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

If you have not already installed HP VEE, follow the instructions in the *Installing HP VEE* manual
included with the HP VEE installation media.

There are two chapters in this manual:

- Chapter 1, "Quick Start," takes you through some simple, hands-on
  exercises that quickly show you how to work within HP VEE and create
  HP VEE programs. The best way to learn how to use HP VEE is to follow
  along, doing these exercises sequentially on your computer. This will take
  about an hour and a half, but you can stop for a break at any time.

- Chapter 2, "Some HP VEE Programming Techniques," illustrates some
  selected HP VEE programming techniques such as mathematically
  processing data and instrument I/O.

Conventions Used in this Manual

This manual uses the following typographical conventions:

Example	Represents
HP VEE Reference	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, 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` $\Longrightarrow$ `Open`	The "$\Longrightarrow$" is used in a shorthand notation to show the location of HP VEE features in the menu. For example, "`File` $\Longrightarrow$ `Open`" means to select the `File` menu and then select `Open`.
`Zoom Out	In 2x	In 5x`	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 PC keyboard.
Press (Ctrl)+(O)	Represents a combination of keys on the PC 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

1

Quick Start

Quick Start

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

In this section you'll learn how to work with the HP VEE graphical programming language — how to manipulate objects, create programs, save files, and print the screen. The best way to use this manual is to follow along, doing the exercises on your computer.

Of Mice and Menus

You're probably already familiar with your computer's menu-driven user interface — with pull-down menus and dialog boxes that you can control with the mouse and keyboard. HP VEE uses this standard user interface. The documentation that came with your computer and its operating system includes information about such topics as:

- Selecting and canceling menus.
- Choosing menu commands.
- Using the control menus.
- Working with dialog boxes.
- Working with windows.
- Using online help.

For further information refer to the following, depending on the computer system that you are using:

- *Microsoft® Windows on a PC:*

  □ The "Windows Basics" chapter in the *Microsoft Windows User's Guide.*

  □ The **Microsoft Windows Tutorial**. (To run the Tutorial, select **Help** from the **Program Manager** window and then click on **Windows Tutorial**.)

- *HP VUE on an HP-UX workstation:*

  □ The "Basic Skills" chapter in the *HP Visual User Environment User's Guide.*

  □ *HP VUE Help.*

- *SunOS/OpenWindows on a Sun SPARCstation:*

  The SunOS/OpenWindows documentation.

N O T E

Whenever we say to "click on" a menu selection, icon, button, or object, we mean to move the mouse pointer to the appropriate location and quickly press and release the *left* mouse button. When we say to "double-click," we mean to click the left mouse button twice in rapid succession. The right mouse button is used less frequently, and only for special purposes. If you need to click the right mouse button, we'll say so explicitly. If your mouse has a middle button, you won't need to use it for HP VEE.

Starting HP VEE

To start HP VEE:

- *HP VEE for Windows*—Double-click on the `HP VEE` icon in the group window (entitled `HP VEE 3.0` by default).
- *HP VEE for UNIX®*—Type `veetest` (Return) from the shell prompt in an HP VUE, X11, or OpenWindows window.

It takes a few seconds for HP VEE to load, and then a window like the following one appears:

Title Bar ⟶
Menu Bar ⟶
Tool Bar ⟶

Work Area ⟶

			HP VEE								▼	▲
File	Edit	Flow	Device	I/O	Data	Math	AdvMath	Display	Help			
🔲 HEWLETT PACKARD					Untitled			Run	Stop	Cont	Step	
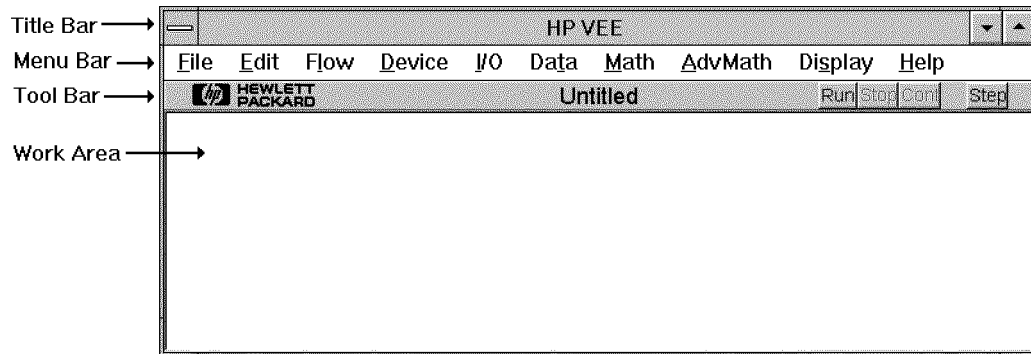
In the figure above we've identified the four major areas of the HP VEE window:

- The **title bar**. The title bar gives the name of the application. (You can move the window by dragging the title bar.)

- The **menu bar**, which allows you to select menu items and features.

- The **tool bar**, which provides the `Run`, `Stop`, `Cont`, and `Step` buttons to control HP VEE programs. The tool bar also displays the title of an HP VEE program (default = `Untitled`).

- The **work area**, which is the space where you can create an HP VEE program.

You can move or resize the HP VEE window by using the standard techniques for your operating system.

**What If I Want to Quit?** You can quit HP VEE at any time. Before you quit, you may want to save the contents of your work area (refer to "To Save Your Program" later in this chapter). Then exit HP VEE (refer to "Quitting HP VEE"). While doing the exercises in this chapter, you can save your file and quit whenever you want to take a break. You can then restart HP VEE, open your file (refer to "To Open a File"), and pick up where you left off.

Working with Objects

An HP VEE program consists of objects, which you place in the work area
and connect together to form a program. Let's begin by learning to work with
objects.

To Add Objects to the
Work Area

To add an object to the work area, you pull down the appropriate menu. For
example, to select the **Function Generator** object, click on **Device** in the
menu bar, and then click on **Virtual Source** in the **Device** menu. The
cascading menu of virtual source objects appears, as shown in the following
figure.
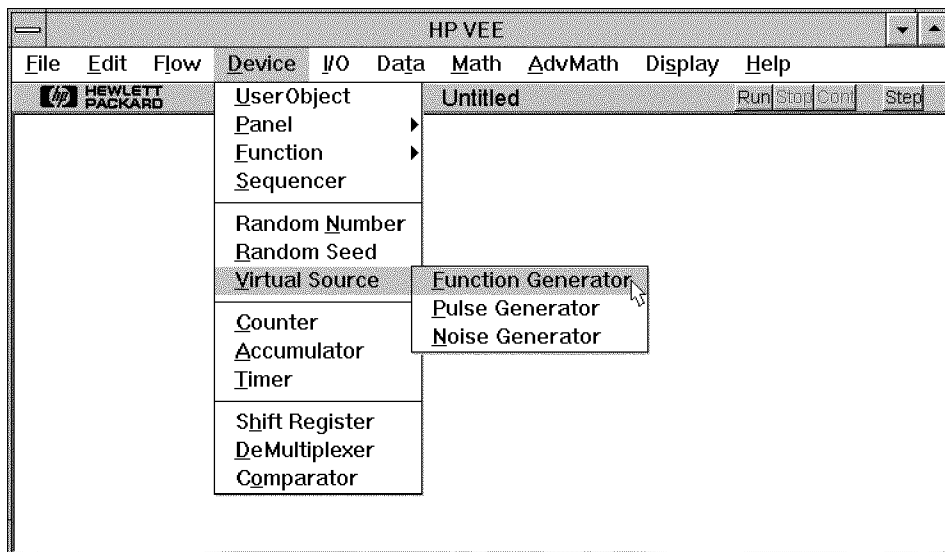
NOTE

From now on, we'll use a shorthand notation to indicate where to find a menu selection. For example, the location of the **Function Generator** object can be given as:

Device ⟹ **Virtual Source** ⟹ **Function Generator**

Now add the object to the work area by clicking on the **Function Generator** menu item. An outline of the object appears in the work area. Move the outline to where you want it and click the mouse button again. The object appears as shown below:
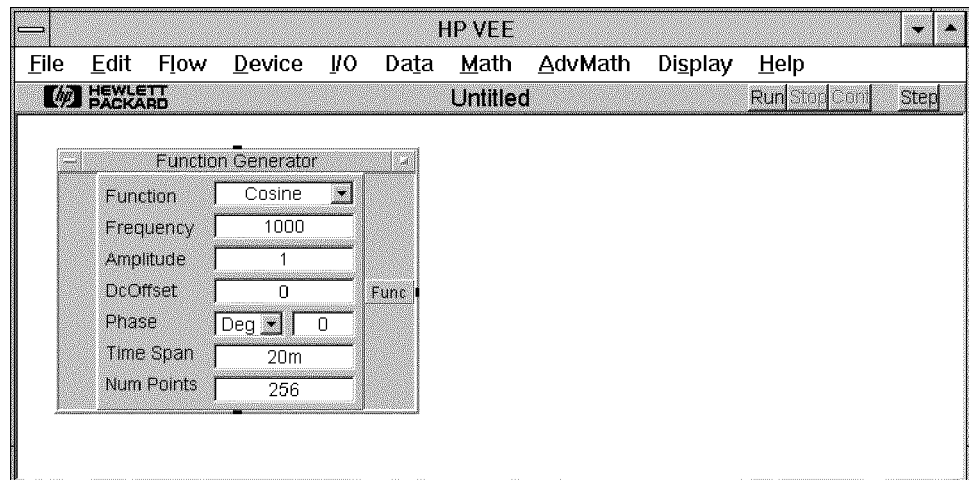
Once you have placed an object in the work area, you can move it by dragging its title bar, just as you would move a window.

To Change Object Views

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

Object
Menu
Button

Title Area

Minimize
Button

Input
Terminal
Area

Output
Terminal
Area

Function Generator

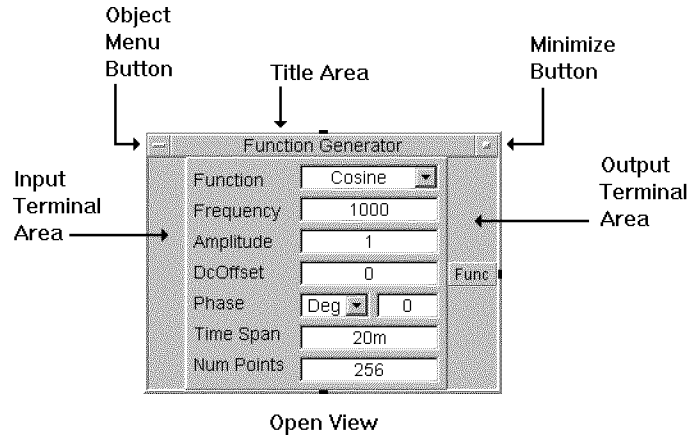| Function | Cosine |
Frequency	1000
Amplitude	1
DcOffset	0
Phase	Deg	0
Time Span	20m
Num Points	256

Func

Open View

Icon

The **Function Generator** object, by default, appears in its open view. In the open view all object parameters are visible, and you can edit them. The object menu button, title area, and minimize button are displayed at the top of the object. The input terminal area and output terminal area are displayed on the left and right sides of the open view object.

To change an object from its open view to its icon, click once on the minimize button. You can use the icon to save space in your work area. To return to the open view, double-click on the icon.

To Select the Object Menu   Each HP VEE object has an **object menu**, which allows you to change the size, position, and several other attributes of the object. Also, you can get online help for the specific object from the object menu.

To select the 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.)
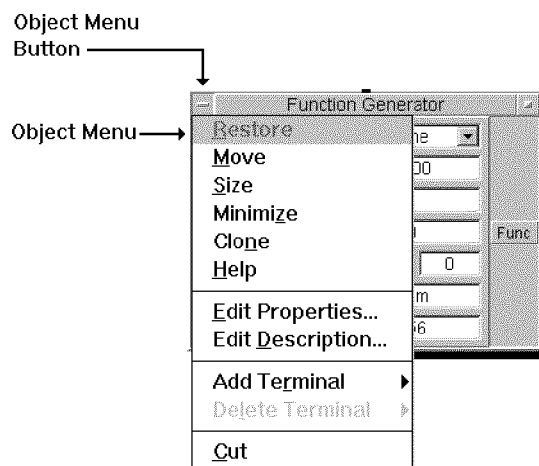
Now you can click on one of the object menu choices to perform the action you desire. Or, to make the object menu go away, click on an empty area *outside* the menu.
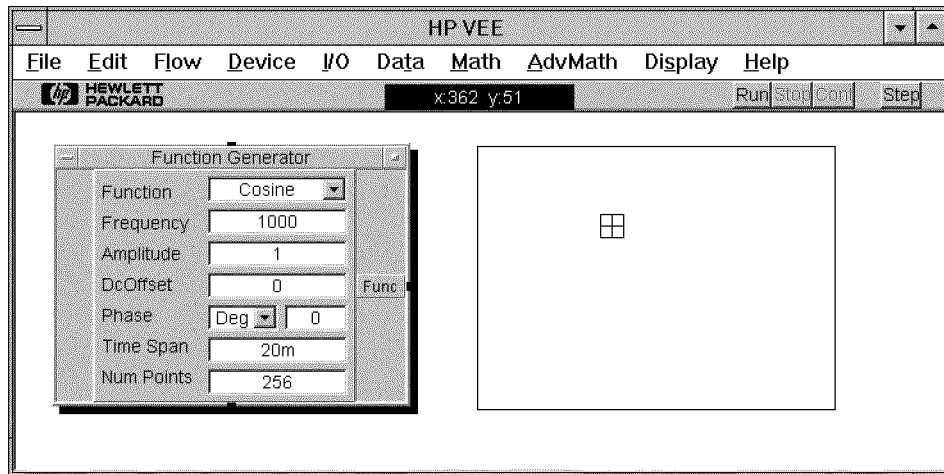

Shortcut

You can also select the object menu as a **pop-up menu** by clicking the *right* mouse button with the mouse pointer positioned anywhere over the object. This works for both the open view and the icon.

To Move an Object

To move the **Function Generator** object, click on **Move** in the object menu (select *object menu* ⟹ **Move**), 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 below:[*]

Now release the mouse button — the object will jump to the new location.

Shortcut

You can move an open view object by grabbing and dragging its title area. You can also grab and drag any part of an open view object *except* for buttons, entry fields, pins, terminals, or the bottom right corner (which resizes the object). You can move an icon by grabbing and dragging any part of it except the bottom right corner (which resizes it).

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[*] The status bar just above the work area 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 area. Use this information if you need to place an object in an exact position.

To Clone (Duplicate) an Object

To clone the **Function Generator** object, click on **Clone** in the object menu. An outline of the object appears, and you can move the outline to the desired location:
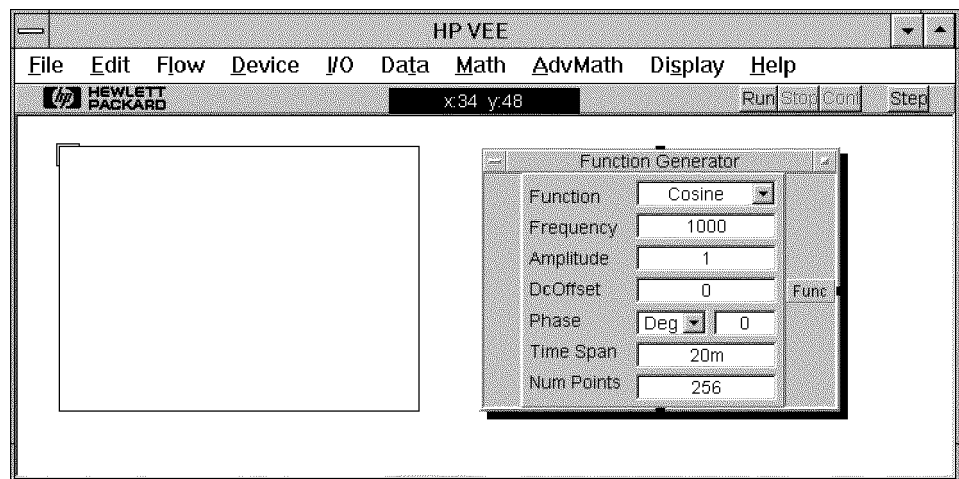
Now click the mouse button and the cloned object appears, while the original object remains.

To Delete an Object

To delete an object from the work area, select *object menu* $\Longrightarrow$ **Cut** for the object you want to delete. For example, select 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. You can use **Edit** $\Longrightarrow$ **Paste** to paste the object back into the work area.

Shortcut

You can also delete an object by *double-clicking* on its object menu button. Be careful, this is easy to do by accident.

To Change the Size of an Object.

To change the size of an object, select *object menu* ⟹ `Size`. The mouse pointer becomes a "bottom-right-corner" bracket. Move this bracket to define the size that you want, as shown below:
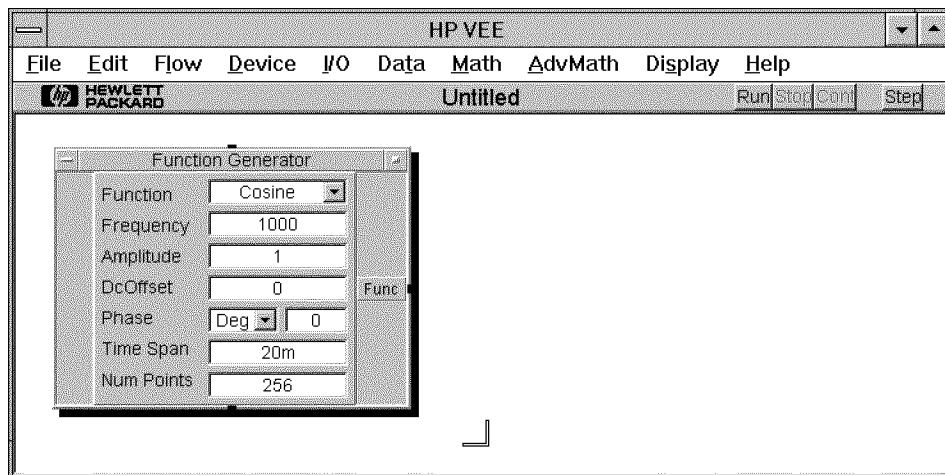
When you click the mouse button again, the object is resized.

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 an icon) by clicking and dragging on its bottom right corner.

To Change the Title of an Object

To change the title, select *object menu* $\Longrightarrow$ **Edit Properties** and edit the title in the dialog box:
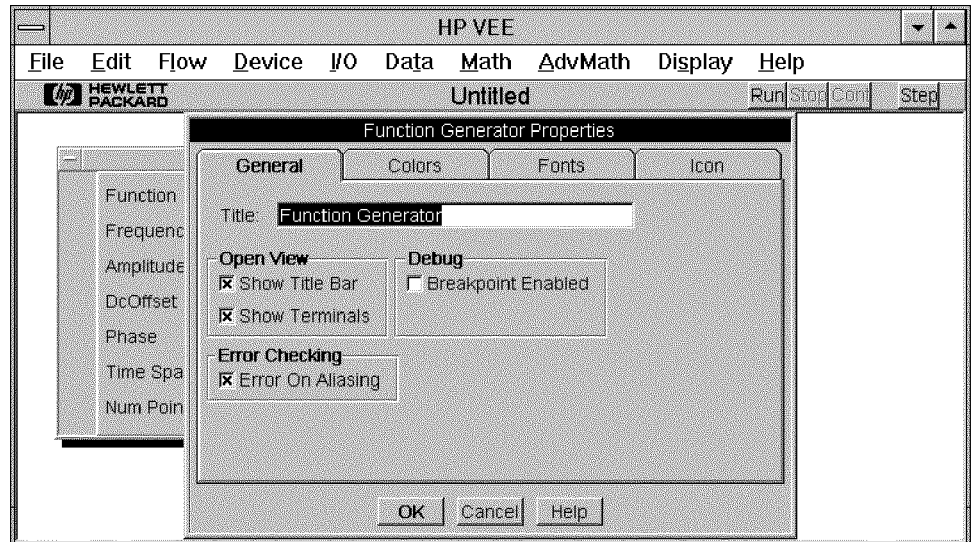

Just start typing to enter the new title. The old title is deleted automatically. When you click on **OK**, the new title appears in the title area. If you minimize the object, the new title appears in the icon.

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

To change the title of an object, double-click on the current title of the open view object. The properties dialog box appears. Type in the new title and press (Enter).
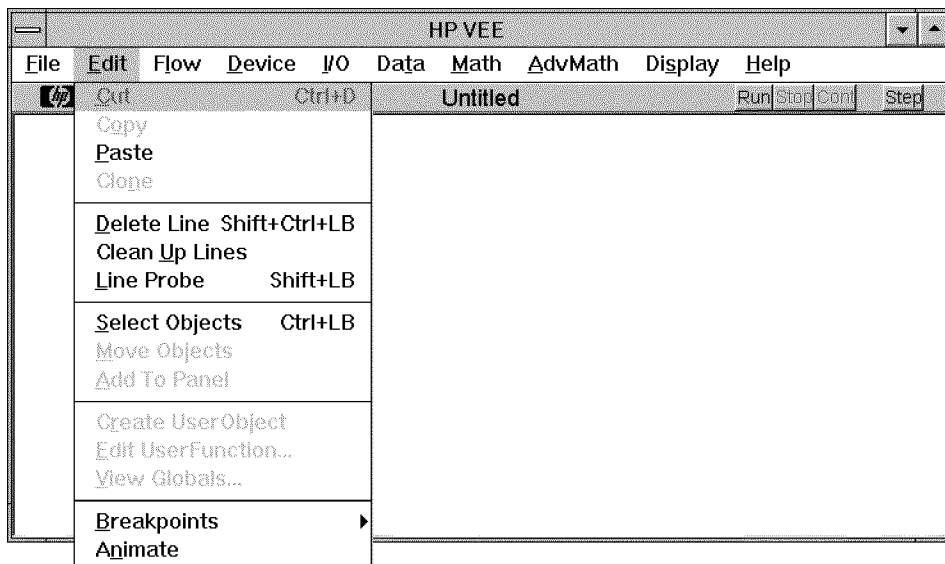

For further information about changing object properties, refer to your *How to Use HP VEE* manual.

To Clear the Work Area

To clear all objects from the work area, select **File ⟹ New**. Try it now by discarding the changes that you've made so far (unless you want to save them, of course). Select **File ⟹ New** and click on **No** in response to the prompt **Save Changes First?**.

To Select the Edit Menu

The **Edit** menu allows you to make changes involving several objects in the work area. You can select the **Edit** menu in either of two ways. If you select **Edit** from the menu bar, the **Edit** menu appears, as shown below:

HP VEE									
File	Edit	Flow	Device	I/O	Data	Math	AdvMath	Display	Help

Untitled   Run Stop Cont   Step

Cut	Ctrl+D
Copy	
Paste	
Clone	
Delete Line	Shift+Ctrl+LB
Clean Up Lines	
Line Probe	Shift+LB
Select Objects	Ctrl+LB
Move Objects	
Add To Panel	
Create UserObject	
Edit UserFunction...	
View Globals...	
Breakpoints	▶
Animate	

Or, you can select the **Edit** menu as a pop-up menu by clicking the *right* mouse button in any *blank* area of the work area.

In either case, click the left mouse button anywhere outside the menu to make the menu go away.

NOTE

The `Edit` menu selections `Cut`, `Copy`, `Clone`, `Move Objects`, `Add to Panel`, and `Create User Object` remain inactive ("grayed out") until at least one object has been selected. You'll see how this works in the next section. (The selections `Edit User Function` and `View Globals` are also inactive unless User Functions or Global variables are present.)

To Cut and Paste Objects The `Edit` menu allows you to cut and paste objects in the work area. For example, add a `Formula` object to the work area by selecting `Math ⟹ Formula`.

Now click on the object. The object's "shadow" appears, as shown below:
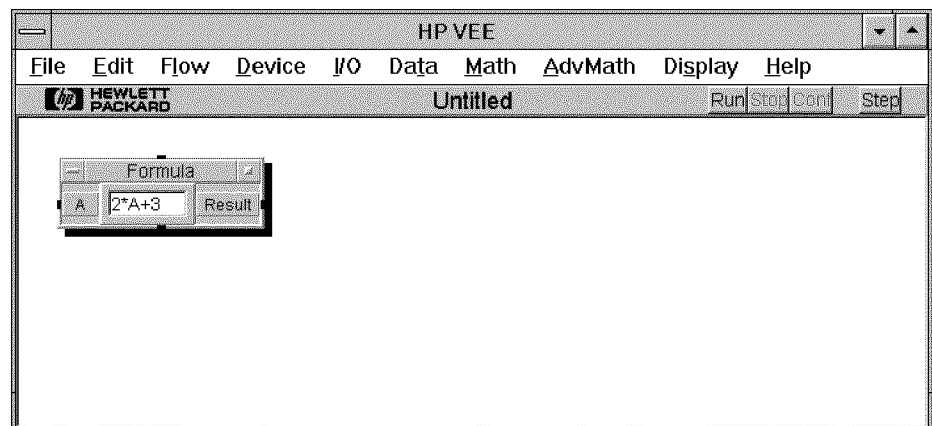
This shadow indicates that the `Formula` object is *selected*, and you can now edit it. To cut the object, select `Edit ⟹ Cut`. (`Cut` becomes active when you select the object. It remains inactive, or "grayed out," until you select at least one object.)

Now paste the object back into the work area (`Edit ⟹ Paste`). Move the outline to the desired location and click the mouse to paste the `Formula`

object. Once 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 or from the object menu), the object is deleted from the work area, 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   You can either **Copy** or **Clone** objects by using the **Edit** menu. The **Copy** selection just copies the selected object into the cut buffer. You can then paste the object as if you had cut it. On the other hand, the **Clone** selection clones the selected object directly, in one step.

Click on the **Formula** object to select it, and then select **Edit** $\Longrightarrow$ **Clone**. Move the object outline to a new location, as shown below:
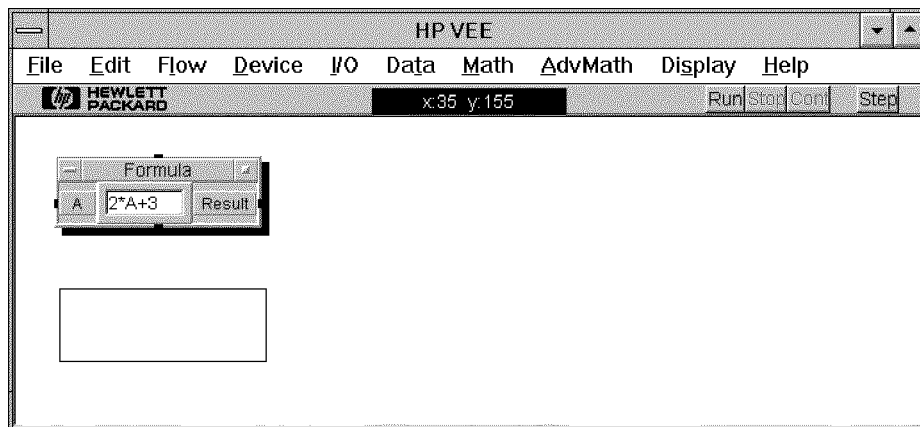

Click again and another **Formula** object appears in the outlined location.

To Select and Edit Multiple Objects   Although the easiest way to select an object is to click on it with the mouse, you can only select one object at a time that way. When you select a second object, the first is "unselected" and its shadow disappears.

To select multiple objects, select **Edit** $\Longrightarrow$ **Select Objects** and then click on each object you want to select. Each will become shadowed in turn. For example, the two **Formula** objects, when selected, appear as follows:
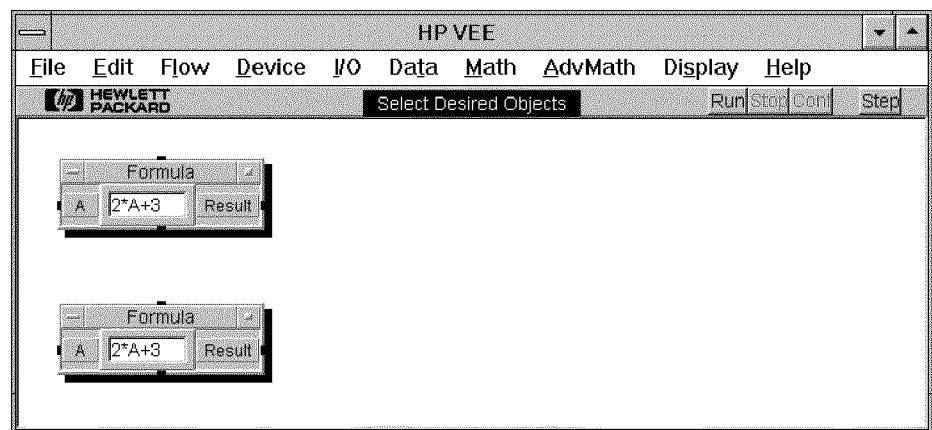
Now click the left mouse button in an empty part of the work area. The **Select Desired Objects** mode is turned off, but the objects remain selected. (However, if you click a second time, the objects become "unselected.")


Shortcut

You can also select a series of objects by pressing and holding Ctrl, and then clicking on each object that you want to select. (Ctrl + *left mouse button*.)

You can use the **Edit** menu to move or copy the selected objects. For example, you can clone the objects with **Edit** $\Longrightarrow$ **Clone**. An outline defining

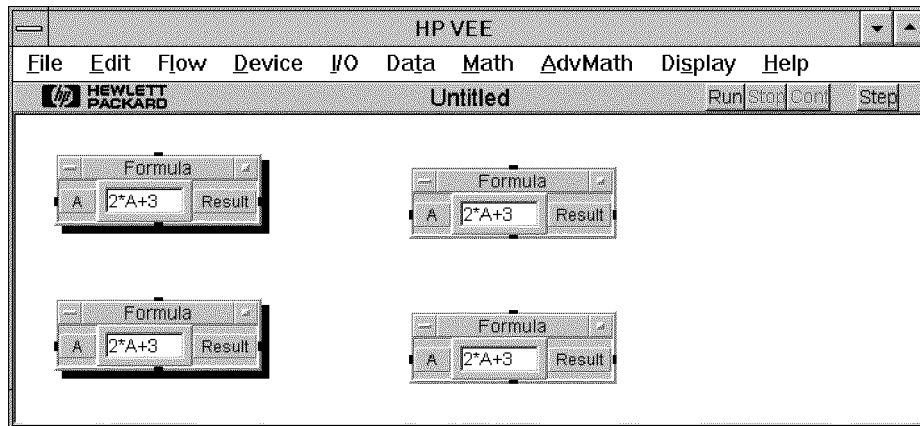*both* selected objects will appear. Just move the outline to the desired location, as shown in the following figure.
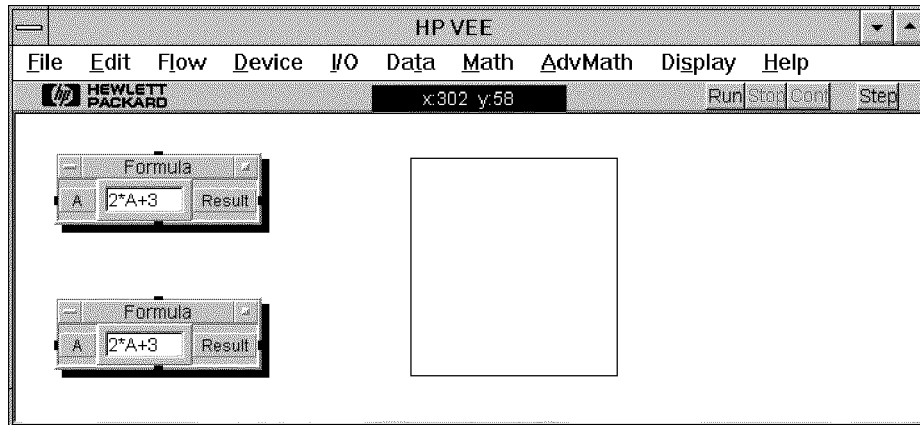
Now click the mouse button again (at the desired location), and two more `Formula` objects appear:

You can select any number of objects with **Edit** $\Longrightarrow$ **Select Objects**. You can then **Cut** and **Paste** the selected objects, or you can use **Move Objects**

to move them. To "unselect" the selected objects, just click on an empty area in the work area. Try experimenting with these commands on your own.

To Move the Work Area So far we've looked at a couple of ways to move individual objects, or to move multiple objects. You can also move the entire work area. One way to move the work area is to click on an empty area and drag the work area in any desired direction. Another way to move the work area is to scroll it using the **scroll bars** and **scroll arrows**, which appear if one or more objects are placed outside the visible work area.

For example, click on an empty area (well away from any object) and drag the work area so that objects are outside both the vertical and horizontal boundaries, as shown below. (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 line will disappear.)
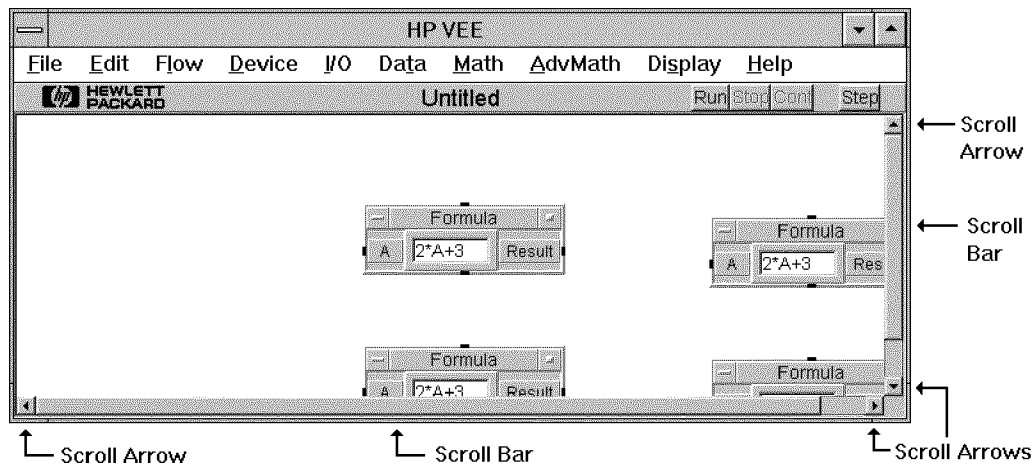

When you release the mouse button, the scroll bars and scroll arrows appear, as shown above:

- To move the work area up and down, drag the scroll bar in the right margin of the HP VEE window.

- To move the work area left and right, drag the scroll bar in the bottom margin of the HP VEE window.

- To move the work area in small steps, use the appropriate scroll arrow: left, right, up, or down.

To Change Default
Preferences

To change the default settings in your HP VEE environment, select **File** ⟹ **Edit Default Preferences**. The **Default Preferences** dialog box appears:
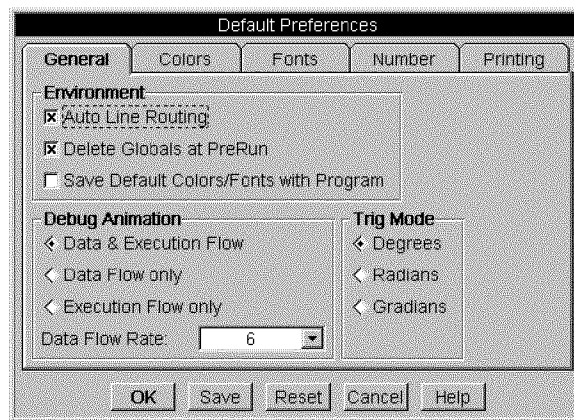
This dialog box has five "tabs," which allow you to select "folders" to edit:

- **General**—This tab is the default when the **Default Preferences** dialog box appears (shown above). You can change the HP VEE **Environment**, **Debug Animation**, and **Trig Mode** parameters.

- **Colors**—This tab allows you to customize the default colors in your HP VEE environment.

- **Fonts**—This tab allows you to customize the default fonts in your HP VEE environment.

- **Number**—This tab allows you to change the default number format.

- **Printing**—This tab allows you to set default parameters for your printer.

For further information about changing default preferences, refer to your *How to Use HP VEE* manual.

Understanding Pins and Terminals

A single object can do little by itself. However, by connecting objects together with lines, you can construct an HP VEE program. The points of connection are the input and output **pins**. Most objects have one or more of the following kinds of pins:

- Pins on the left-hand side of an object are **data input pins**.

- Pins on the right-hand side of an object are **data output pins**.

- The pin on the top of an object is the sequence input pin.

- The pin on the bottom of an object is the sequence output pin.

```
                        Sequence
                        Input Pin
                            |
                            ↓
        Data                          Data
        Input  ──→ [        ] ←──     Output
        Pin                           Pin
                            ↑
                            |
                        Sequence
                        Output Pin
```
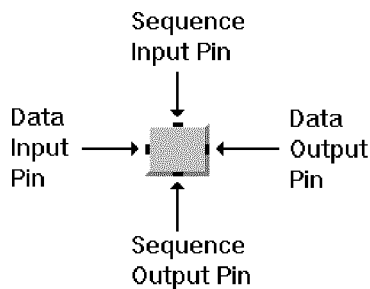
Some objects have all four kinds of pins, while others have only one or two kinds of pins. In an object's open view, the data input and output pins can be represented as input and output **terminals**, which display their **terminal labels**. The terminal labels are visible only in the open view, and only if the `Show Terminals` option is turned on.

Let's look at an example. Add a **Formula** object to the work area (**Math** $\Longrightarrow$ **Formula**). By default, the object shows its terminals, as shown below on the left:
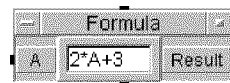
**Show Terminals
Is Active**
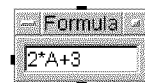
**Show Terminals
Is Not Active**

If you turn off **Show Terminals**, the **Formula** object appears as shown on the right.

To turn **Show Terminals** on or off, select **Edit Properties** from the object menu. The properties dialog box displays a checkbox in front of **Show Terminals**.
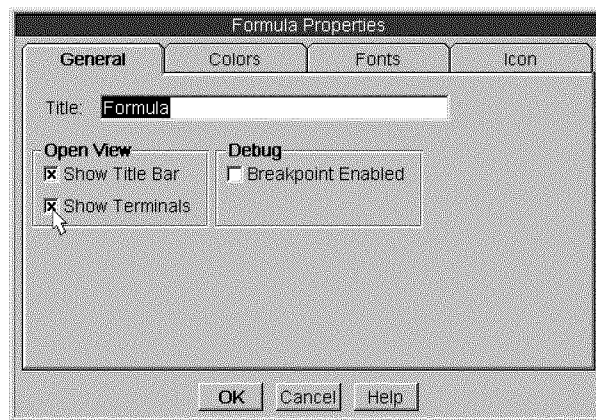
Click on the checkbox, if checked, to turn **Show Terminals** off. Click on the checkbox again to turn **Show Terminals** back on. (Click on **OK** after you have made your selection.)

For further information about changing object properties, refer to your *How to Use HP VEE* manual.

**To Add a Terminal**

You can add a second data input terminal to the **Formula** object by using the object menu (*object menu* ⟹ **Add Terminal** ⟹ **Data Input**). Or, provided **Show Terminals** is active, you can simply 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:
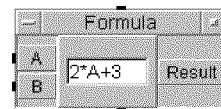
To Obtain Terminal Information

If you want to obtain information about a terminal, double-click on the terminal label area. For example, if you double-click on terminal **B**, the following dialog box appears:
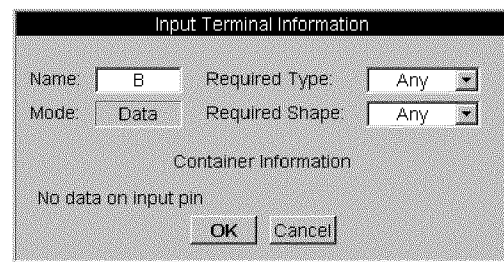
You can now edit the terminal. The dialog box has three kinds of fields:

- A field with a white background, but no arrow, is an **entry field**, which 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.

- A field with a gray background is a **status field**, which cannot be edited. For example, the **Mode** field cannot currently be edited.

- A field with a white background that has an arrow on its right-hand side
  is a **selection field**. Click on the field or its arrow and a **drop-down list**
  appears. 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:
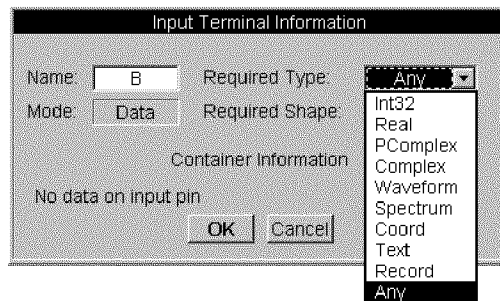
If you select a data type other than `Any` for a data input terminal, only the
specified type of data, or data that can be converted to that type, will be
accepted by the terminal. Most of the time it is best to leave the `Required`
`Type` and `Required Shape` fields set to `Any`. For further information about
data types and shapes, refer to *How to Use HP VEE*.

To Delete a Terminal   To delete a terminal, you can use the object menu:

Use *object menu* ⟹ `Delete Terminal` ⟹ `Input` to delete an input.

Use *object menu* ⟹ `Delete Terminal` ⟹ `Output` to delete an output.

Or, as a shortcut, you can place the mouse pointer over the terminal you
want to delete and press Ctrl+D. However, make sure that you place the
pointer over the terminal — otherwise, you may accidentally delete the object
itself. (Ctrl+D is also the shortcut for deleting an object.)

Getting Help

HP VEE uses the standard online help system for your operating system. Click on **Help** and the following menu appears:
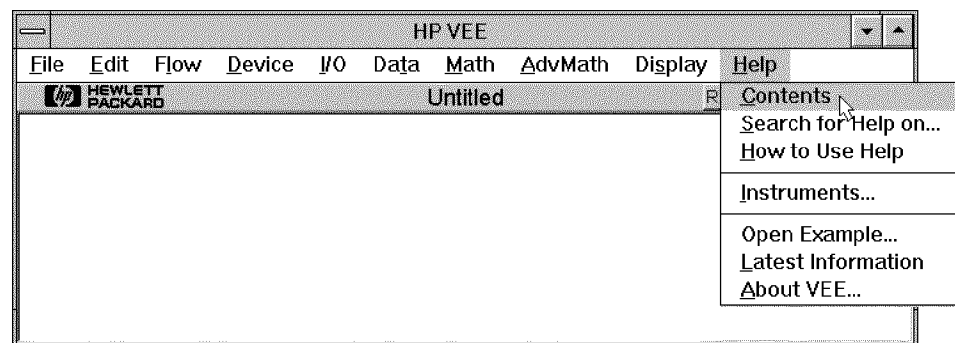
Select **How to Use Help** for information on the help system. Or select **Contents** to start *HP VEE Help*. (The HP VEE for Windows help screens are shown here. The UNIX screens are slightly different.)
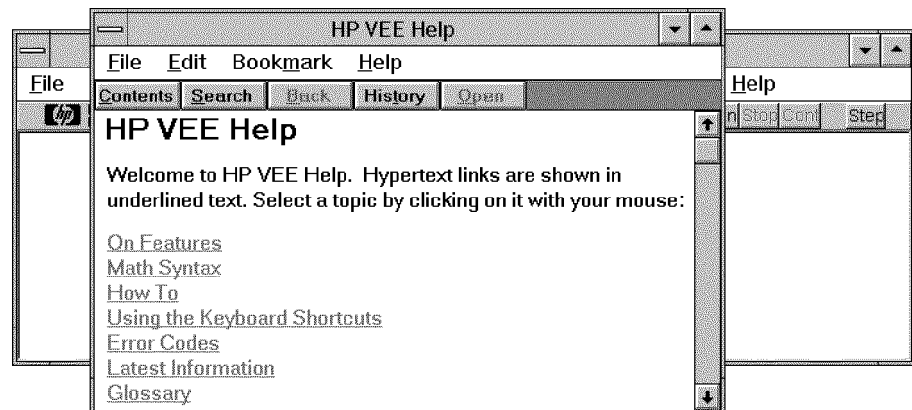
The help window is **hypertext** driven. Just click on the desired topic to move through the help system. The major topics are listed in the **Contents** screen:

- **On Features** brings up a list of HP VEE features and objects. Click on the name of the feature that you want to explore.

- **Math Syntax** brings up a list of HP VEE mathematical operators and functions that you can use in the **Formula** object. Most of these operators and functions are also available as individual objects that you can select from the **Math** and **AdvMath** menus.

- **How To** brings up some topics that summarize how to use HP VEE.

- **Using the Keyboard Shortcuts** brings up a list of keyboard accelerators.

- **Error Codes** brings up the list of HP VEE error codes and associated messages.

- **Latest Information** brings up the latest information on the current HP VEE release.

- **Glossary** brings up a list of terms with pop-up definitions.

For help on a particular object, you can click on **Help** in the *object menu* for that object. This takes you directly to the appropriate help topic.

To quit help and close the help window, select **File** $\Longrightarrow$ **Exit** *for the help window, not for the HP VEE window.*

Quitting HP VEE

You can quit HP VEE by selecting **File** $\Longrightarrow$ **Exit**. However, if a program is running, you'll have to stop it first (refer to "To Run Your Program" later in this chapter). Also, if you haven't saved your most recent changes to a file, a dialog box asks you if you want to save your changes. Select **No** to discard your changes, or **Yes** to save them to a file (refer to "To Save Your Program" later in this chapter).

Programming with HP VEE

Now that you've learned to work with objects and the HP VEE user interface, let's look at how to use objects to create HP VEE programs. We'll also discuss how HP VEE graphical programs work.

A Simple Program

In this section you'll create a simple HP VEE program, print the HP VEE screen, and save your program to a file.

To Create a Simple Program

Fundamentally, an HP VEE program consists of HP VEE objects connected together to form an executable "block diagram." Let's create a very simple program that displays a waveform. If you've quit HP VEE, restart it. If HP VEE is already running, clear the work area by selecting `File ⟹ New`.

Now 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.

Data Output Pin ——————————— Data Input Pin
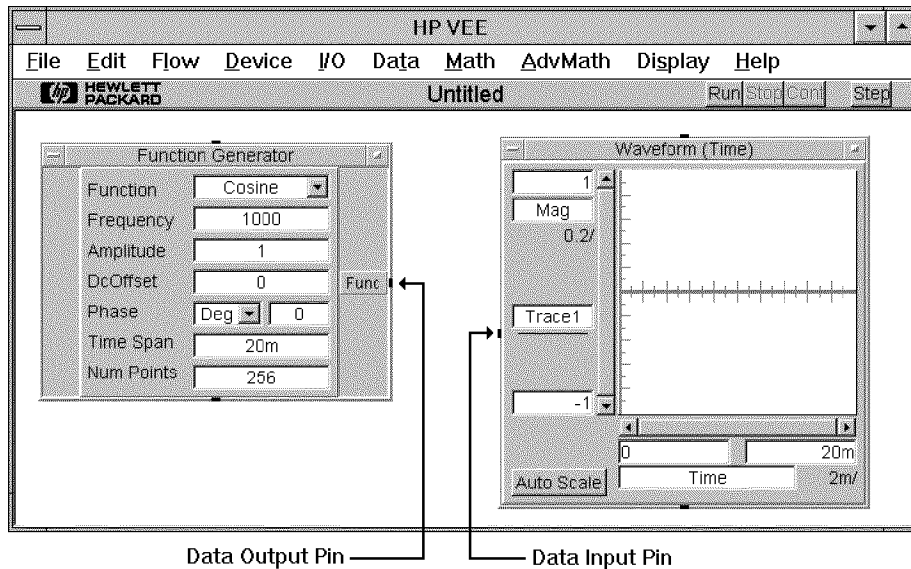
Now you can complete the program by connecting the data output pin on the **Function Generator** to the data input pin on the **Waveform (Time)** display. Click the left mouse button just outside of one of the pins. (Don't click on the pin itself, or inside the object — you'll end up moving the object.) Now move the mouse pointer 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 is automatically rerouted to the most logical path between the two objects. This auto-line routing feature saves you lots of time when you build a large program.

NOTE

Occasionally you may want to use `Edit` $\Longrightarrow$ `Clean Up Lines` to reroute all of the lines in your program.

You can add a title for your program. Just double-click on the default title (`Untitled`) and change the title to `Simple Program` in the dialog box. Then click on `OK`.

To Run Your Program

To run your program, click on the `Run` button in the tool bar. The program displays a 1000 Hz cosine wave in the `Waveform (Time)` display, as shown below:
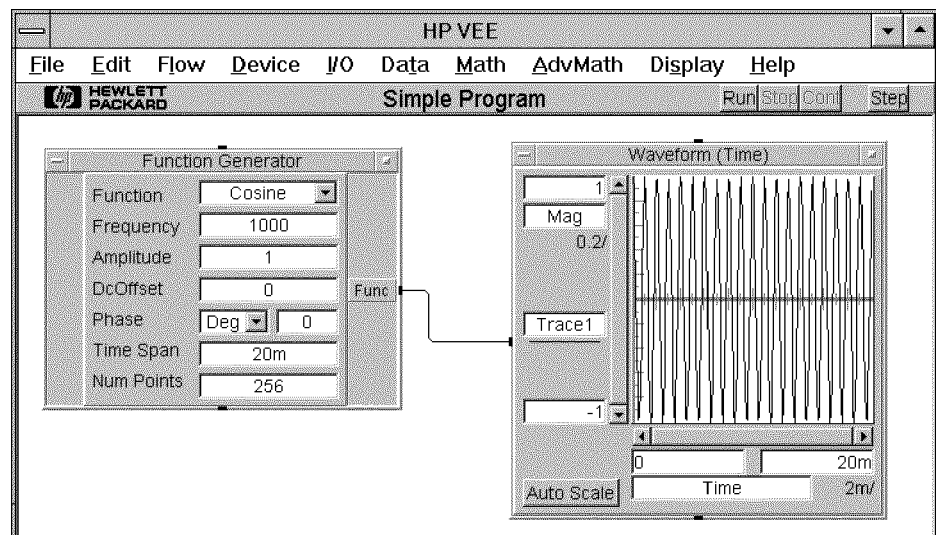
In addition to the `Run` button, you can use the `Stop`, `Cont`, and `Step` buttons to control the program. Once you have stopped a running program,

---

you can use `Cont` to continue it. Or you can use `Step` to run a program one-step-at-a-time.

NOTE

From now on, when we say to "run" your program, just click on the **Run** button in the tool bar (or press ⬚Ctrl⬚+⬚G⬚).

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:
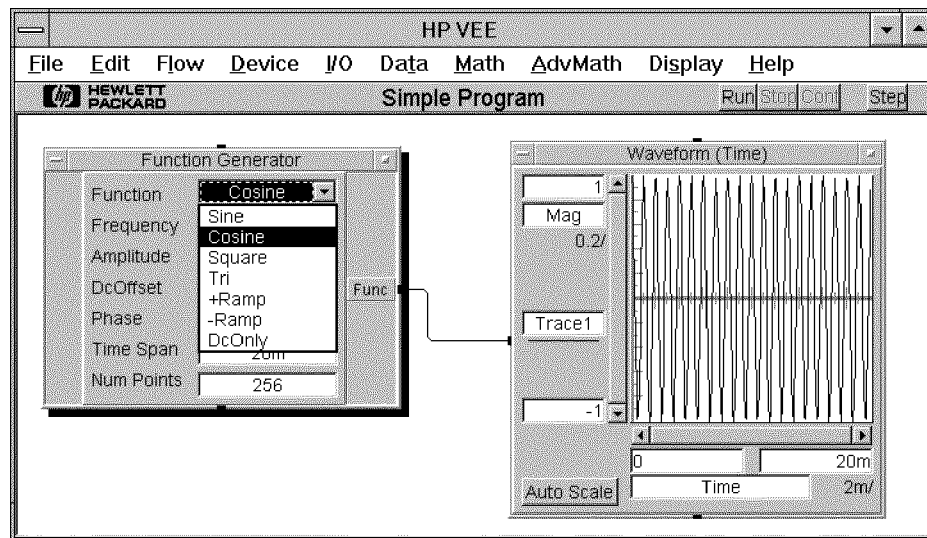
Click on **Sine** to select the sine function.

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

For example, click on the `Frequency` field to the right of the value `1000` and, while holding the mouse button down, move the mouse to the left to highlight the last `0`, then release the mouse button:
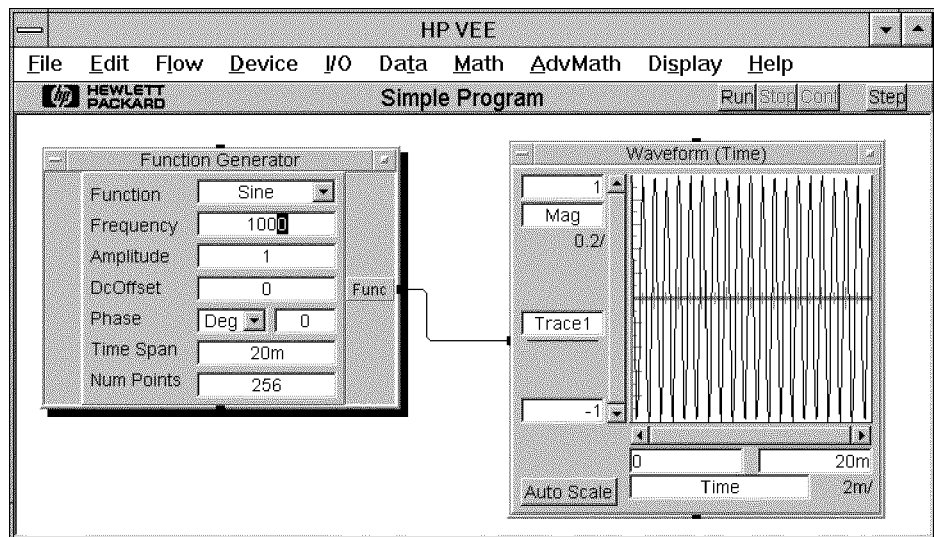
Now, press (Delete) to delete the last 0, changing the **Frequency** value to 100.
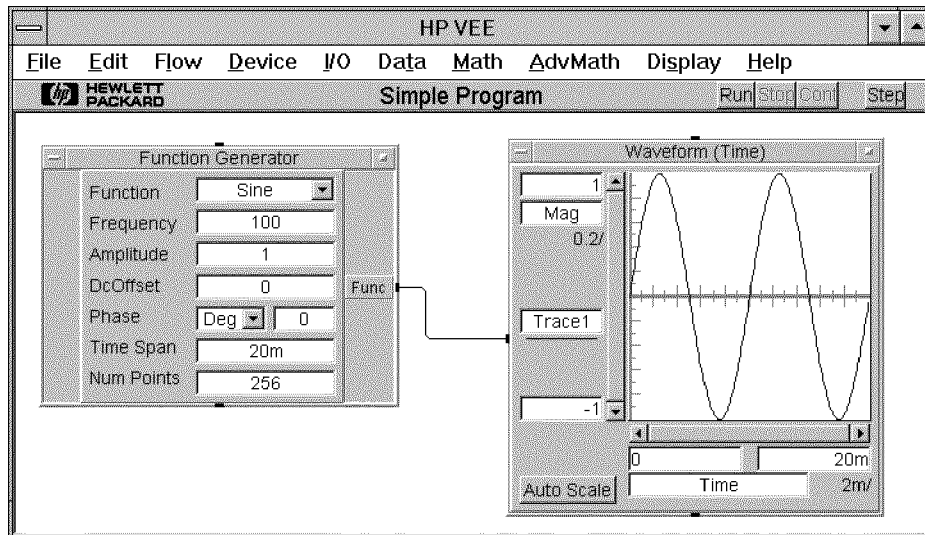Run the program (click on **Run**) and you should get the following result:

The displayed waveform is now a 100 Hz sine wave.

Try changing a few object parameters on your own:

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**. Click on **Run** 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:*

> **Print**
>
> Printer: Default Printer (HP LaserJet 4si on \\hpxxx\lj4sixxx (LPT1:))   **OK**   **Cancel**   **Setup...**
>
> Print Range
> ● All
> ○ Selection
> ○ Pages
>   From: [   ]   To: [   ]
>
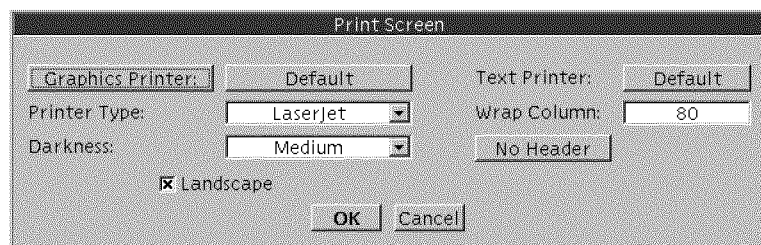> Print Quality: [300 dpi ▼]   Copies: [1]
>   □ Collate Copies
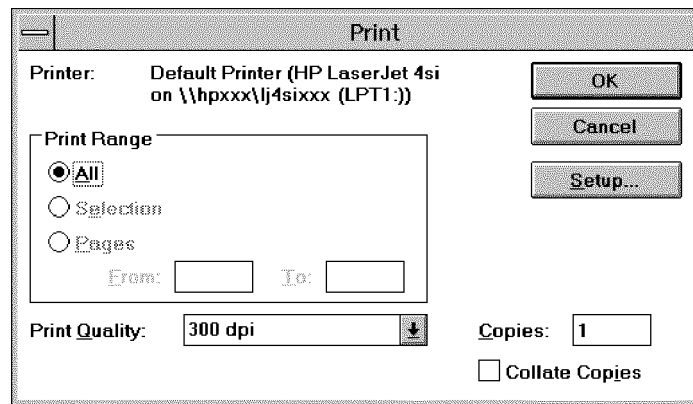
When you click on **OK**, HP VEE prints the screen on the Windows default printer (LPT1 in this example). You can change the print range, the print quality, or the number of copies before you print. Click on the **Setup** button for more selections. For further information about using Windows dialog boxes, refer to the *Microsoft Windows Tutorial*.

- *For HP VEE for UNIX, the following dialog box appears:*

> **Print Screen**
>
> **Graphics Printer:** [Default]   Text Printer: [Default]
> Printer Type: [LaserJet ▼]   Wrap Column: [80]
> Darkness: [Medium ▼]   No Header
>   ☒ Landscape
>   **OK**   Cancel

When you click on **OK**, HP VEE prints the screen on the default printer. This dialog box allows you to select a graphics printer or text printer, and to change the configuration of these devices, before you print.

To Save Your Program

You can save your program (whatever is in the work area, whether a complete program or not) at any time. To save the program select `File` $\Longrightarrow$ `Save`.

- *For HP VEE for Windows, the following dialog box appears:*
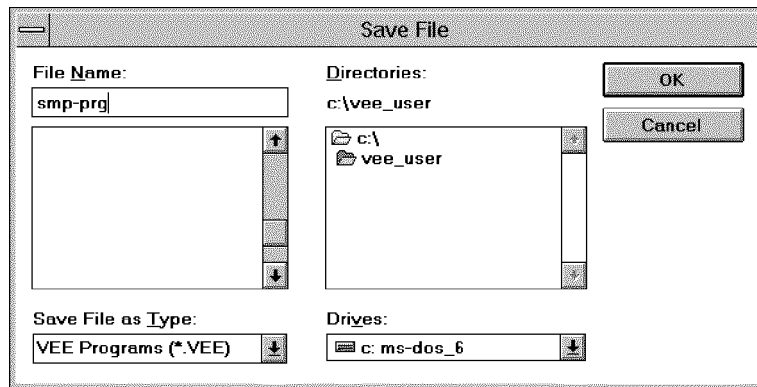
By default, HP VEE for Windows saves your files to the `C:\VEE_USER` directory. To save the current program, just click on the `File Name` field and type in a name (for example, `simp-prg`) and click on `OK`. HP VEE for Windows automatically adds the extension `.vee` to the file name.

N O T E

HP VEE for Windows file names must follow the MS-DOS® file name conventions. Up to eight characters are allowed, followed by a period and an extension of up to three characters. Alpha characters are case insensitive — they are "case-folded" into upper-case characters.

● *For HP VEE for UNIX, the following dialog box appears:*
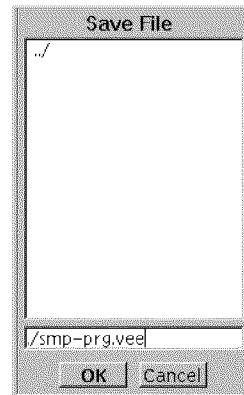
By default, HP VEE for UNIX saves your files to the directory from which you started HP VEE. To save the current program, just type in a name (for example, `simp-prg.vee`) and click on `OK`.

N O T E

To re-save your program to the same file name select `File ⟹ Save` (or press `Ctrl`+`S`) at any time. 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, select `File ⟹ Save As` instead.

To Open a File

You can open a program file by selecting `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 `OK` 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 the order they appear in the program, except where statements cause execution to branch to another statement or section 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 appropriate data output pins have been activated.*

In HP VEE you can change the order of execution by using sequence input and output pins. However, you won't 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 (**simp-prg.vee**) that you saved in the previous section (select **File** $\Longrightarrow$ **Open**) and run it. It should appear as follows:
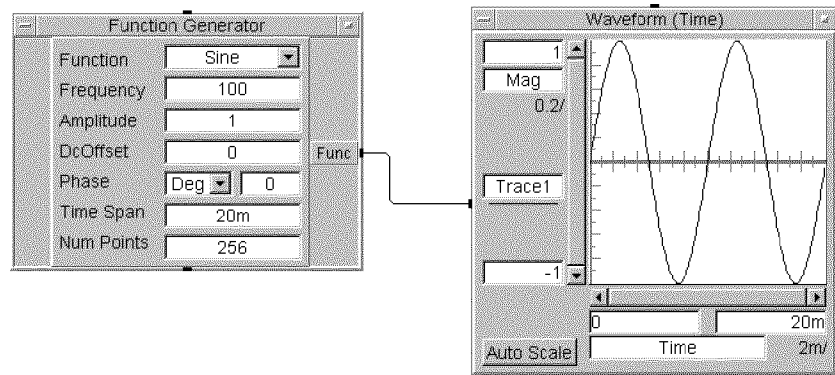
Note that the data output pin of the **Function Generator** object is connected to the data input pin of the **Waveform (Time)** object. When you run the program, the **Waveform (Time)** object won't execute until it receives data from the **Function Generator** object. This is a simple example of data flow.

Now let's create a "noisy sine wave" by adding a **Noise Generator** object to our program, as shown below:
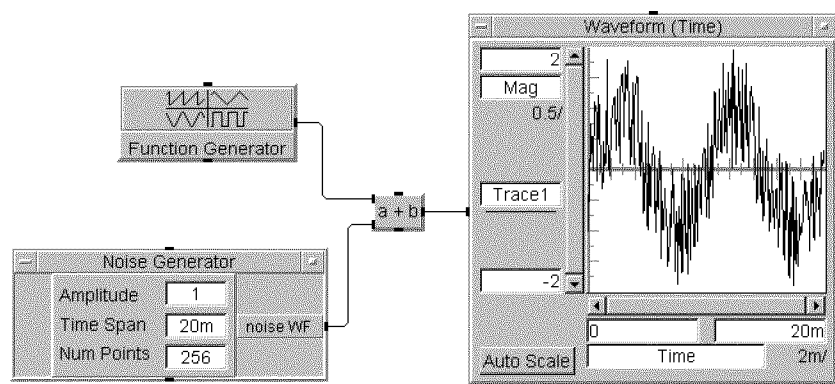
To create this program you'll first need to delete the line connecting the **Function Generator** and **Waveform (Time)** objects in the original program.

You can use the **Edit** menu to do this: click on **Edit** ⟹ **Delete Line**, and then click on the line. Or you can use a shortcut: press and hold (Shift)+(Ctrl), and then click on the line.

Now minimize the **Function Generator** to its icon, and add the **Noise Generator** (**Device** ⟹ **Virtual Source** ⟹ **Noise Generator**) and A+B (**Math** ⟹ **+-*/** ⟹ **A+B**) objects. Connect the input and output pins as shown in the figure.
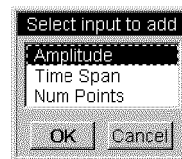
Run the program, and click on the **Auto Scale** button on the **Waveform** display. What is the order of execution? The **Waveform (Time)** object won't execute until it has received data from the **A+B** object. The **A+B** object won't execute until *both* of its inputs have been satisfied by the **Function Generator** and **Noise Generator** objects. This leaves the question of which executes first, the **Function Generator** object or the **Noise Generator** object? The answer is that *it doesn't matter.* In either case, the result is the same. The **A+B** object doesn't execute until both generator objects execute. Once both of its inputs 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, execution being determined solely by data flow.

To see the order of execution, turn on animation by selecting **Edit** ⟹ **Animate**. Now run the program. Each object is highlighted when it executes, and data flow is shown by small square markers (commonly called "torpedoes" by HP VEE programmers) that move down the lines.


NOTE

Animate is a toggle feature. Select it once to turn it on, and again to turn it off. Normally, you'll want to turn **Animate** off since it slows down your program.

Now let's add an **Amplitude** input for the **Noise Generator**. You can 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** ⟹ **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:
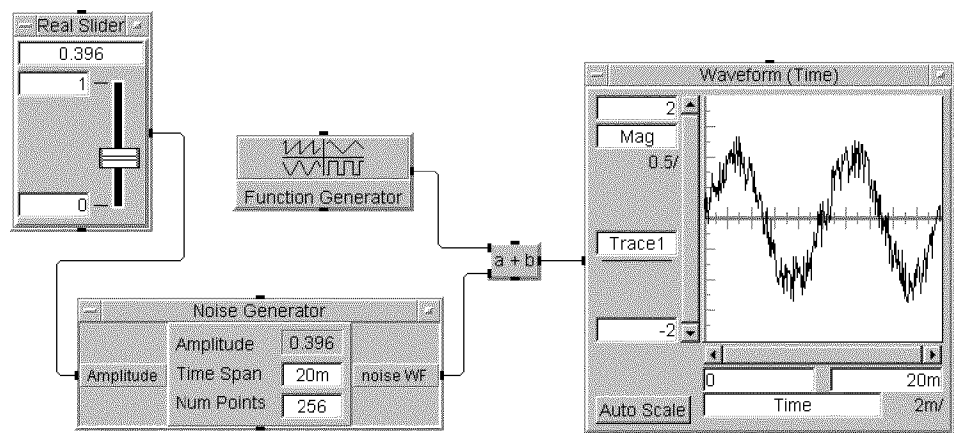
Try changing the amplitude of the noise (drag the "knob" on the **Real Slider** object). The amplitude of the noise doesn't change until you run the program, and then the noise component of the displayed waveform depends on the **Real Slider** output value.

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` have executed, 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 `simp-prg.vee`). You'll add some more features to it in the next chapter.

2

Some HP VEE
Programming Techniques

Some 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'll learn some selected HP VEE programming techniques that you may find useful in building your own programs. These techniques include:

- Creating `UserObject`s.
- Creating panel views.
- Using data files.
- Mathematically processing data.
- Instrument I/O techniques.

General Techniques

This section provides some general HP VEE programming techniques that include working with data, creating UserObjects, and creating a panel view.

Creating a UserObject

A UserObject is an object that you can create by collecting a logical grouping of objects into one custom object. A UserObject has a work area, similar to the work area of the main HP VEE window. You can place and connect various objects (including other "nested" UserObjects) within the work area of a UserObject. You can also define the appropriate input and output pins for your UserObject. In brief, a UserObject is a separate context from the context of the main program (the main work area). You can use a logical grouping of objects to create a UserObject that performs a useful purpose within your main program. This not only conserves "real estate" in your main work area — it makes your program more understandable by providing structure.

One way to create a UserObject is to select Device ⟹ UserObject from the menu bar and place a blank UserObject in the work area:
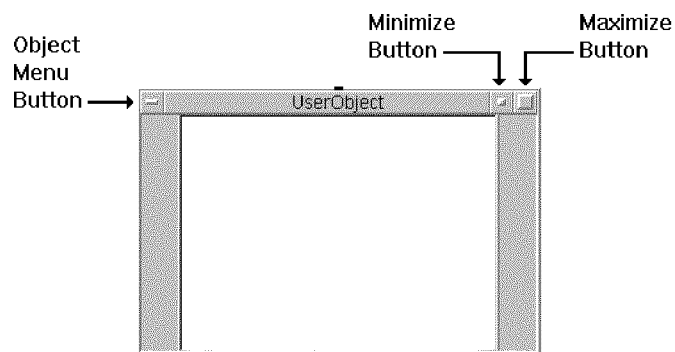
Now you can add objects to the **UserObject** work area, add the appropriate input and output pins, and connect the pins to other objects in the main program.

Note that the **UserObject** has an object menu button and minimize button, like any HP VEE object. In addition, it has a maximize button. If you need a larger work area within the **UserObject**, you can resize it from the object menu or by clicking and dragging on its bottom-right corner. Or you can click on the maximize button to make the **UserObject** take up the entire HP VEE work area. You can move the work area of the **UserObject** just as you would the main work area.

Another way to create a **UserObject** is to select objects within a program, and then create a **UserObject** from them. Let's use the program you created in the last chapter as an example. Open the program that you created (**simp-prg.vee**), minimize the **Noise Generator** object, and rearrange the objects as shown in the figure below:
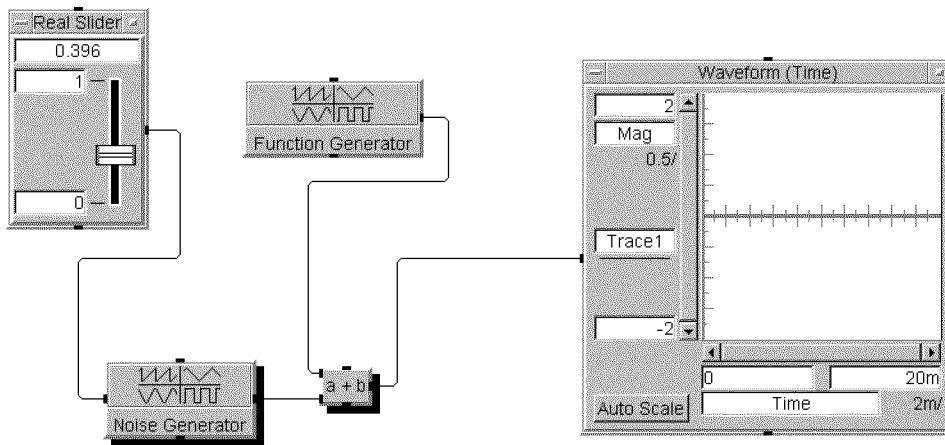
Now select the **Noise Generator** and **A+B** objects. To do this, turn on "Select desired objects" by clicking on **Edit** ⟹ **Select Objects** (or use the shortcut (Ctrl)+*left mouse button*). Click on the objects to select, and then move the mouse pointer to an empty area and click again to turn off "Select desired objects."

To create the `UserObject` from the selected objects, click on `Edit` ⟹ `Create UserObject`. The `UserObject` will contain the `Noise Generator` and `A+B` objects, and will automatically be created with the appropriate input and output pins and connections:
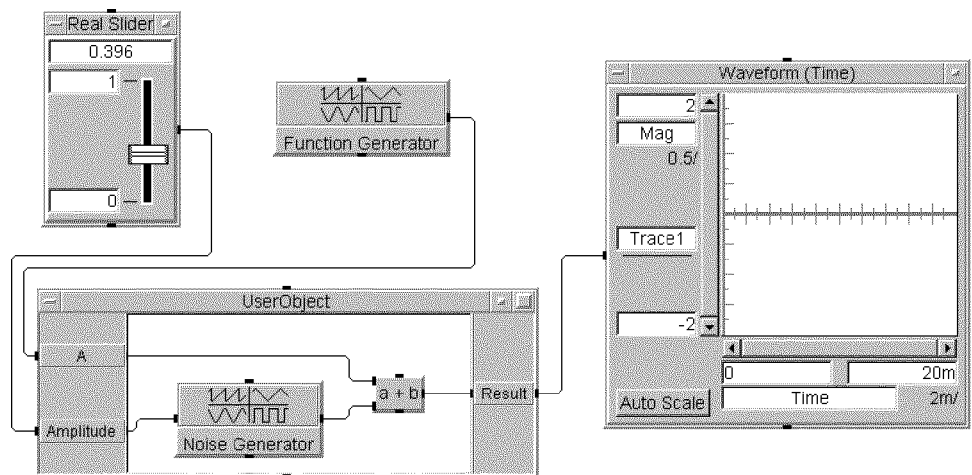

NOTE

The reason for 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, `Clean Up Lines` is context dependent. You'll need to run it once for the main program and once within the `UserObject`.

You can save screen space in your program, and make it easier to read visually, by minimizing a **UserObject**. But it is a good idea to add a title to the **UserObject** first. 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**. Note how this makes the logic of the program easier to follow:
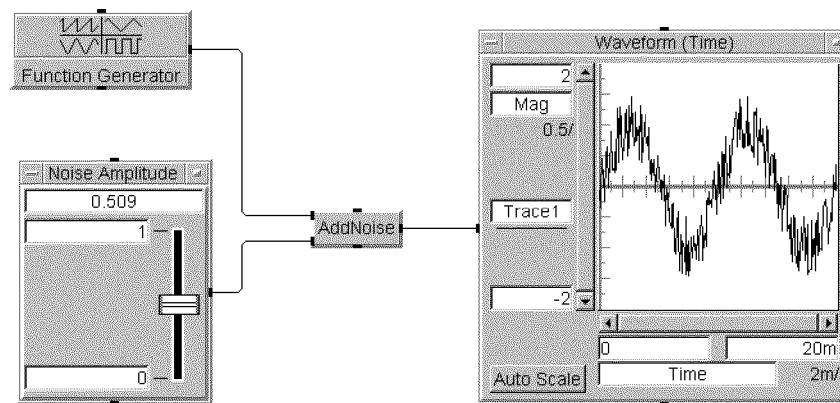
The key to the proper use of **UserObject**s is to make sure that the **UserObject** has a logical purpose within the program. Thus, the **UserObject** is not just a space saving device, but rather a way of structuring your program. **UserObject**s help you use "top-down" design in your HP VEE programs. For further information on **UserObjects**, refer to your *How to Use HP VEE* manual.

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

Creating a Panel View

Often, you'll want to add an operator interface to your program. To do this, you can create a **panel view**. Let's continue with our previous example to see how this is done:

1. Open your program (`simp-prg.vee`) if it is not already in the work area.

2. Select the `Real Slider` and `Waveform (Time)` objects (use `Edit ⟹ Select Objects`).

3. Add the selected objects to the panel (use `Edit ⟹ Add To Panel`). A panel view appears, showing the two objects that you added to the panel.

You can move the objects in the panel view to appropriate locations to create a panel similar to the one shown below:
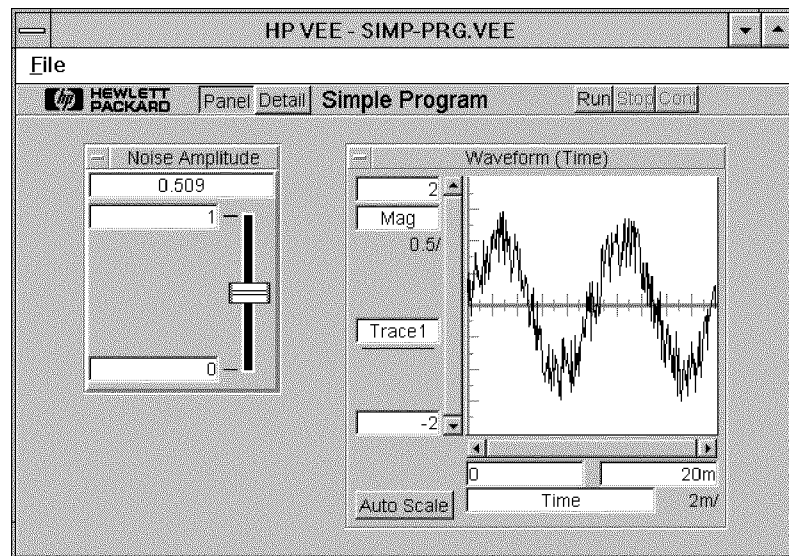
Note that two additional buttons appear in the tool bar: `Panel` and `Detail`. Try pressing `Detail` to go to the detail view, and then `Panel` to return to the `Panel` view. The detail view is the normal HP VEE work area, from

which you would typically edit your program. On the other hand, you can edit the panel view separately. For example, you can move, resize, or delete objects in the panel view independently from the detail view. Thus, you can organize the panel view as an operator interface for your program. For further information, refer to your *Building an Operator Interface with HP VEE* manual.

Again, save your program (**simp-prg.vee**) if you want to quit now. We'll use it again in the next section.

Using Data Files

You can easily write data from HP VEE in a data file, and read the data back into HP VEE, by including the **To File** and **From File** objects in your program. As an example, let's add a **To File** object to the detail view of the program you've been building.

Open the program (**simp-prg.vee**), if it isn't already in your work area, and go to the detail view. Now add a **To File** object to the work area (**I/O** $\Longrightarrow$ **To** $\Longrightarrow$ **File**):
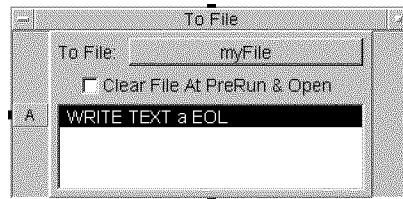
Now change the name of the data file (the **To File** field) to **wavedata**. Just click on **myfile**, and the following dialog box appears:
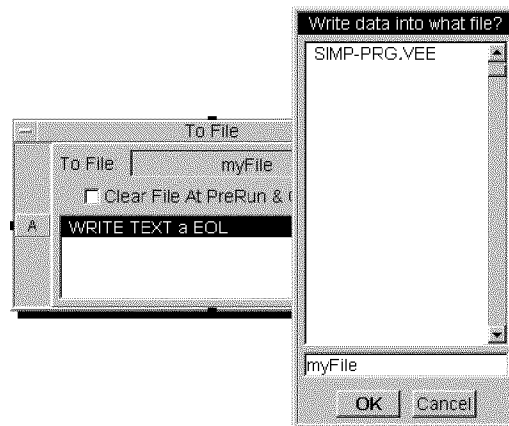
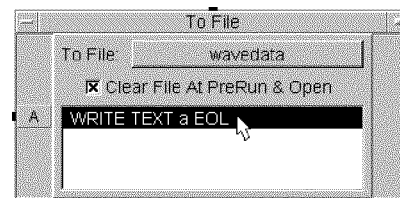Backspace over **myfile**, type in the new name, and then click on **OK**. Also, click on the checkbox in the **To File** object to activate **Clear File at PreRun and Open**, as indicated in the following figure:

Now double-click on the write **transaction** labeled **WRITE TEXT a EOL**, as indicated by the mouse pointer (arrow) in the above figure. The **I/O Transaction** dialog box appears as follows.
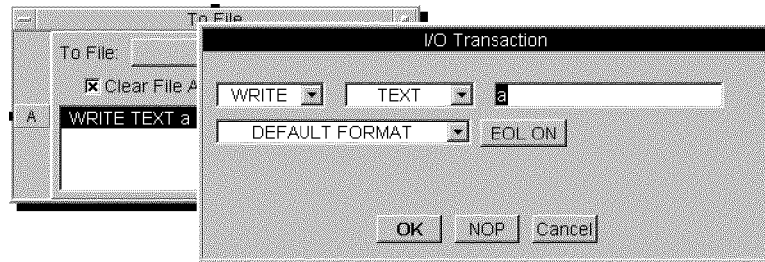
Click on the **TEXT** field (or its arrow) to show the drop-down list of data
types. Click on **CONTAINER**, and then on **OK** to change the transaction
to **WRITE CONTAINER a**. Connect the data output pin of the **AddNoise**
UserObject to the data input pin of the **To File** object, as shown below:
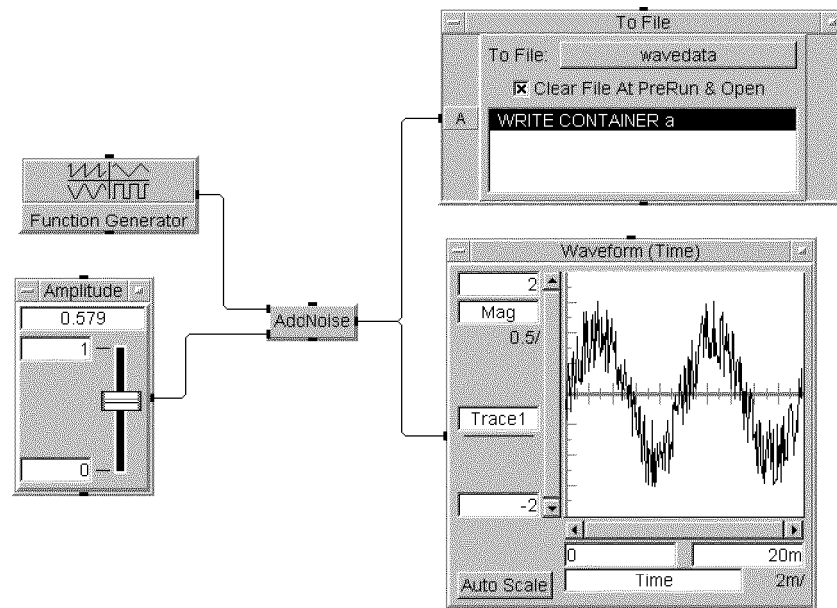
Now the program not only displays the noisy sine wave output by the **AddNoise UserObject**, but also writes a container of waveform data to the file **wavedata**.

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:
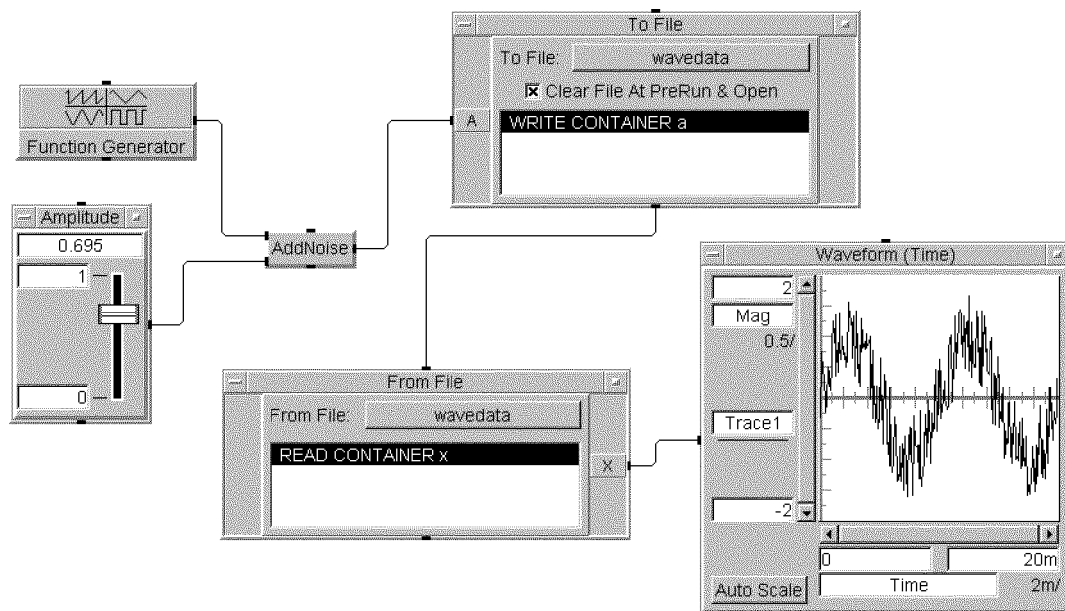

Note that when the **To File** object finishes executing (after it has written to the file **wavedata**) it activates the sequence input pin on the **From File** object, which reads the container of data and outputs the waveform to the display object.

Try clicking on the **Panel** button. You'll find that the panel view has not been changed by any of the changes to the detail view.

For further information about using file I/O, and about data containers, refer to your *How to Use HP VEE* manual.

Mathematically Processing Data

HP VEE provides extensive mathematical capabilities, which are documented in the *HP VEE Reference* manual and in *HP VEE Help*. Let's take a quick look at some of these capabilities.

To Use Data Types

HP VEE supports several data types, including text, integer and real numbers, and several types of complex and coordinate numbers. For further information about data types, refer to *How to Use HP VEE*. 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 types of data. Let's look at an example:

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

- **Real Constant** object:
  Select **Data** ⟹ **Constant** ⟹ **Real**.

- **Complex Constant** object:
  Select **Data** ⟹ **Constant** ⟹ **Complex**.

- **A+B** object:
  Select **Math** ⟹ **+-*/** ⟹ **A+B**.

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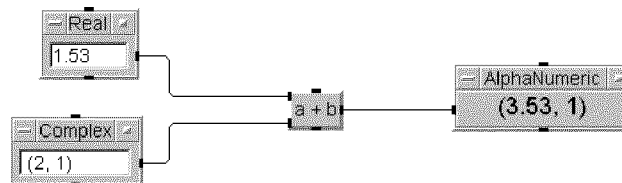
HP VEE automatically converts the data as needed, then performs the addition in the **A+B** object. The real value **1.53** is converted to the complex value **(1.53,0)**, which is then added to the complex value **(2,1)**. The result, **(3.53,1)** (a complex number), is displayed in the **Alphanumeric**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

Normally, HP VEE takes care of all data type conversions for you. For further information about data types and data type conversions, refer to *How to Use HP VEE*.

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 work area, place the following objects in the work area, and connect them as shown:

- **For Range** object:
  Select **Flow** $\Longrightarrow$ **Repeat** $\Longrightarrow$ **For Range**.

- **Sliding Collector** object:
  Select **Data** $\Longrightarrow$ **Sliding Collector**.

- **median(x)** object:
  Select **AdvMath** $\Longrightarrow$ **Statistics** $\Longrightarrow$ **median(x)**.

- **AlphaNumeric** object:
  Select **Display** $\Longrightarrow$ **AlphaNumeric**.
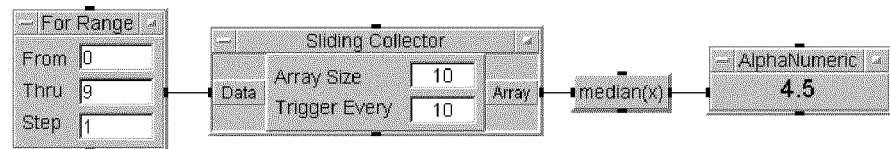
When you run the program, the **For Range** object repeats 10 times, outputting the following series of real scalar values: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. The **Sliding Collector** creates a 10 element array from these values. To see this, double-click on the input and output terminals for the **Sliding Collector**. When you double-click on the **Data** input terminal, the **Input**

Terminal Information dialog box should show that the last value input was the real scalar value 9. When you double-click on the **Array** output terminal, the **Output Terminal Information** dialog box should show that the output data is a one-dimensional, ten-element array. The **median(x)** object calculates the median value for the array, which is displayed by the **AlphaNumeric** object.

To Use the Formula Object HP VEE provides numerous mathematical operators and functions, all of which are documented in the *HP VEE Reference* manual and under **Math Syntax** in *HP VEE Help*. Most of these features are available as individual objects under the **Math** and **AdvMath** menus. However, you can create any valid HP VEE mathematical expression within the **Formula** object, which is found under the **Math** menu.

Let's look at an example that shows the use of the **Formula** object. To create the program, clear the work area and follow these steps:

1. Add the **Function Generator** object to the work area and modify it to produce a 100 Hz sine wave.

2. Add the **Formula** object to the work area. Add a second input (**B**) to it (move the mouse pointer to the input terminal area and press Ctrl+A). Now type the mathematical expression **abs(A)+B** in the entry field.

3. Add the **Real** constant object (**Data ⟹ Constant ⟹ Real**), and type in the value **0.5**.

4. Add the **Waveform (Time)** display object and set the Y-axis scale to **-2** through **2**.

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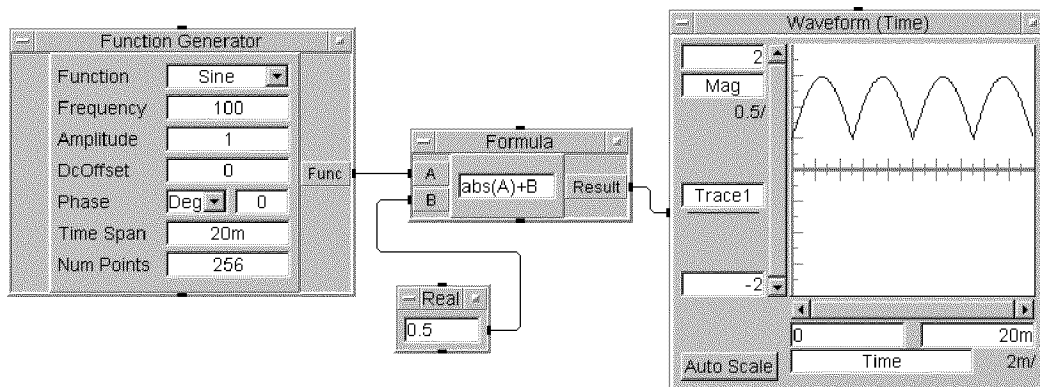
When you run the program, the **Formula** object takes the waveform input
A and the real value **B**, and adds **B** to the absolute value of **A**. In effect, the
expression **abs(A)+B** "rectifies" the sine wave and adds a "dc offset." You
could have produced the same effect by using the **A+B** and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

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.

Instrument I/O Techniques

HP VEE for Windows provides extensive capabilities to communicate with and control test instruments. There are three kinds of instrument I/O objects:

- An **instrument panel** 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.

- A `Direct I/O` object provides a means of direct communication with an instrument without the use of an instrument driver file.

N O T E

Instrument panel and component driver objects require that an 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. Refer to "To Load an Instrument Driver" in *How to Use HP VEE* for further information.
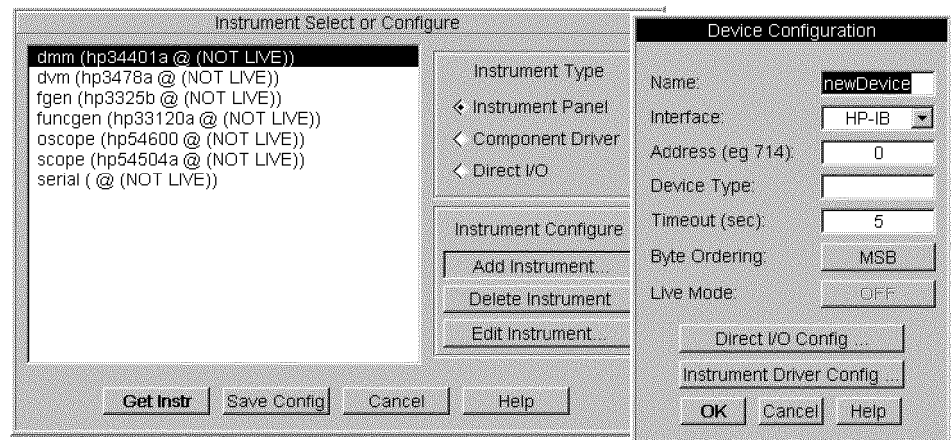

This section introduces the use of instrument panels. For further information about instrument I/O, including component drivers and direct I/O, refer to your *How to Use HP VEE* manual.

Configuring Instruments

Let's begin by configuring an instrument. In this example you'll 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**, which means that the instrument doesn't have to be connected to your computer. Or the instrument can be connected, but in **Live Mode OFF** HP VEE won't communicate with it. This allows you to test much of your program before actually connecting and communicating with the instrument.

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

1. Select **I/O** ⟹ **Instrument**. The **Instrument Select or Configure** dialog box appears. By default several selections, shown below, are present. *Please don't delete these selections.* They are used in some of the example programs provided with HP VEE.

2. The **Instrument Panel** button (in the **Instrument Type** section) should already be selected. If not, click on it. Now click on **Add Instrument**. The **Device Configuration** dialog box appears:

You'll edit the fields in this dialog box to add a function generator to your
list of instruments. However, when changing values, do not press ⌜Enter⌟.
If you do, you may exit the dialog box. Instead, when you have edited
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. Just enter a new name (for
    example, **Func-Gen**) to start your new configuration. Now click on the
    Address field and enter the address of your instrument. Typically, the
    address for the HP 3325B Function Generator is **707**. (For information
    about addressing a particular instrument, refer to the instrument owner's
    manual.)

4. Click on the **Instrument Driver Config** ... button. The following
    dialog box appears. Note that the **Live Mode** field in the **Device
    Configuration** dialog box changes to **ON** at this point because you
    entered a non-zero address:
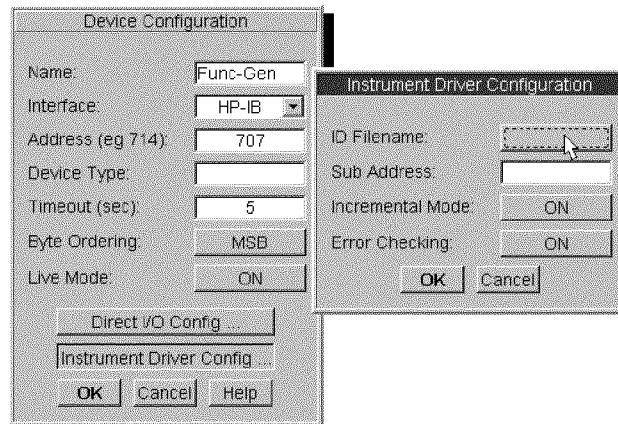
5. Click on the **ID Filename** field to select an ID (Instrument Driver) file. In
    the list that appears, click on **hp3325b.cid**, and then click on **OK**.

6. Now click on **OK** in the **Instrument Driver Configuration** dialog box
    to return to the **Device Configuration** dialog box. Click on the **Live
    Mode** field to change it back to **OFF**, and then click on **OK** to return to the
    Instrument Select or Configure dialog box.
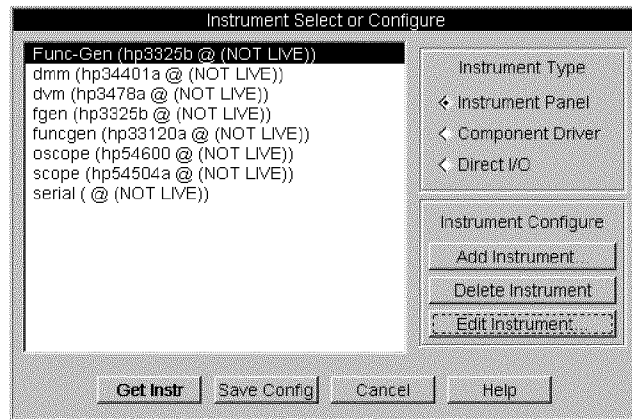
Note that the new selection **Func-Gen (HP3325B @ (NOT LIVE))** has appeared in the list of instruments that you can select.

7. Now click on the **Save Config** button at the bottom of the dialog box. The dialog box disappears and your new instrument configuration has been saved.

Your **Func-Gen** configuration is now complete, and the configuration will be available whenever you start HP VEE. Now let's try using this configuration.

Using an Instrument Panel

The open 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 object 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** again. The **Instrument Select or Configure** dialog box appears. Click on **Func-Gen (HP3325B @ (NOT LIVE))** once to highlight the selection, and then click on it again (or click on the **Get Instr** button). An outline of the **Func-Gen** instrument panel object appears in the work area. Place the outline where you want it, and click the mouse button to add the object to the work area:
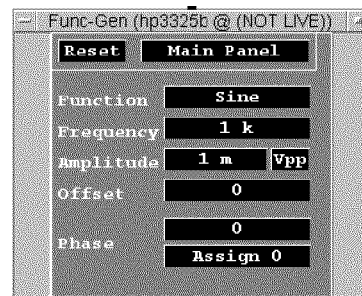
2. Click on **Sine**. A dialog box gives you a series of choices for the **Function** field. Double-click on **Square** to change the shape of the waveform. If a function generator was connected, and live mode was **ON**, this change would also occur on the physical instrument.

3. 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.

4. Go to another panel, such as the **Sweep** or **Modulation** panel. To do this, either 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** again.

Using an Instrument Panel in a Program

Let's create a program that uses the **Func-Gen** 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 **Func-Gen** object. To do this, select *object menu* ⟹ **Add Terminal** ⟹ **Data Input**. 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 a value of **1** for the delay in seconds.

4. Connect the objects as shown below:
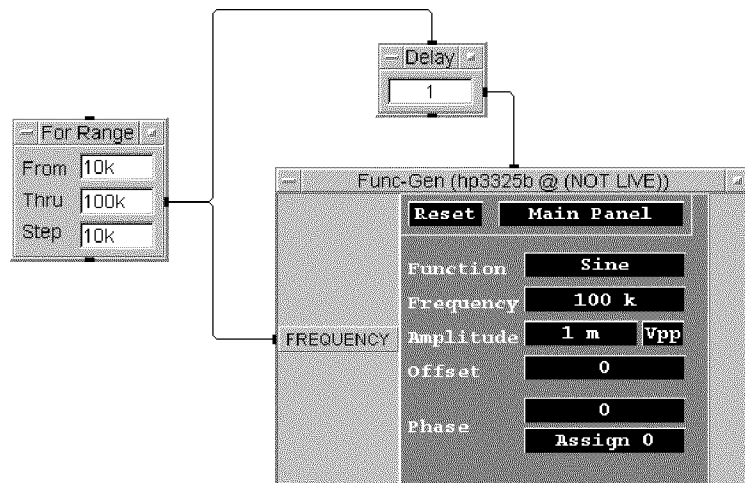
When you run the program, the **For Range** object steps the function generator through frequencies of 10 kHz, 20 kHz, and so forth, up to 100 kHz. Because of the delay object, each step takes 1 second.
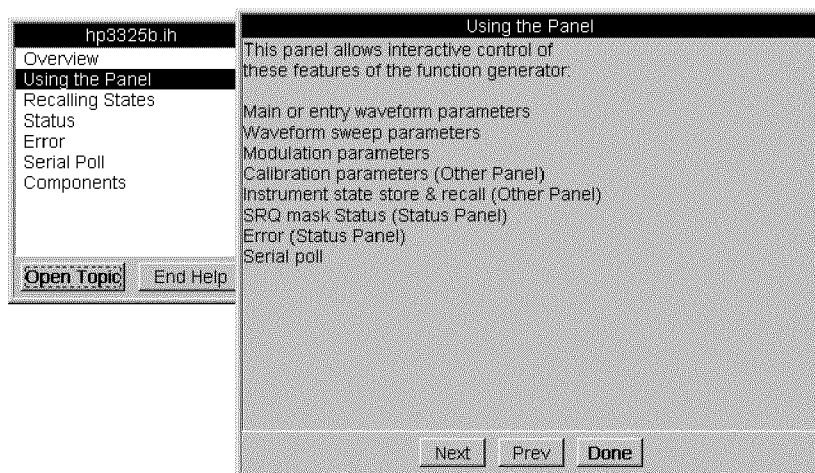
If you have an HP 3325B Function Generator connected to your computer, you can now turn live mode **ON** and control your real instrument. To do this, select **I/O** $\Longrightarrow$ **Instrument**, and then select **Func-Gen (HP3325B @(NOT LIVE))**. Click on **Edit Instrument**. Change **Live Mode** to **ON** in the **Device Configuration** dialog box. Click on **OK** and then **Save Config** to save the new configuration. Now try the program again and watch the front panel of your physical instrument. For further information, refer to *How to Use HP VEE.*

Getting Instrument Help

You can get online help for any instrument for which you have installed an instrument driver (refer to Chapter 1). When you install a driver, the program also installs a help file for the driver. To get help, select **Help** $\Longrightarrow$ **Instruments** . . . and then select the help file (for example, **hp3325b.ih**) for your instrument from the list.

Unlike the other HP VEE help topics, the instrument driver help files do not use the Windows help system. The following is an example of help for the HP 3325B Function Generator:

hp3325b.ih
Overview
Using the Panel
Recalling States
Status
Error
Serial Poll
Components

Open Topic   End Help

Using the Panel
This panel allows interactive control of
these features of the function generator:

Main or entry waveform parameters
Waveform sweep parameters
Modulation parameters
Calibration parameters (Other Panel)
Instrument state store & recall (Other Panel)
SRQ mask Status (Status Panel)
Error (Status Panel)
Serial poll

Next   Prev   Done

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 manuals to help you:

- *How to Use HP VEE* is the best place to start. This manual is a task-oriented guide to HP VEE programming. Use *How to Use HP VEE*, along with the HP VEE online help, as a guide while you create your programs.

- *Building an Operator Interface with HP VEE* provides detailed information about using HP VEE features to build an operator interface for your program.

- *HP VEE Reference* provides reference sections for all of the HP VEE features. (These reference sections are also provided in *HP VEE Help*.)

- *HP VEE Advanced Programming Techniques* provides detailed information about the advanced features of HP VEE.

Glossary

Glossary

This Glossary defines some terms used in this manual. For a complete glossary of HP VEE terms, refer to the *HP VEE Reference* manual or to *HP VEE Help*.

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."

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` $\Longrightarrow$ `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 between 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` $\Longrightarrow$ `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` and `AdvMath` 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.

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 a Microsoft Windows application within a group window. See "Group Window."

Instrument Panel

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.

Maximize Button

A button on a `UserObject`, or the HP VEE window, that makes the `UserObject`, or the HP VEE window, occupy all of the available screen space.

Menu Bar

The bar at the top of the HP VEE window that displays the titles of the pull-down, main menus, from which you select features.

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 is more detailed than an
icon. Most object open views have fields that allow you to modify the
operation of the object.

Panel View

The view of an HP VEE program, or of a `UserObject`, 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

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 `File` $\Longrightarrow$ `Edit 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.

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 *object menu* $\Longrightarrow$ `Edit Properties`. Work area properties are attributes of the HP VEE work area that you can change using `File` $\Longrightarrow$ `Edit Properties`. Properties include 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 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 *object menu* $\Longrightarrow$ `Edit Properties`.

Tool Bar

The rectangular bar at the top of the HP VEE window which provides the `Run`, `Stop`, `Cont`, and `Step` buttons to control HP VEE programs. The tool bar also displays the title of a program, and the `Panel` and `Detail` buttons if present.

Transaction

The specifications for input and output (I/O) used by certain objects in HP VEE. These 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.

Work Area

The area within the HP VEE window or the open view of a `UserObject` where you group objects together. When you `Open` a program, it is loaded into the main work area.

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