices for the `Function` field. Double-click on `Square` to change the shape of the

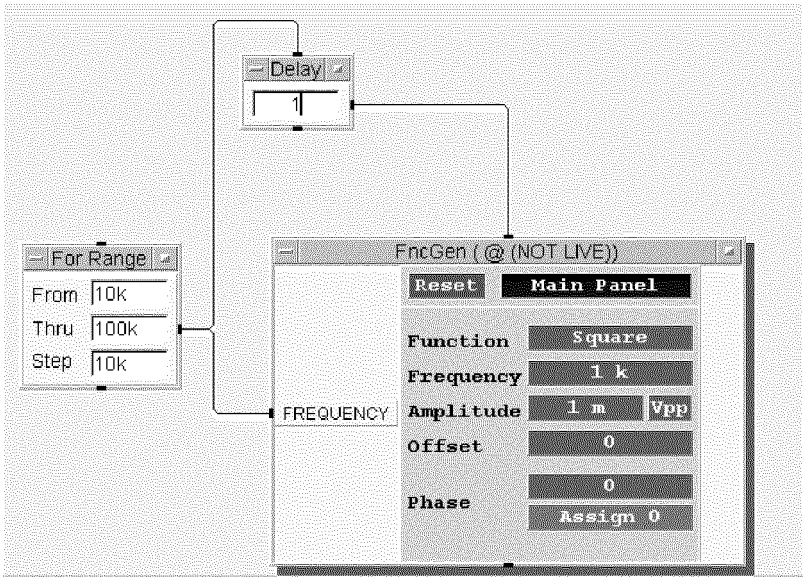
waveform. (If a function generator was connected, and live mode was `ON`, this change would also occur on the physical instrument.)

4. Click on the `Main Panel` field. A dialog box lists the panels for this particular instrument. Each panel allows you to change various instrument parameters. To try this, go to another panel; for example, the `Sweep` or `Modulation` panels. To do this, double-click on the panel name, or click on the panel name and then click on `OK`. The panel you selected appears in place of the main panel. By using the various panels, you can interactively access and control the features of the instrument.
5. Return to the main panel by clicking on the panel field and selecting `Main Panel`.

Using an Instrument Panel in a Program

Let's create a program that uses the `FncGen` object to control the frequency of the function generator in a step-wise fashion. To do this, follow these steps:

1. Add a `Frequency` data input terminal to the `FncGen` object. To do this, select `Add Terminal` ⟹ `Data Input` in the object menu. A dialog box lists the possible input terminals that you can add. Click on `Frequency` and then click on `OK`.
2. Add a `For Range` object (`Flow` ⟹ `Repeat` ⟹ `For Range`). Change the parameters as follows: `From = 10k`, `Thru = 100k`, and `Step = 10k`. (You can type either `10k` or `10000`.)
3. Add a `Delay` object (`Flow` ⟹ `Delay`). Click on the recessed field and enter `1` for the delay in seconds.
4. Connect the objects as shown in the next figure.



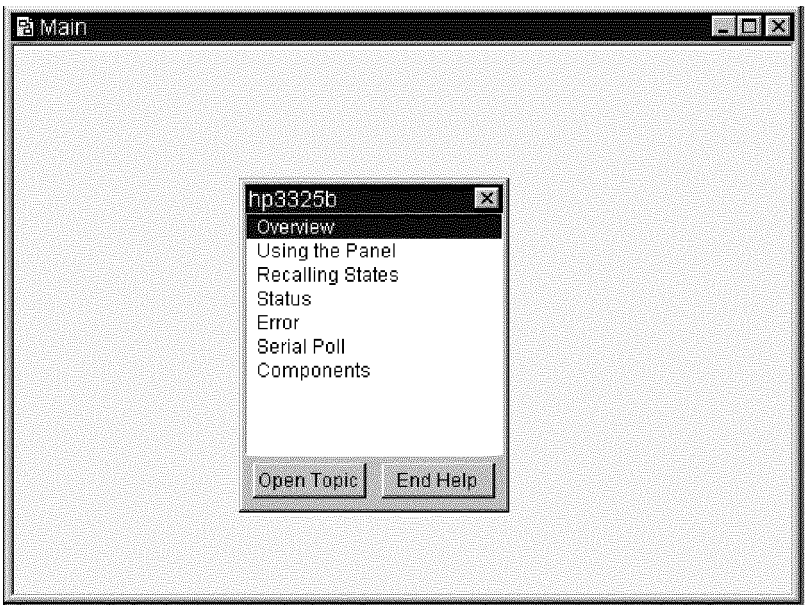
When you run the program, the `For Range` object steps the function generator through frequencies of 10 kHz, 20 kHz, and so forth, up to 100 kHz. Because of the `Delay` object, each loop takes 1 second.

If you have an HP 3325B Function Generator connected to your computer, you can turn live mode `ON` and control your real instrument. To do this, select `I/O` ⟹ `Instrument Manager ...` , and then select `FncGen (HP3325B @(NOT LIVE))`. Click on `Edit ...` . Click on `Advanced I/O Config ...` . Click on the `Live Mode:` field (it changes from `OFF` to `ON`). Then, click on `OK` to return to `Device Configuration`. Click on `OK` to return to the `Instrument Manager`. Click on `Save Config` to save the new configuration. Now try the program again and watch the front panel of your physical instrument. For more information, select `Help` ⟹ `Contents` from the HP VEE menu bar. Then, browse `How Do I ...` , `Tell Me About ...` , or `Reference`.

Getting Instrument Help

You can get online help for any instrument for which you installed an instrument driver. When you install a driver, the program also installs a help file for the driver. The instrument driver help files do not use the same help system as the other HP VEE help files, but you do get help.

To get help, select `Help` ⟹ `Instruments` . . . . From the list, click on the help file for your instrument; for example, `hp3325b.ih`. Open the file and you get help as shown in the next figure. Select the help you want according to the topics; for example, `Using the Panel`.



What's Next?

Now that you've finished our short introduction to HP VEE's capabilities, try some things on your own. Use the following information to help you:

- The online help is a good place to start (click on `Help` in the HP VEE menu). The online help discusses instruments, has an open example, discusses HP VEE, explains how to use help, and contains online contents. Clicking on `Contents` has browsable items; for example, `How Do I ...` and `Tell Me About ...` . Collectively, these items explain how to use HP VEE. You can browse topics as desired, and you can print the information.
- The *Controlling Instruments with HP VEE* manual explains how to control instruments via HP VEE programs.
- The *HP VEE Advanced Programming Techniques* manual provides detailed information about the advanced features of HP VEE.
- The `Reference`, which you reach via `Help` ⟹ `Contents`, provides specific information about objects, menu items, error codes, math functions, operators, and glossary items. There is even an ASCII table.

Glossary

Glossary

This Glossary defines terms used in this manual. For a complete glossary of HP VEE terms, select `Help` ⟹ `Contents". Then, select Reference". Finally, select Glossary.` In the glossary, clicking on a term displays a definition. When you finish reading the definition, clicking anywhere dismisses it.

Button
A graphical object in HP VEE that simulates a momentary switch or selection button, and which appears to pop out from your screen. When you "press" a button in HP VEE, by clicking on it with the mouse, an action occurs. (May also refer to the left or right mouse button.)

Cascading Menu
A sub-menu on a pull-down or pop-up menu that provides additional selections.

Checkbox
A recessed square box on HP VEE menus and dialog boxes that allows you to select a setting. To select a setting, click on the box and an "x" appears in the box to indicate a selection has been made. To cancel the setting, simply click on the box again.

Click
To press and release a mouse button. Clicking usually selects a menu feature or object in the HP VEE window. See also "Double-Click" and "Drag."

Clone
A menu item on the HP VEE object menus, that duplicates objects and their interconnections, placing a copy of them in the `Paste` buffer. `Clone` copies all the attributes of the cloned objects including pins, parameters, and size.

Component
A single instrument function or measurement value in an HP VEE instrument panel or component driver. For example, a voltmeter driver contains components that record the range, trigger source, and latest reading.

Component Driver
An instrument control object that reads and writes values to components you specifically select. Use component drivers to control an instrument using a driver by setting the values of only a few components at a time. (Component drivers do not support coupling.)

Container
See "Data Container."

Context
A level of the work area that can contain other levels of work areas (such as nested `UserObjects`), but is independent of them.

Cursor
A pointer (caret) in an entry field that shows where alphanumeric data will appear when you type information from the keyboard.

Cut Buffer
The buffer that holds objects that you cut or copy. You can then paste the object back into the work area with `Edit` ⟹ `Paste`.

Data Container
The data package that is transmitted over lines and is processed by objects. Each data container contains data and the data type, data shape, and mappings (if any).

Data Flow
The flow of data through and between HP VEE objects. Data flows from left to right through objects, but an object does not execute until it has data on all of its data input pins. Data is propagated from the data output pin of one object to the data input pin of the next object. Data flow is the chief factor that determines the execution of an HP VEE program.

Data Input Pin
A connection point on the left side of an object that permits data to flow into the object.

Data Output Pin
A connection point on the right side of an object that propagates data flow to the next object and passes the results of the first object's operation on to the next object.

Data Shape
Each data container has both a shape and type. The data shape can be either a scalar or an array (Array 1D, Array 2D, and so forth).

Data Type
Each data container has both a type and shape. HP VEE supports several data types including Text, Real, and Integer.

Detail View
The view of an HP VEE program that shows all the objects and the lines that connect them.

Direct I/O Object
An instrument control object that allows HP VEE to directly control an instrument without using an instrument driver.

Double-Click
To press and release a mouse button twice in rapid succession. Double-clicking is usually a short-cut to selecting and performing an action. For example, double-clicking on a file name from `File` ⟹ `Open` will select the file and open it.

Drag
To press, *and continue to hold down*, a mouse button while moving the mouse. Dragging moves something (for example, an object or scroll bar).

Drop-Down List
A list of selections obtained by clicking on the arrow to the right of a selection field.

Entry Field
A field that is typically part of a dialog box or an editable object, and which is used for data entry. An entry field is editable when its background is white.

Expression
An equation in an entry field that may contain input terminal names, global variable names, math functions, and user-defined functions. An expression is evaluated at run time. Expressions are allowed in `Formula`, `If/Then/Else`, `Get Values`, `Get Field`, `Set Field`, `Sequencer`, and `Dialog Box` objects, and in I/O transaction objects.

Font

HP VEE allows you to change the "font"—the size and style of type—used to display text for various HP VEE objects, titles, and so forth.

Grayed Feature

A menu feature that is displayed in gray rather than black, indicating that the feature is not active or not available. Dialog box items such as buttons, checkboxes, or radio buttons may also be grayed.

Group Window

A group window in Microsoft Windows is a window that contains icons for a group of applications. Each icon starts an application in the group.

HP-UX

The derivative of the UNIX operating system that has been developed by Hewlett-Packard Company.

Hypertext

A system of linking topics so that you can jump to a related topic when you want more information. In online help systems, typically hypertext links are designated with underlined text. When you click on such text, related information is presented.

Icon

1. A small, graphical representation of an HP VEE object, such as the representation of an instrument, a control, or a display.

2. A small, graphical representation of an application, file, or folder in the Microsoft Windows operating systems.

Main Window

A window that contains the primary work area in which you develop an HP VEE program. The work area for this window resides in the work space for the HP VEE window.

Maximize Button

A button on a `UserObject`, `UserFunction`, or the Main window, that makes the `UserObject`, `UserFunction`, or Main window, occupy all of the available work space.

Menu Bar

The bar at the top of the HP VEE window that displays the titles of the pull-down menus from which you select commands and objects.

Minimize Button
A button on an object, or the HP VEE window, that iconifies the object, or the HP VEE window.

Object
A graphical representation of an element in a program, such as an instrument, control, display, or mathematical operator. An object is placed in the work area and connected to other objects to create a program.

Object Menu
The menu associated with an object that contains features that operate on the object (for example, moving, sizing, copying, and deleting the object). To obtain the object menu, click on the object menu button at the upper-left corner of the object, or click the right mouse button with the pointer over the object.

Object Menu Button
The button at the upper-left corner of an open view object, which displays the object menu when you click on it.

Open View
The representation of an HP VEE object that shows more detail than the minimized view (icon). Most object open views have fields that allow you to modify the operation of the object.

Panel Driver
An instrument control object that forces all the function settings in the corresponding physical instrument to match the settings in the control panel displayed in the open view of the object.

Panel View
The view of an HP VEE program, or of a `UserObject` or `UserFunction`, that shows only those objects needed for the user to run the program and view the resulting data. You can use panel views to create an operator interface for your program.

Pin (or Pins)
An external connection point on an object to which you can attach a line.

Pointer

The graphical image that maps to the movement of the mouse. The pointer allows you to make selections and provides you feedback on a particular process underway. HP VEE has pointers of different shapes that correspond to process modes, such as an arrow, crosshairs, and hourglass.

Pop-Up Menu

A menu that is raised by clicking the right mouse button. For example, you can raise the `Edit` menu by clicking the right mouse button in an empty area within the work area. Or you can raise the object menu by clicking the right mouse button on an inactive area of an object.

Preferences

Preferences are attributes of the HP VEE environment that you can change using the `Default Preferences` button on the toolbar, or the menu `File` ⟹ `Default Preferences`. For example, you can change the default colors, fonts, and number format.

Program

In HP VEE, a graphical program that consists of a set of objects connected with lines. The program typically represents a solution to an engineering problem.

Program Explorer

A facility in the HP VEE window that permits exploration of a program, especially the parts of a program that might not be visible on the physical screen.

Propagation

The rules that objects and programs follow when they operate or run. See also "Data Flow."

Properties

Object properties are attributes of HP VEE objects that you can change using `Properties` on the object menu; for example, colors, fonts, and titles.

Pull-Down Menu

A menu that is pulled down from the menu bar when you position the pointer over a menu title and click the left mouse button.

Scroll Arrow
An arrow that, when clicked on, scrolls through a list of data files or other choices in a dialog box, or moves the work area.

Scroll Bar
A rectangular bar that, when dragged, scrolls through a list of data files or other choices in a dialog box, or moves the work area.

Select
To choose an object, an action to be performed, or a menu item. Usually you select by clicking with your mouse.

Selection Field
A field in an object or dialog box that allows you to select choices from a drop-down list.

Sequence Input Pin
The *top* pin of an object. When connected, execution of the object is held off until the pin receives a container (is "pinged").

Sequence Output Pin
The *bottom* pin of an object. When connected, this output pin is activated when the object and all data propagation from that object finishes executing.

Status bar
A line at the bottom of the HP VEE window in which information about the current status of and information about HP VEE is displayed.

Status field
A field displaying information that cannot be edited. A status field looks like an entry field, but has a gray background.

Terminal
The internal representation of a pin that displays information about the pin and the data container held by the pin. Double-click on a terminal to view the container information.

Title Bar
The rectangular bar at the top of the open view of an object or window, which shows the title of the object or window. You can turn off an object title bar using `Properties` in the object menu.

Toolbar
The rectangular bar at the top of the HP VEE window which provides buttons for quick access to frequently used commands. The buttons run commands from; for example, the `File`, `Edit`, `View`, `Device`, and `Debug` menus.

Transaction
The specifications for input and output (I/O) used by certain objects in HP VEE. Examples include the `To File`, `From File`, `Direct I/O`, and `Sequencer` objects. Transactions appear as phrases listed in the open view of these objects.

UserObject
An object that can encapsulate a group of objects to perform a particular purpose within a program. A UserObject allows you to use top-down design techniques when building a program, and to build user-defined objects that can be saved in a library and reused.

Views
HP VEE presents a program in one of two views; panel view, which provides a user interface for an HP VEE program, or detail view, which provides a window for developing an HP VEE program.

Windows 95
An operating system, developed by Microsoft Corporation, in which HP VEE runs.

Windows NT
An operating system, developed by Microsoft Corporation, in which HP VEE runs. This includes versions 3.51 and 4.0.

Work Area
An region within the `Main` window (also the `UserObject` and `UserFunction` windows) in which you place HP VEE objects and wire them together to create an HP VEE program.

Work Space
A region in the HP VEE window that contains the programming or editing windows such as `Main`, `UserObject`, and `UserFunction`. These windows contain work areas in which you place HP VEE objects and wire them together.