Getting Started with HP VEE for Windows

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Preface

This manual is written for engineers and scientists who have some experience with programming and working with instruments. It assumes some knowledge of Microsoft® Windows and your Personal Computer (PC).

There are three chapters:

- Chapter 1, "Installing HP VEE for Windows," shows how to install HP VEE on your PC. The installation is primarily automatic, and should only take a few minutes if your PC is already set up.
- Chapter 2, "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 3, "Some HP VEE Programming Techniques," illustrates some selected HP VEE programming techniques.

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` ⟹ `Open`	The "⟹" is used in a shorthand notation to show the location of HP VEE features in the menu. For example, "`File` ⟹ `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

Installing HP VEE for Windows

Installing HP VEE for Windows

This chapter tells how to install HP VEE for Windows. The installation is primarily automatic, and requires only a few minutes if your PC is already set up and running.

Before you can install HP VEE for Windows, you'll need to install Microsoft® Windows (version 3.1 or a later version) and MS-DOS® (version 5.0 or a later version) on a personal computer meeting the following requirements:

- *Microprocessor:*
  - Minimum: 80386, 33 MHz or faster, *with* 80387 coprocessor.
  - Recommended: 80486, 33 MHz or faster.
- *RAM (Random Access Memory):*
  - Minimum: 12 MB (megabytes).
  - Recommended: 16 MB.
- *Display system:*
  - Minimum: VGA (640-by-480).
  - Recommended: Super VGA (800-by-600) or Ultra VGA (1024-by-768).
- *Mass storage:*

  A 3.5-inch (1.44 MB) floppy disk drive, and a hard disk drive with at least 15 MB of free disk space.

Before you install the software, install any hardware I/O interfaces that you intend to use. The following I/O interfaces are supported:

- *PC serial ports (COM1, COM2, COM3, and COM4).*
- *HP 82335 and HP 82341 HP-IB Cards.* Install each HP-IB (IEEE-488) card following the instructions provided with the card. You need only install the hardware interface card, *not* the HP-IB Command Library or SICL software that may be provided with the card. HP VEE provides the appropriate SICL drivers, which are installed as part of the HP VEE installation. You can install multiple HP-IB cards, and you can mix HP 82335 and HP 82341 cards in your system. However, if you are installing multiple HP-IB cards, refer to Appendix A for information about select codes and I/O addressing.

NOTE

If you are installing HP 82335 HP-IB Cards, you must exclude address space for each card before you install HP VEE. Also, you must assign a unique select code for each card. Refer to "Excluding Address Space (HP 82335 HP-IB Card Only)" in Appendix A for further information. (You don't need to do this for the HP 82341 HP-IB Card, nor for any of the National Instruments GPIB cards listed below.)

- *National Instruments AT-GPIB, MC-GPIB, and GPIB-PCII/IIA cards.* You can install up to four GPIB (IEEE-488) cards, but they must all be of the same type. Before you install HP VEE, install the GPIB card(s), and install the GPIB driver software (for Windows) provided with the card.

NOTE

HP VEE for Windows does not currently support GPIO or MXI interfaces or devices.

HP VEE for Windows does not currently support direct access to a VXI backplane through embedded VXI controllers. However, you can access VXI devices from HP VEE for Windows by using an HP E1406 Command Module connected to one of the supported HP-IB or GPIB cards.

Once you have completed the installation, you can run the `Instrument Finder` utitity (refer to "Finding Instruments" at the end of this chapter) to determine the select codes and addresses of your serial, HP-IB, and GPIB devices. For complete information about I/O addressing, refer to Appendix A.

HP VEE for Windows supports most printers supported by Microsoft Windows, including:

- HP LaserJet Printers.
- HP DeskJet Printers.
- HP PaintJet Printers.

Installation

Once you have set up your computer, and Microsoft Windows is installed, you can install HP VEE for Windows. The installation program uses standard Microsoft Windows keyboard and mouse techniques.

NOTE

Some anti-virus programs, including the one provided with MS-DOS 6.0, interfere with the installation program. Before you begin the installation, disable any anti-virus program that is present following the instructions provided with the program. Once you've installed HP VEE you can re-enable the anti-virus program.

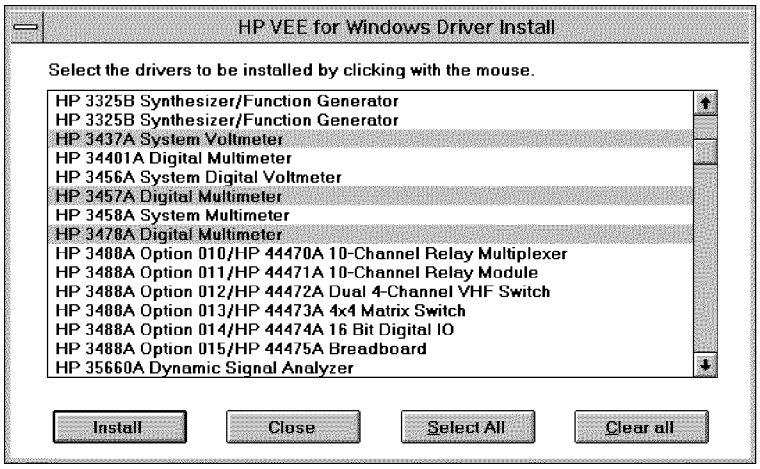
1. Start Microsoft Windows.
2. Insert "HP VEE for Windows Disk 1" in your floppy disk drive.
3. Pull down the **File** menu from the **Program Manager** window and select **Run**.
4. Type the name of the floppy disk drive, followed by **SETUP**, and then press Enter. For example, type: **A:SETUP** Enter. (It takes a few seconds for the installation program to load and start.)
5. Answer the questions that the installation program asks. To do this, click on the appropriate **button** on the screen (for example: **OK** or **Yes**), or type in the requested information. (To click on a button on the screen, move the mouse pointer over the button and press the left mouse button.)
   a. The installation program asks you where you want to install the HP VEE software (the default is **C:\VEE**), and where you want to store the programs you create with HP VEE (the default is **C:\VEE_USER**). The program then asks you to enter your name and the name of your company.
   b. The installation program asks you whether you want to fill out and print the product registration card. Just answer the questions and print

out the card (assuming you already have a printer connected to your PC). Or just fill out the pre-printed card supplied with the product and skip the electronic form.

c. The installation program asks you to insert disks 2 and 3 at the appropriate times. Just click on `OK` once you've inserted each disk.

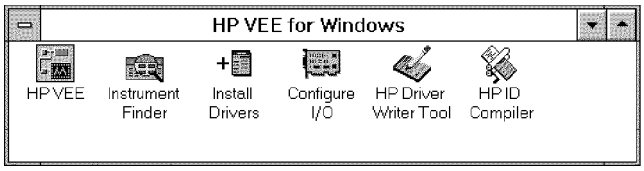
d. Once the files are installed, the installation program automatically configures your serial ports and any HP-IB cards found.

6. You'll be asked whether you want to install any instrument drivers at this time. (If you click on `No`, you can install drivers later by using the `Install Drivers` utility.) To install drivers now, click on `Yes`, insert "HP VEE for Windows Drivers Disk 1" when prompted, and then click on `OK`. A screen like the following one appears:



Use the scroll bar to search through the list, click on each driver that you want to install (or click on `Select All`), and then click on `Install`. Insert the driver disks as requested.

Once you have finished installing drivers (or if you have skipped that step), the **HP VEE for Windows** group window appears:



This group window contains six programs. To start HP VEE, double-click on the **HP VEE** icon. The next chapter shows how to start and use HP VEE. You can also start one of the five utility programs: **Instrument Finder**, **Install Drivers**, **Configure I/O**, **HP Driver Writer Tool**, and **HP ID Compiler**. These programs are described in the "HP VEE Utilities" appendix in *HP VEE Advanced Programming Techniques*.

NOTE

The installation program automatically configures any serial ports and HP-IB cards found. However, if you change your I/O hardware (for example, if you add or remove an HP-IB card), you'll need to reconfigure. Just double-click on the **Configure I/O** icon to run the utility before starting your next HP VEE session.

Your HP VEE for Windows installation is now complete. Before you start HP VEE, run the **Instrument Finder** utility to determine your current I/O configuration. Refer to "Finding Instruments" at the end of this chapter for details.

To Un-Install

If you want to "un-install" HP VEE for Windows, follow these steps:

1. Delete all the files (including subdirectories) in your installation directory (default = `C:\VEE`) and your program directory (default = `C:\VEE_USER`), and then remove the directories. *Be sure to back up or make copies of any programs in C:\VEE_USER that you want to keep.*
2. Delete the files (including subdirectories) in `C:\SICL`, and then remove the directory.
3. Delete the files in `C:\HPIDS` and `C:\HPIDS\HELP`, and then remove the directories.
4. Delete the `VEEHELP.DLL`, `HPIB.DLL`, `SICL16.DLL`, and `SICLUT16.DLL` files from your windows directory (default = `C:\WINDOWS`). Then, remove the `[VEE]`, `[SICL]`, and `[HPIDS]` sections from the `WIN.INI` file, also in your windows directory.
5. Delete all of the icons in the `HP VEE for Windows` group window, and then delete the group window.

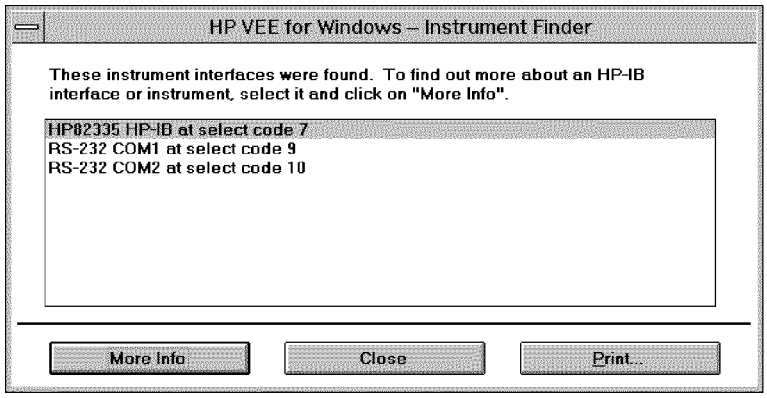
To Re-Install

You can re-install HP VEE at any time without difficulty — you do not have to un-install it first. When you re-install HP VEE the `V.INI` file, which contains your configuration information, is replaced. However, the old version of this file is saved as `VOLD.INI`. To restore your old configuration, start an MS-DOS window (or exit Windows) and execute the following MS-DOS commands:

```
CD C:\VEE
COPY VOLD.INI V.INI
```

Finding Instruments

The **Instrument Finder** utility finds and reports the select codes of your serial ports, HP-IB cards, and GPIB cards. The utility also finds and reports the addresses of instruments connected to your HP-IB and GPIB cards. To run the utility, double-click on the **Instrument Finder** icon in the **HP VEE for Windows** group window. The **Instrument Finder** screen appears:



In this example, one HP 82335 HP-IB Card is reported at select code 7, along with RS-232 serial ports COM1 and COM2 at select codes 9 and 10, respectively. To find individual HP-IB devices, click on **More Info** with the HP-IB selection highlighted, as shown. To print your configuration, click on **Print**. When you are ready to exit the utility, click on **Close**.

NOTE

If you have installed an HP 82335 HP-IB Card and it is not found, you probably haven't excluded address space for it. Do this, following the instructions in Appendix A, run **Configure I/O**, and then run **Instrument Finder** again to test the new configuration.

2

Quick Start

Quick Start

HP VEE is HP's *Visual Engineering Environment*, an iconic programming language for solving engineering problems. HP VEE gives you the ability to gather, analyze, and display data without conventional (text-based) programming. HP VEE increases your productivity by shortening the time it takes to solve engineering problems.

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

Interacting with HP VEE

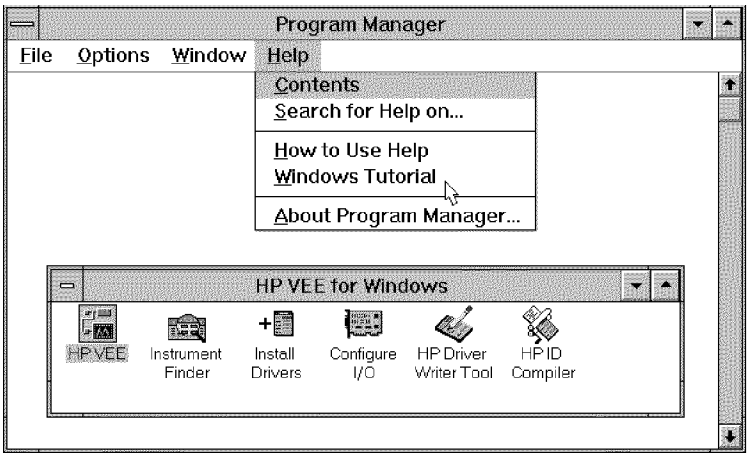
In this section you'll learn how to work with the HP VEE iconic programming environment — how to manipulate objects, create programs, save files, and print the screen. The best way to use this manual is to follow along, doing the exercises on your computer.

Of Mice and Menus

You're probably already familiar with the Microsoft Windows menu-driven user interface — with pull-down menus and dialog boxes that you can control with the mouse and keyboard. HP VEE for Windows uses this standard user interface. If you're not familiar with using a mouse or operating in the Windows environment, please refer to the "Windows Basics" chapter in the *Microsoft Windows User's Guide* for information such as:

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

Or, you may want to run the *Microsoft Windows Tutorial*, which shows you how to use the mouse and how to work in the Windows environment. To run the Tutorial, select **Help** from the **Program Manager** window and then click on **Windows Tutorial** (see the following figure).

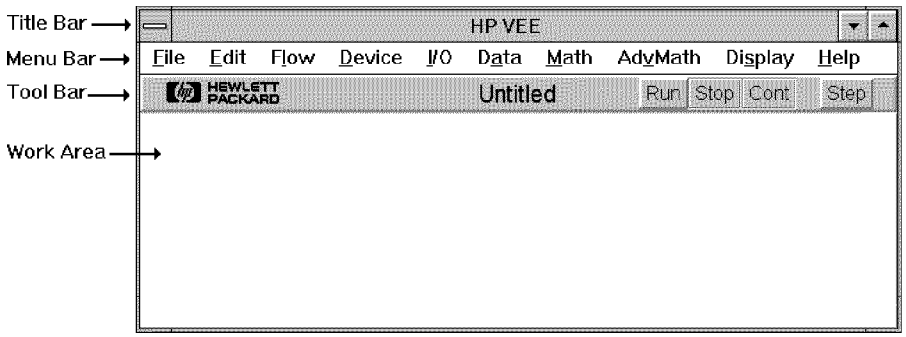


NOTE

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, double-click on the `HP VEE` icon in the `HP VEE for Windows` group window (see the previous figure). It takes a few seconds for HP VEE to load, and then a window like the following one appears:



In the figure above we've identified the four major areas of the HP VEE window:

- The **title bar**. This is the standard Microsoft Windows title bar, which 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 standard Windows techniques.

What If I Want to Quit?

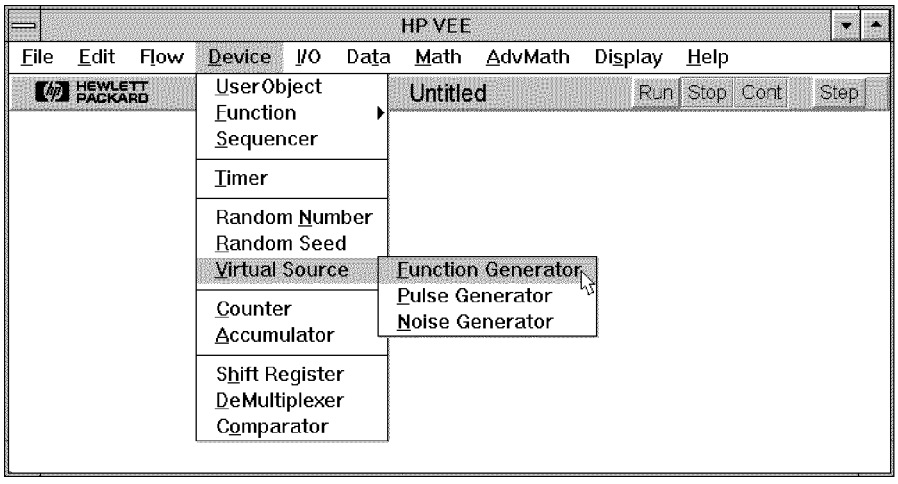
You can quit HP VEE at any time. Before you quit, you may want to save the contents of your work area (refer to "To Save Your Program" later in this chapter). Then exit HP VEE (refer to "Quitting HP VEE"). While doing the exercises in this chapter, you can save your file and quit whenever you want to 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 an executable "block diagram." 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 sources appears, as shown in the following figure.

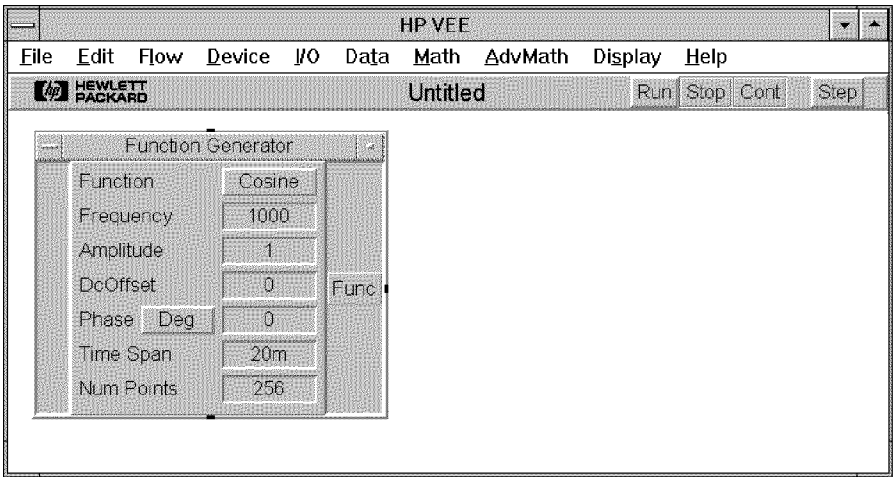


NOTE

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`

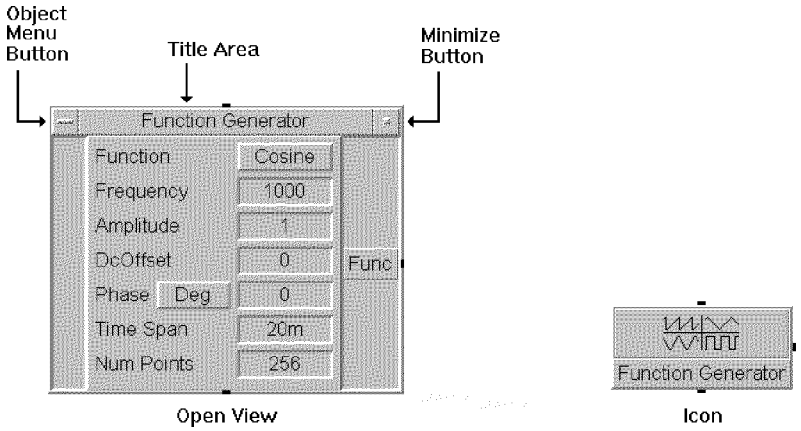
Now add the object to the work area by clicking on the `Function Generator` menu item. An outline of the object appears in the work area. Move the outline to where you want it and click the mouse button again. The object appears as shown below:



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** — from which you can choose. The two views of the `Function Generator` object are shown below:



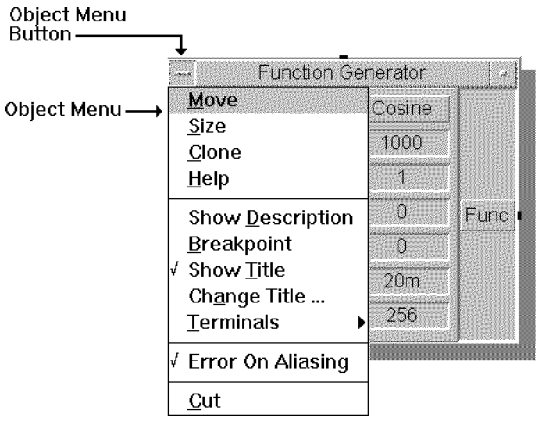
The `Function Generator` object, by default, appears in its open view. In the open view all object parameters are visible, and you can edit them. Also, the **object menu button**, **title area**, and **minimize button** are displayed at the top of the object.

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, title, 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 — you'll delete the object instead.)



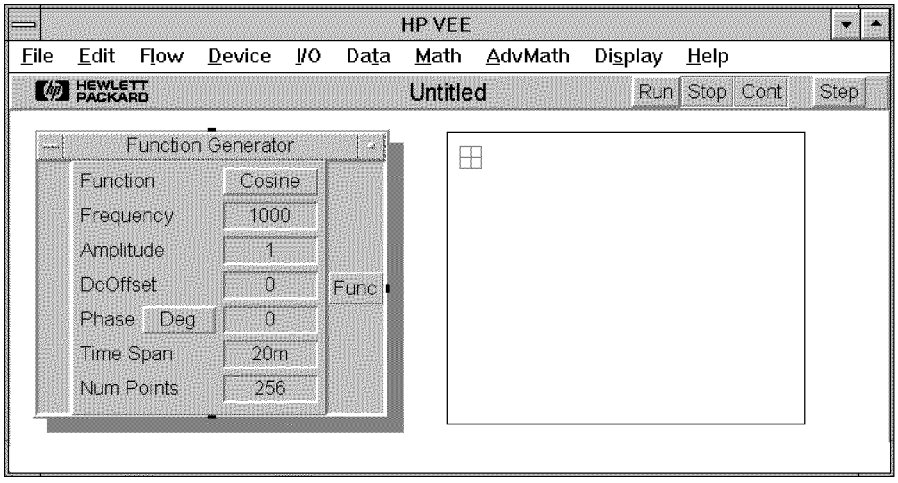
Now you can click on one of the object menu choices to perform the action you desire. Or, to make the object menu go away, click on an empty area *outside* the menu.

Short Cut

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. Just move the outline to the new location while continuing to hold the mouse button down, as shown below:



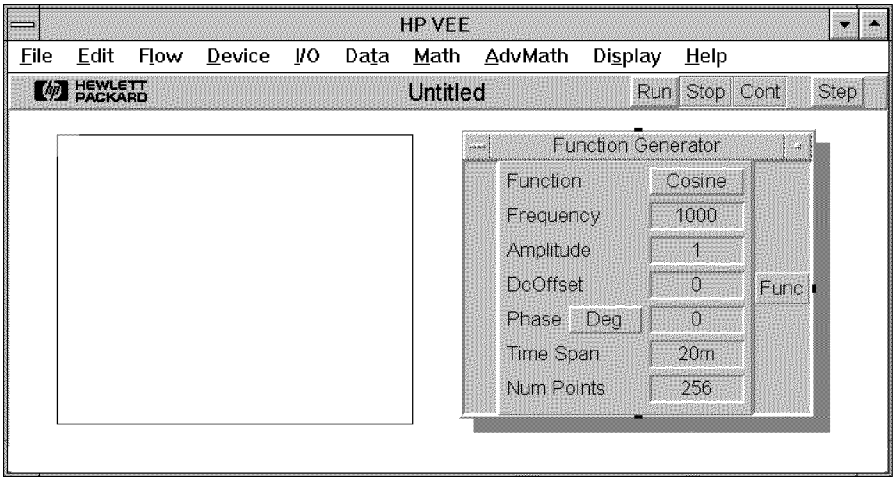
Now release the mouse button — the object will jump to the new location.

Short Cut

You can move an open view object by grabbing and dragging its title area (the standard Microsoft Windows method). You can also grab any part of the open view object *except* for buttons, entry fields, pins, or terminals. You can move an icon by grabbing and dragging any part of it.

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

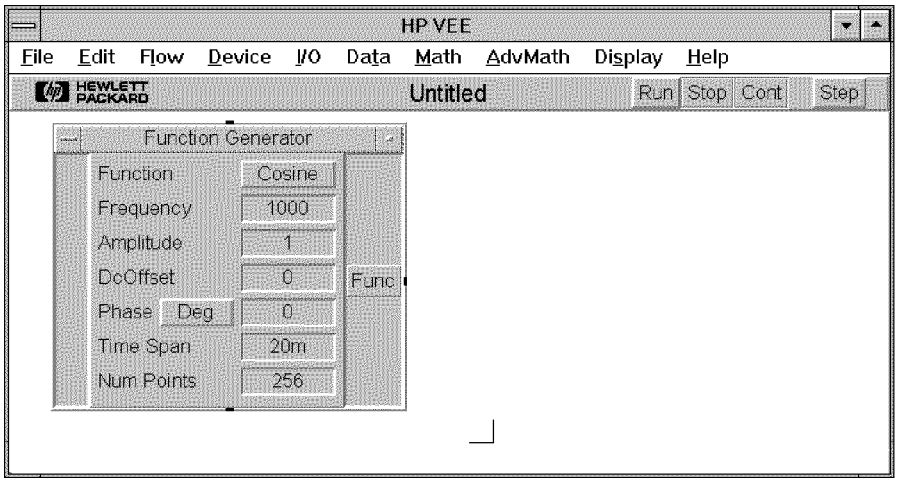
To delete an object from the work area, select *object menu* ⟹ `Cut` for the object you want to delete. For example, select the object menu for the `Function Generator` on the right and click on `Cut`. The object disappears from the work area, but it is saved in the "cut-and-paste" buffer.

Short Cut

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:

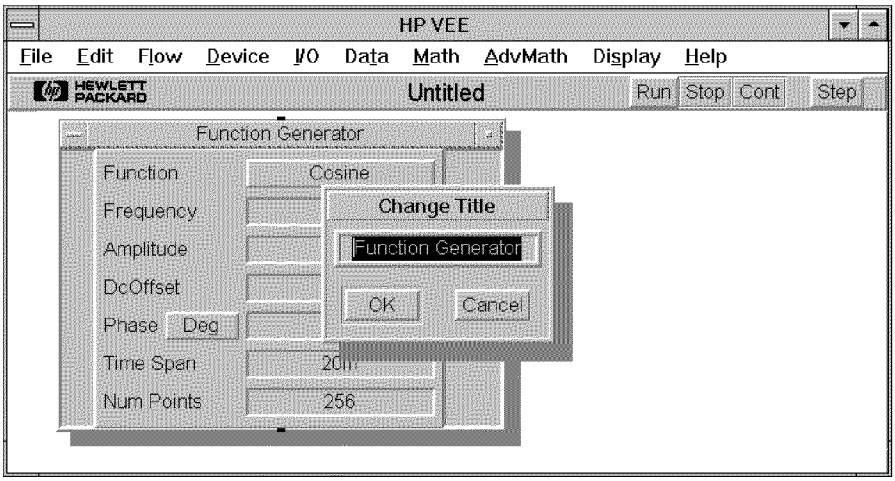


When you click the mouse button again, the object is resized. (Note that this procedure is different than that for resizing a window.)

Try resizing the object a few times on your own. You can enlarge the object or reduce it as much as you want. However, if you reduce the object too much, you may not be able to find the object menu button. No problem. Click the right mouse button with the mouse pointer over the object. The object menu reappears, and you can resize the object.

To Change the Title of an Object

To change the title, select *object menu* ⟹ `Change Title`. The `Change Title` dialog box appears:



To enter a new title, click on the edit area of the dialog box and start typing — the old title disappears. Type `Example Function Generator`. 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.

Short Cut

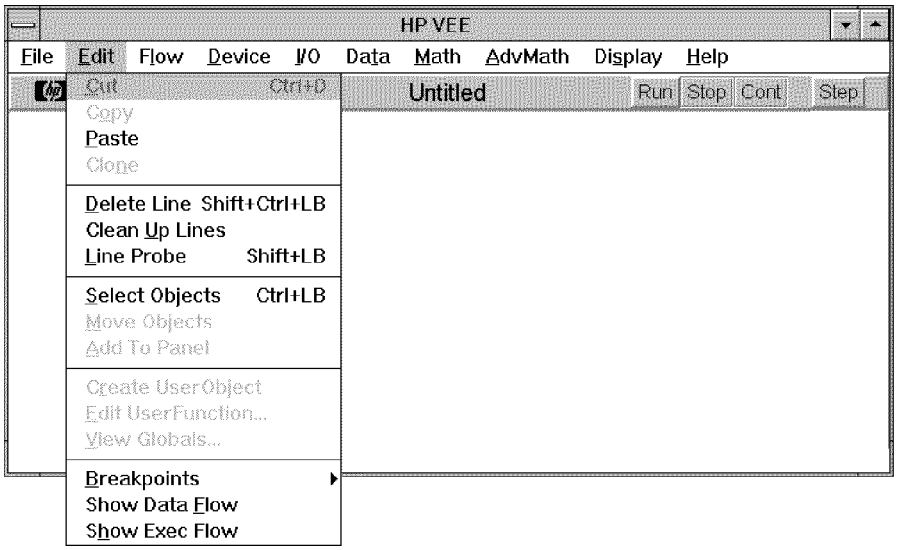
You can save time by using standard Windows editing techniques. For example, if you click at the extreme left edge of the edit area, the cursor will appear there. You can then type `Example` without destroying the rest of the title.

To Clear the Work Area

To clear all objects from the work area, use the standard Windows procedure: select `File` ⟹ `New`. Try it now. Just discard the changes in the work area when prompted by the dialog box. (Click on `No` in response to `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:



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.

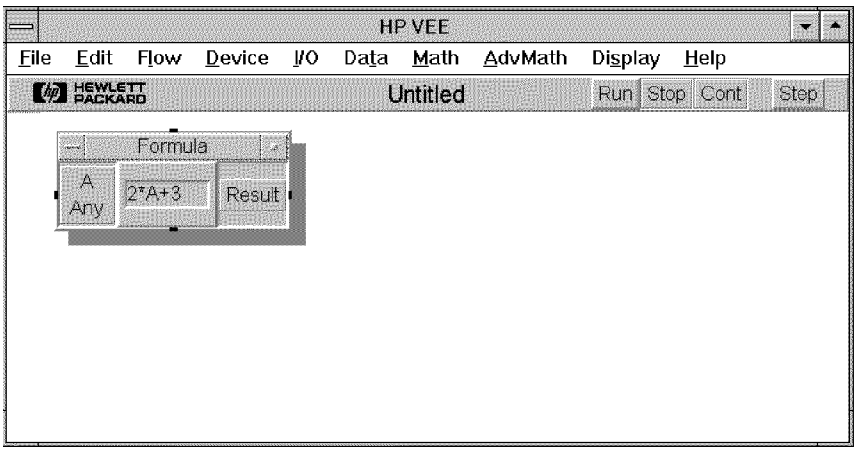
In either case, click the left mouse button anywhere outside the menu to make the menu go away.

> **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.)

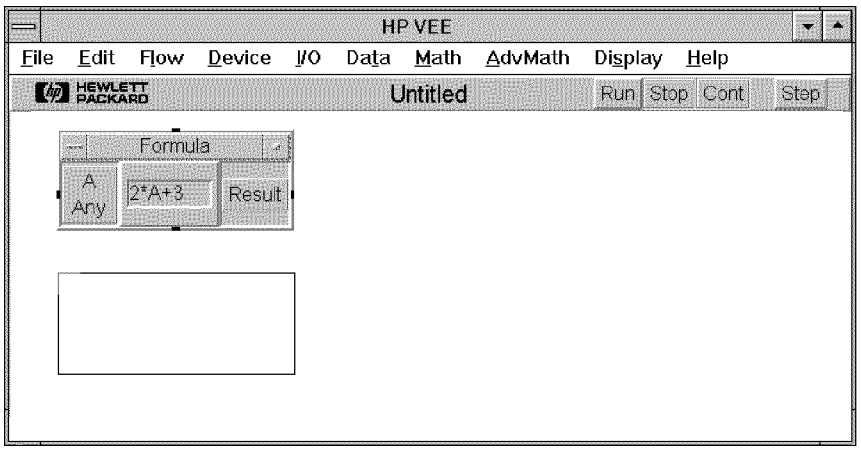
Now paste the object back in the work area (**Edit** ⟹ **Paste**). Move the outline to the desired location and click the mouse to paste the **Formula** object back in the work area. Once an object is in the cut-and-paste buffer, you can paste it as many times as you want.

> **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-and-paste" 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-and-paste" 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** ⟹ **Clone**. Move the object outline to a new location, as shown below:

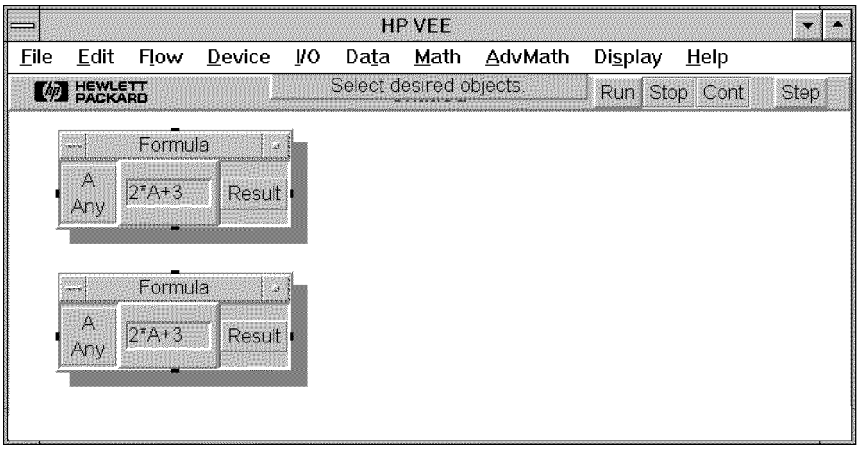


Click again and another **Formula** object appears in the outlined location.

To Select and Edit Multiple Objects

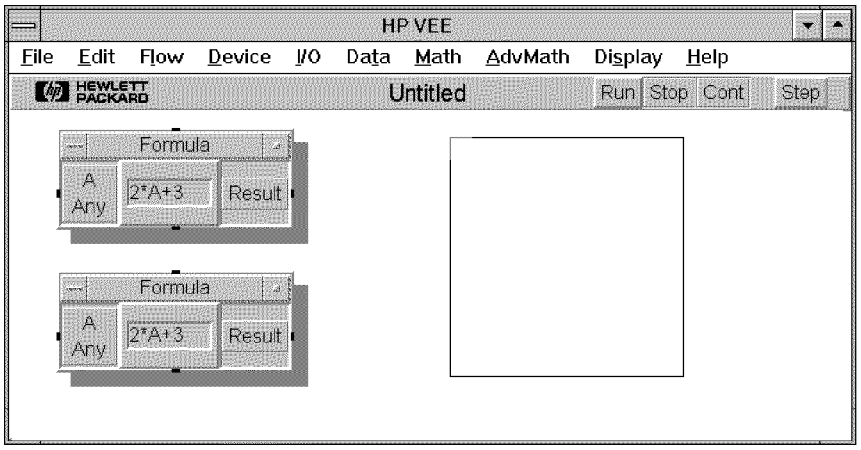
Although the easiest way to select an object is to click on it with the mouse, you can only select one object at a time that way. When you select a second object, the first is "unselected" and its shadow disappears.

To select multiple objects, select **Edit** ⟹ **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:

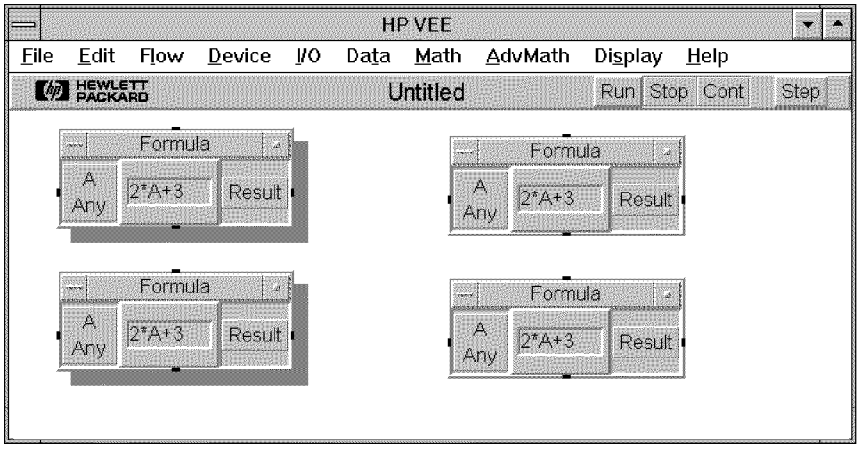


Now click the left mouse button in an empty part of the work area. The "Select desired objects" mode is turned off, but the objects remain selected. (However, if you click a second time, the objects become "unselected.")

You can use the **Edit** menu to move or copy the selected objects. For example, you can clone the objects with **Edit** ⟹ **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:

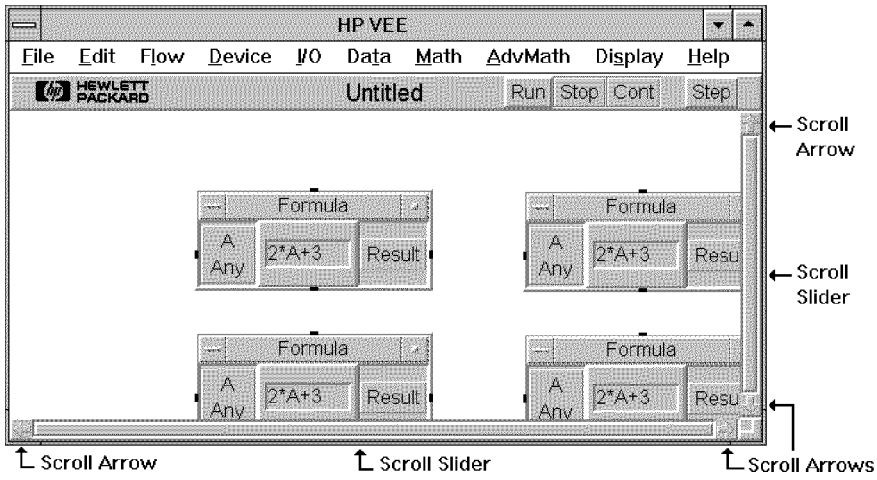


You can select any number of objects with `Edit` ⟹ `Select Objects`. You can then `Cut` and `Paste` the selected objects, or you can use `Move Objects` to move them. To "unselect" the selected objects, just click on an empty area in the work area. Try experimenting with these commands on your own.

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 sliders** and **scroll arrows**, which appear if one or more objects are placed outside the visible work area.

For example, click on an empty area and drag the work area so that objects are outside both the vertical and horizontal boundaries, as shown below:



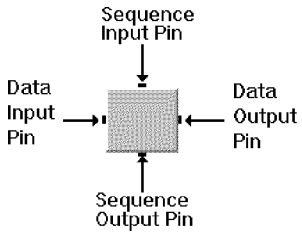
When you release the mouse button, both sets of scroll sliders and scroll arrows appear, as shown above:

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

Understanding Pins and Terminals

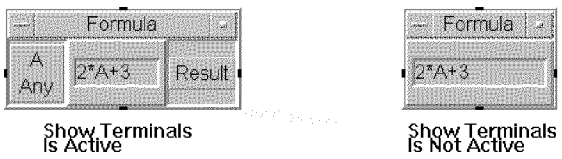
A single object can do little by itself. However, by connecting objects together with lines, you can construct an HP VEE program. The points of connection are the input and output **pins**. Most objects have one or more of the following kinds of pins:

- 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**.



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 (selectable from the object menu) is active.

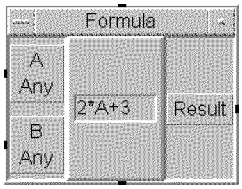
Let's look at an example. Add a **`Formula`** object to the work area (**`Math`** ⟹ **`Formula`**). By default, the object shows its terminals, as shown below on the left:



If you turn off **Show Terminals** (*object menu* ⟹ **Terminals** ⟹ **Show Terminals**), the **Formula** object appears as shown on the right. **Show Terminals** is a "toggle" feature. That is, each time you select it, it changes state. If **Show Terminals** is active, a checkmark appears in front of it in the object menu.

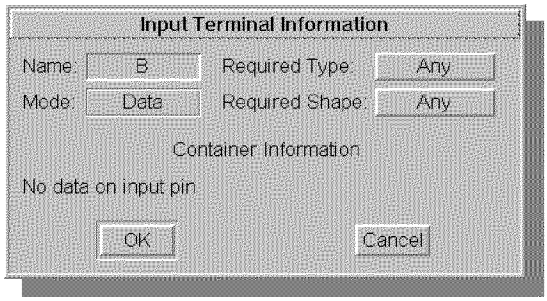
To Add a Terminal

You can add a second data input terminal to the **Formula** object by using the object menu (*object menu* ⟹ **Terminals** ⟹ **Add 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:

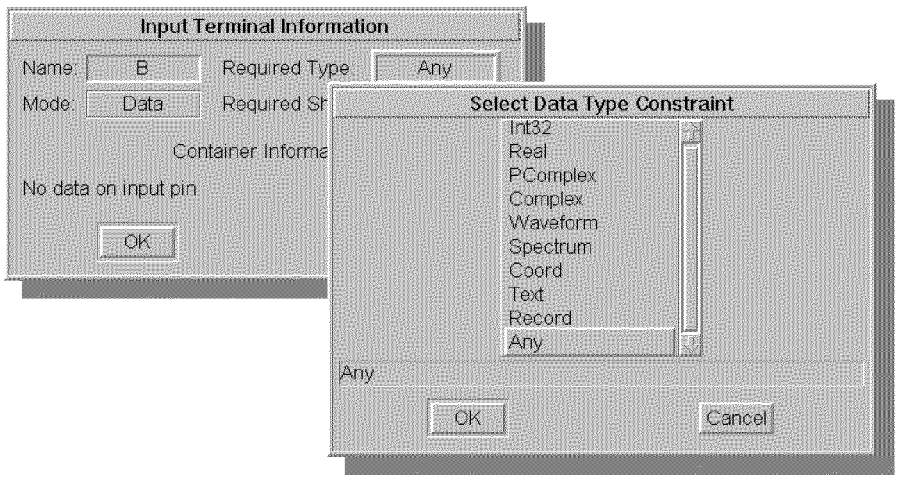


To Obtain Terminal Information

The terminal label gives you some terminal information. For example, the **B** data input terminal that you added is labeled **B Any**. The terminal name is **B** and the required data type for the input terminal is **Any**, meaning any HP VEE data type is allowed. To obtain more information, double-click on the terminal label area. The following dialog box appears:



You can now edit the terminal. For example, if you click on the **Name** entry field, you can change the name of the terminal. If you click on **Any** in the **Required Type** field, you can select another data type from a second dialog box, shown below:



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. For further information about data types and shapes, refer to *Using HP VEE*.

To Delete a Terminal

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

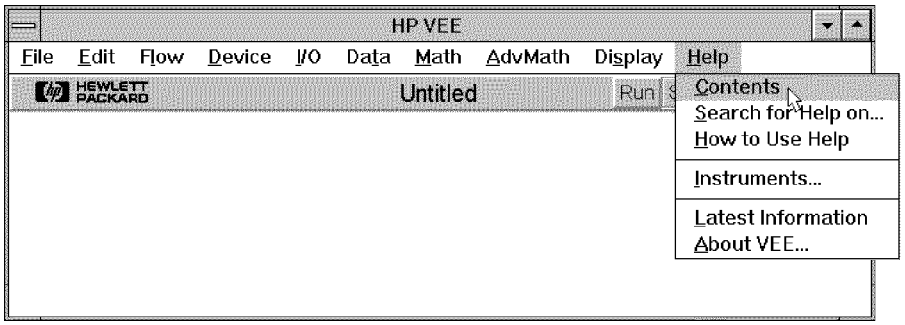
Use *object menu* ⟹ **Terminals** ⟹ **Delete Input** to delete an input.

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

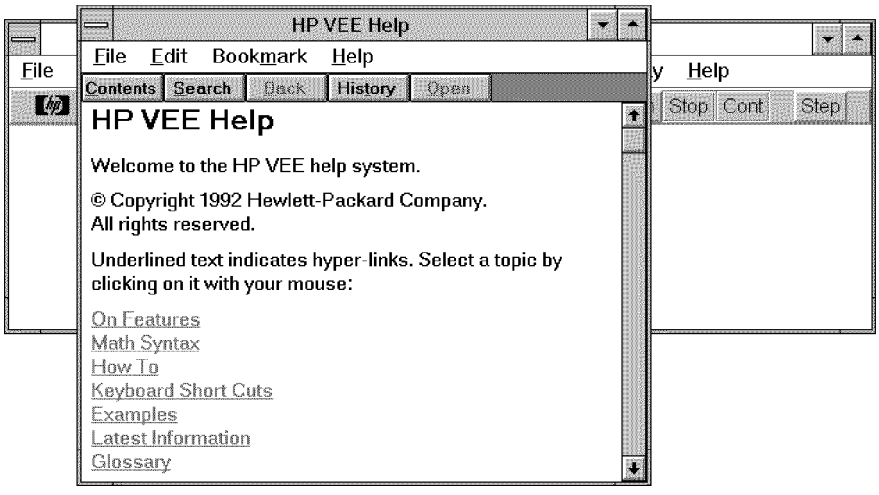
Or, as a short cut, you can place the mouse pointer over the terminal you want to delete and press Ctrl+D. However, make sure that you place the pointer over the terminal — otherwise, you may accidentally delete the object itself. (Ctrl+D is also the short cut for deleting an object.)

Getting Help

HP VEE uses the standard Windows online help system. Click on `Help` and the following menu appears:



Select `How to Use Help` for information on Windows Help. Or select `Contents` to launch the help window:



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.
- `Keyboard Short Cuts` brings up a list of keyboard accelerators.
- `Examples` brings up a list of example programs. You can select and open an example directly from `Help`.
- `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` ⟹ `Exit` *for the help window, not for the HP VEE window.*

Quitting HP VEE

You can quit HP VEE by selecting `File` ⟹ `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, clear` to discard your changes, or `Yes, save` 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 iconic programs work.

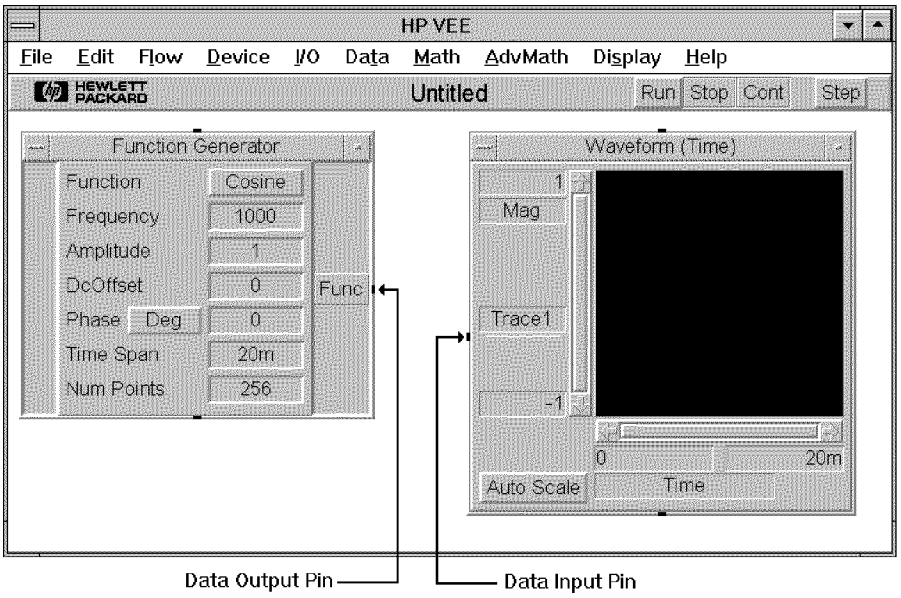
Your First Program

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.



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. (Don't grab a pin or terminal — you'll get strange results 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.

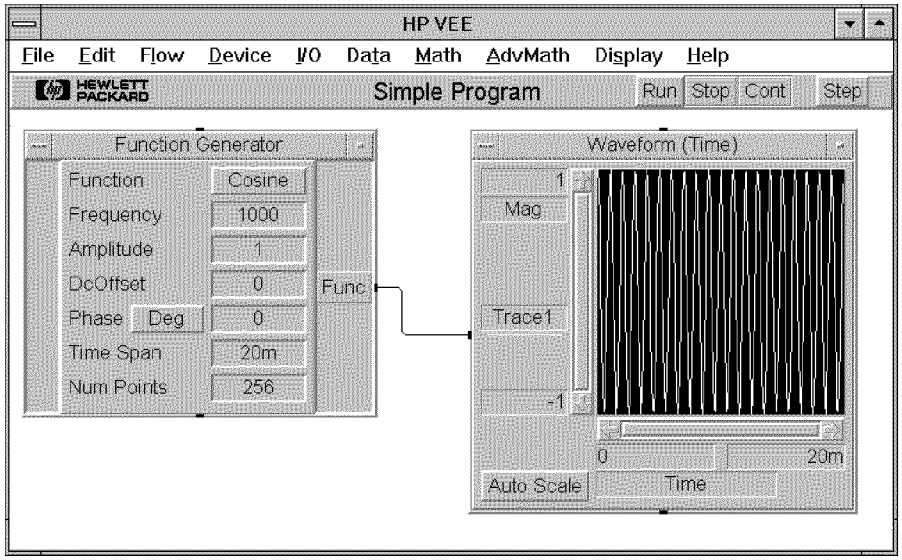
NOTE

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

You can add a title for your program. Just select **File** ⟹ **Change Title** and change **Untitled** to **Simple Program** in the dialog box.

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:



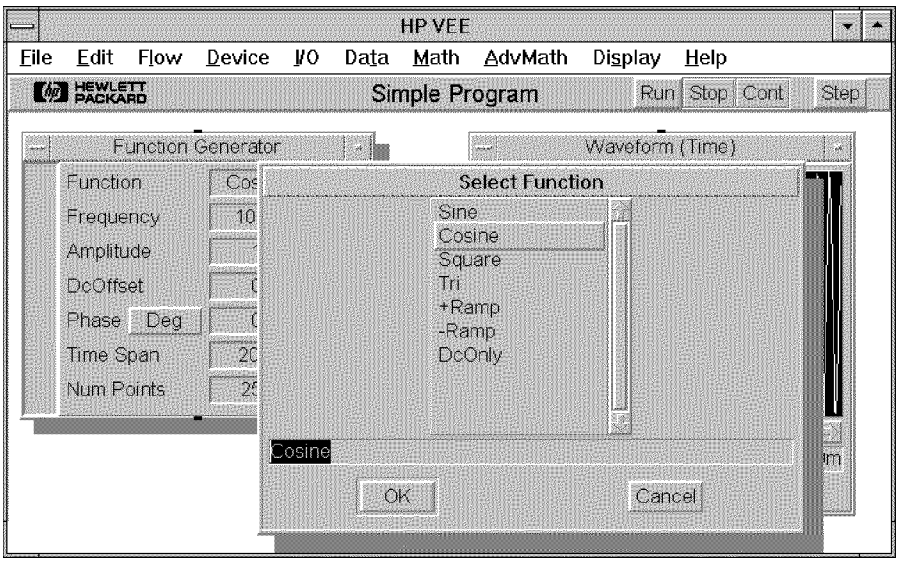
In addition to the **Run** button, you can use the **Stop**, **Cont**, and **Step** buttons to control the program. Once you have stopped a running program, you can use **Cont** to continue it. Or you can use **Step** to run a program one-step-at-a-time.

NOTE

From now on, when we say to "run" your program, just click on the **Run** button in the tool bar.

To Change Object Parameters

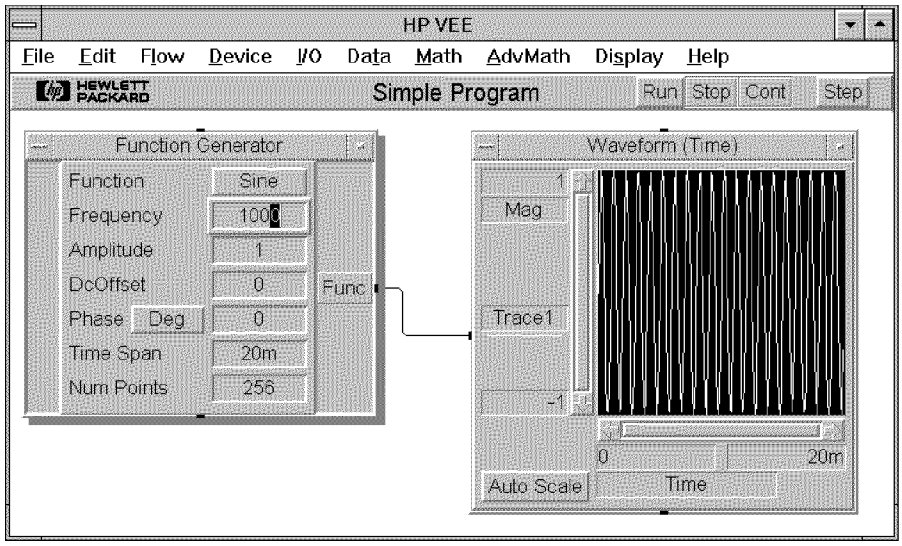
You can change the parameters of an object in its open view. You may have noticed that the `Function Generator` object has "raised" fields. For example, `Cosine` is raised in the `Function` field. Such raised fields are **buttons**, which you can "press" by clicking on them. If you click on `Cosine`, the `Select Function` dialog box appears:



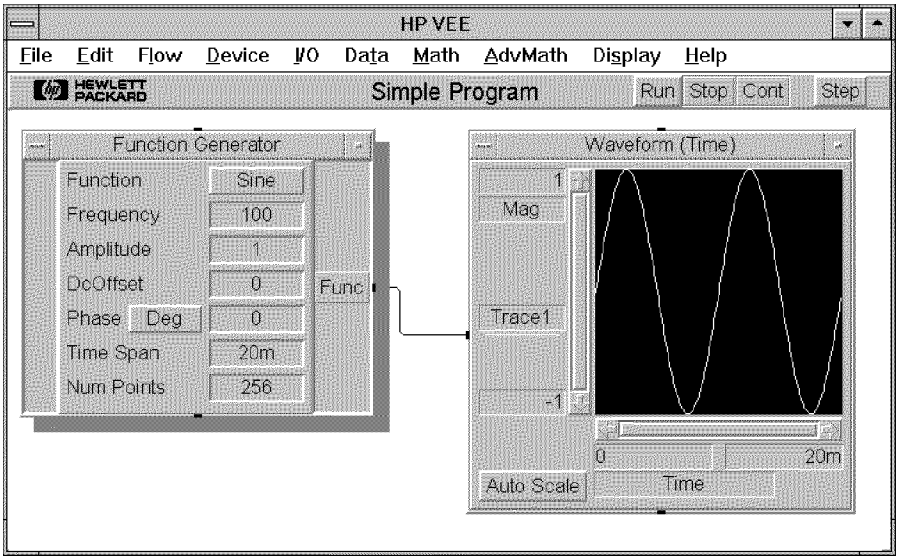
To select the sine function, click on `Sine`, and then click on `OK`. (Or just double-click on `Sine`.)

Other fields are "recessed" (for example, the `Frequency` field). These are **entry fields**, which become "type-in" fields when you click on them. Just click on the field and a cursor will appear. You can use standard keyboard editing techniques to move the cursor and enter the desired value. Or you can use standard Windows mouse techniques to select and modify text within the field.

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:



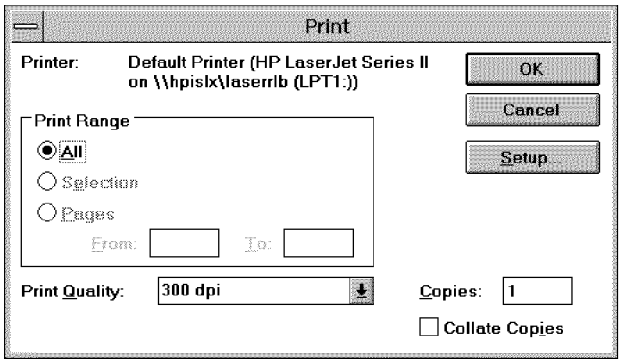
The displayed waveform is now a 100 Hz sine wave.

Try changing a few object parameters on your own:

1. Click on `Deg` 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`.

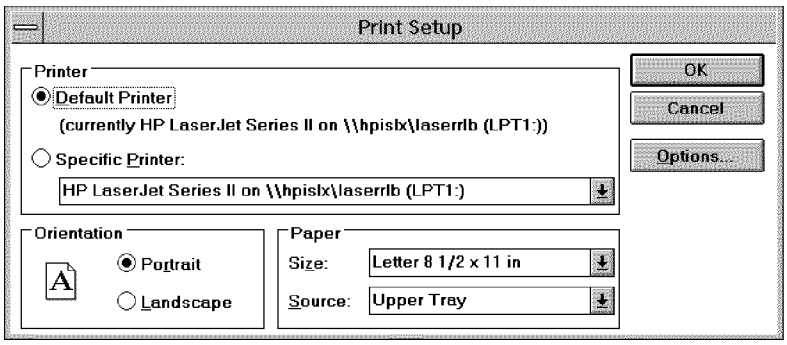
To Print the Screen

To print the screen, select `File` ⟹ `Print Screen`. The following dialog box appears:



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.

When you click on `Setup`, the Windows `Print Setup` dialog box appears, from which you can access any printer you have set up in Windows.



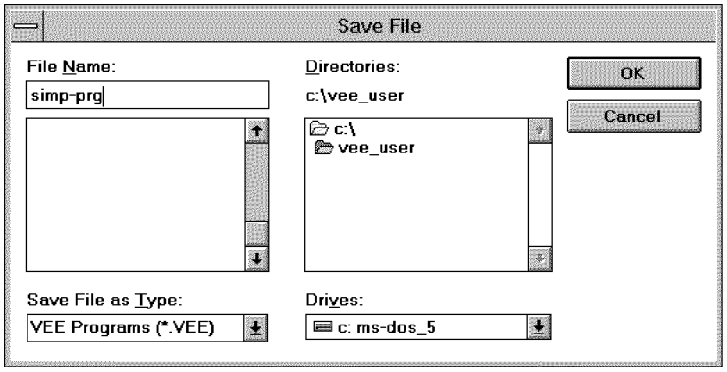
You can select a printer (select `Specific Printer`, click on the down arrow, and then click on the desired printer), change the orientation (`Portrait` or

`Landscape`), and select the paper size and source. Click on `OK` to return to the `Print` dialog box, and then click on `OK` to print the screen.

For further information about using dialog boxes, refer to the *Microsoft Windows Tutorial*.

To Save Your Program

You can save your program (whatever is in the work area, whether complete or not) at any time. To save the program select `File` ⟹ `Save As` and the `Save File` dialog box appears, as shown below:



By default, HP VEE saves your files to the `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 automatically adds the extension `.vee` to the file name.

NOTE

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.

You can re-save your program to the same file name at any time by selecting `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, 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

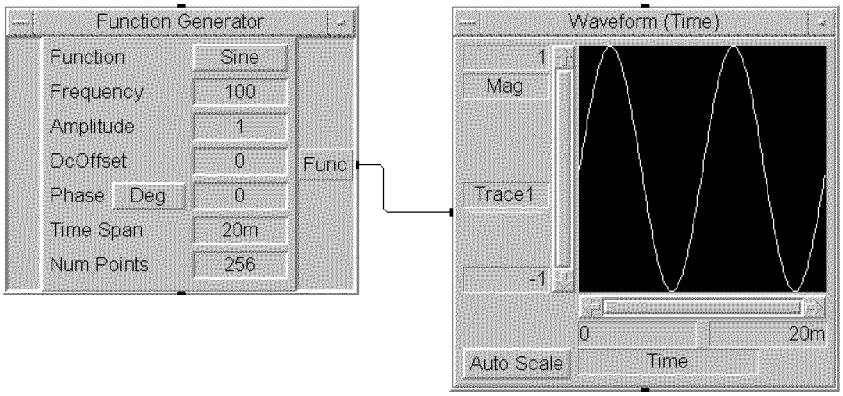
In conventional programming languages such as C, BASIC, or Pascal, the order in which program statements execute is determined by a set of sequence and selection rules. Generally, statements execute in the order they appear in the program, except where statements cause execution to branch to another 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 data.*
- *An object finishes executing only after all appropriate data output pins have been activated.*

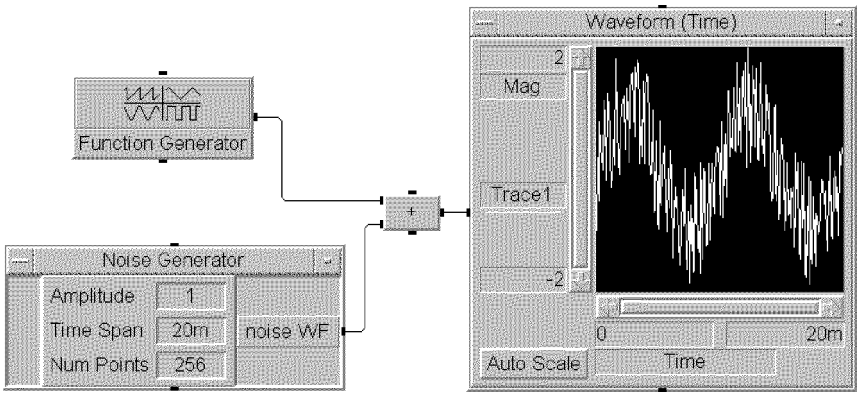
In HP VEE you can change the order of execution by using sequence input and output pins. However, you won't normally need to use sequence pins, except to ensure the order of execution when controlling external devices such as instruments. For internal HP VEE operations, it is generally best to avoid 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` ⟹ `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:



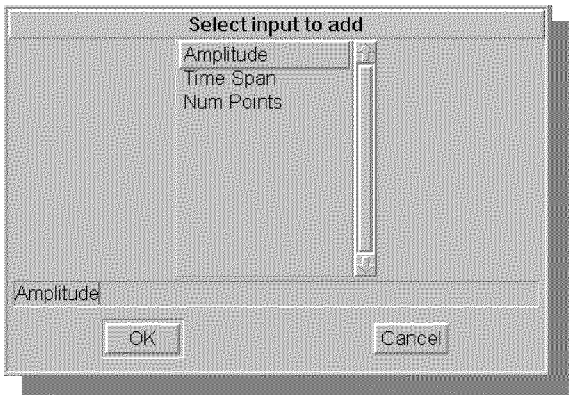
To create this program you'll first need to delete the line connecting the **Function Generator** and **Waveform (Time)** objects in the original program. You can use the **Edit** menu to do this: click on **Edit** ⟹ **Delete Line**, and then click on the line. Or you can use a shortcut: press and hold 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 **+** (**Math** ⟹ **+-*/** ⟹ **+**) objects. Connect the input and output pins as shown in the figure.

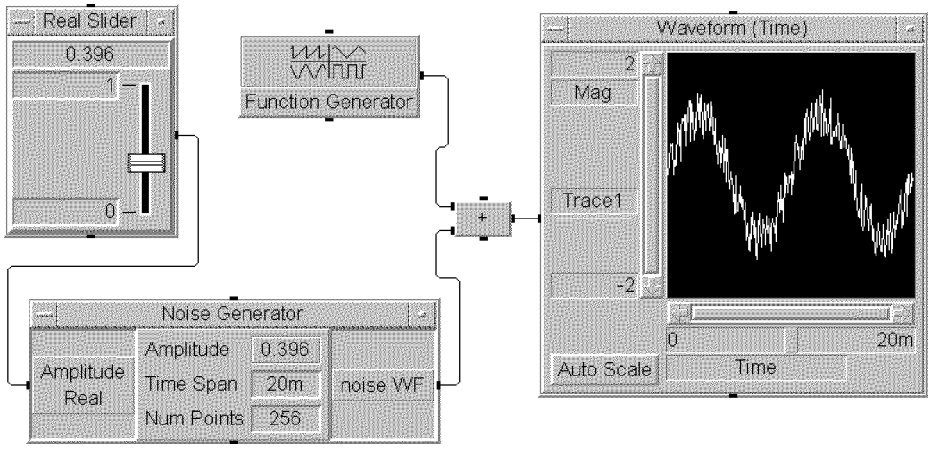
What is the order of execution? The **Waveform (Time)** object won't execute until it has received data from the **+** object. The **+** object won't execute until *both* of its inputs have been satisfied by the **Function Generator** and **Noise Generator** objects. This leaves the question of which 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 **+** object doesn't execute until both generator objects execute. Once both of its inputs receive data, the **+** 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 **Show Exec Flow** and **Show Data Flow** by selecting each of these in the **Edit** menu. These "show flow" features are "toggles" — a checkmark in the menu indicates that the feature is active. Now run the program. Each object is highlighted when it executes, and data flow is shown by "torpedoes" that move down the lines. (These "show flow" features do slow down program execution, so normally you'll want to turn them off.)

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:



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 **+** 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 **+** object has executed.

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

3

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.

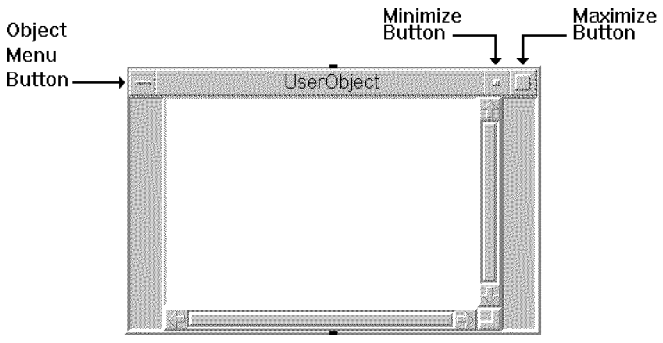
General Techniques

This section provides some general HP VEE programming techniques that include working with data, creating User Objects, and creating a user interface.

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 readable.

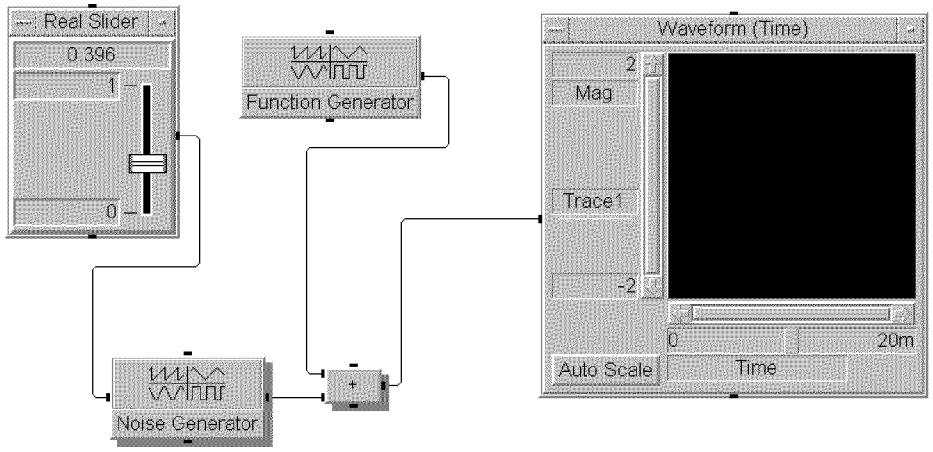
One way to create a UserObject is to select `Device` ⟹ `UserObject` from the menu bar and place a blank UserObject in the work area:



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.

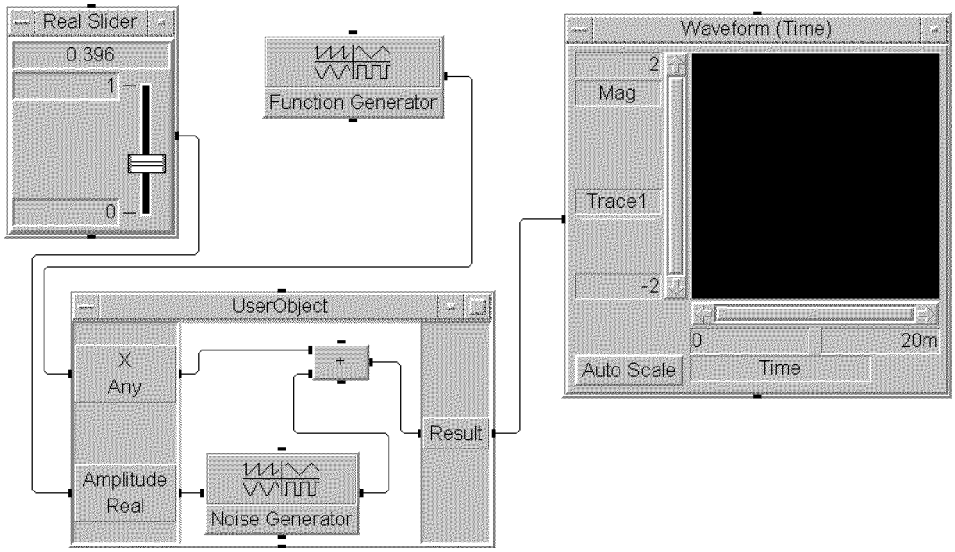
Note that the UserObject has an object menu button and minimize button, like any HP VEE object. In addition, it has a maximize button. If you need a larger work area within the UserObject, you can resize it from the object menu, or you can click on the maximize button to make the UserObject take up the 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 `+` 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 **+** objects, and will automatically be created with the appropriate input and output pins and connections:

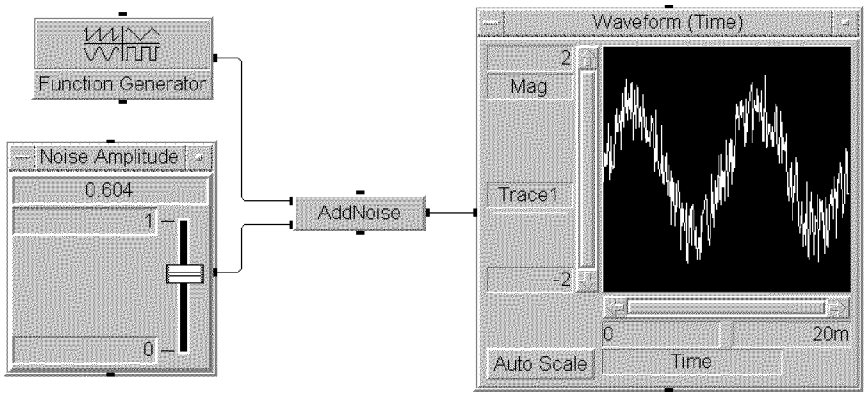


NOTE

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 be rather large and convoluted. You can rearrange and resize the work area of the UserObject, and move the UserObject to an appropriate place in the work area after the fact. 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 have 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` (*object menu* ⟹ `Change Title`). 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 UserObjects 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. UserObjects help you use "top-down" design in your HP VEE programs. For further information on UserObjects, refer to *Using HP VEE*.

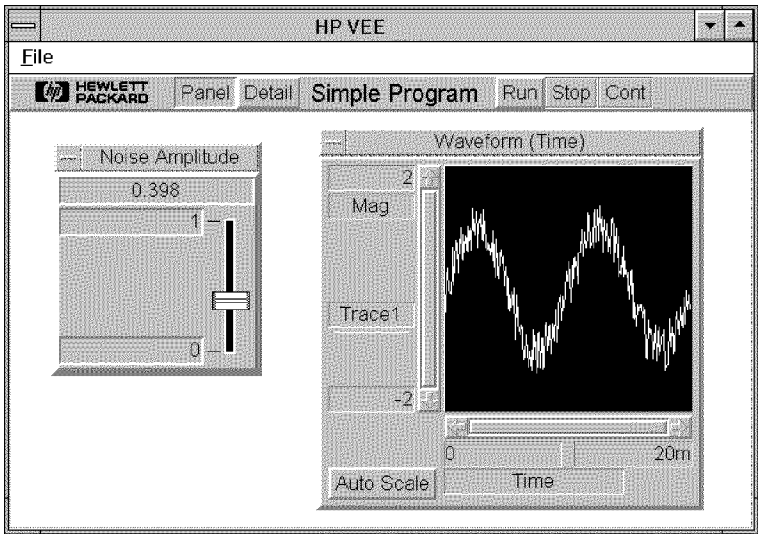
We'll continue with this example in the following section, so if you want to quit now, save your program (`simp-prg.vee`).

Creating an Operator Interface

HP VEE makes it easy to create an operator interface for your program. All you need to do is 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 `XY Trace` 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 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. (For example, if you want to change

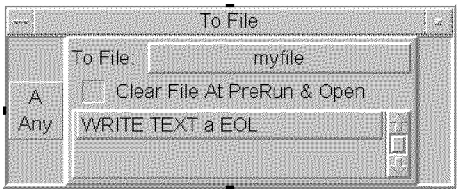
the title of the program, you'll have to do it from the detail view.) On the other hand, you can edit the panel view separately. For example, you can move, resize, or delete objects in the panel view independently from the detail view. Thus, you can organize the panel view as an operator interface for your program.

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

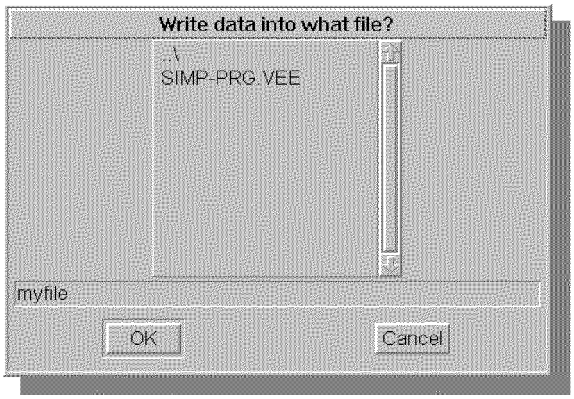
Using Data Files

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.

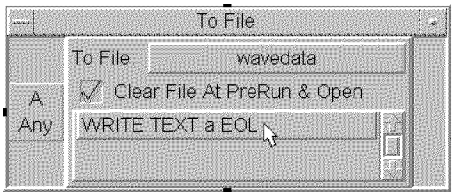
Open the program (`simp-prg.vee`), if it isn't already in your work area, and go to the detail view. Now add a `To File` object to the work area (`I/O` ⟹ `To` ⟹ `File`):



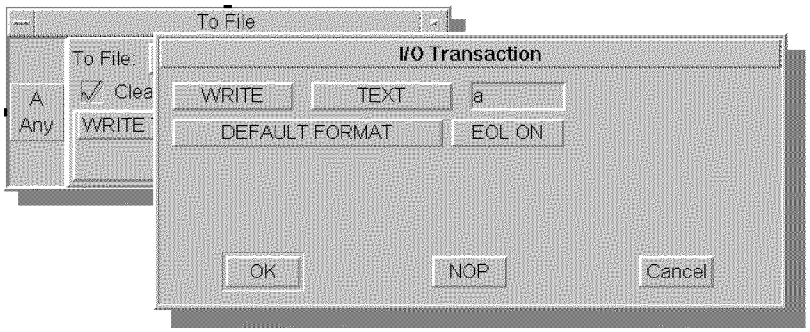
Now change the name of the data file (the `To File` field) to `wavedata`. Just click on `myfile`, and the following dialog box appears:



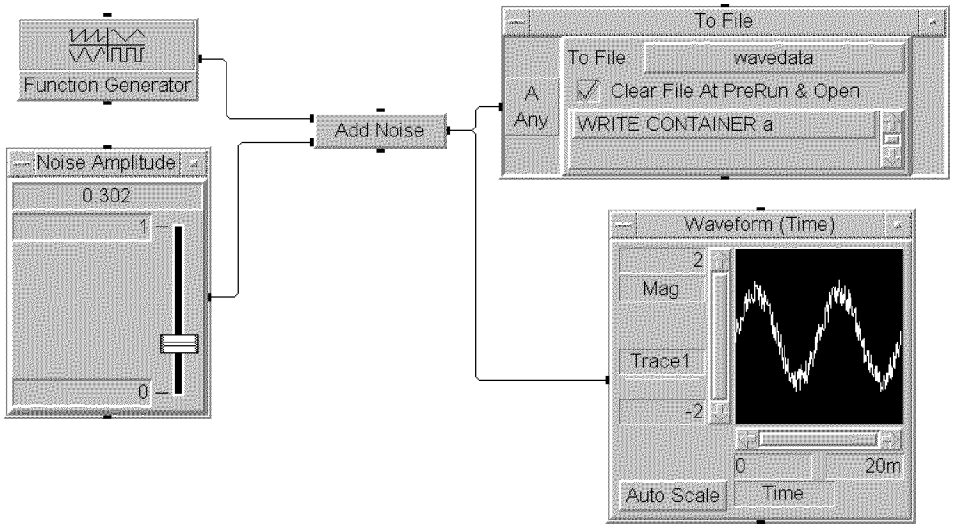
Double-click in the edit field to select `myfile`, type in the new name, and then click on `OK`. Also, click on the checkbox in the `To File` object to activate `Clear File at PreRun and Open`, as indicated by the checkmark in the following figure:



Now 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.



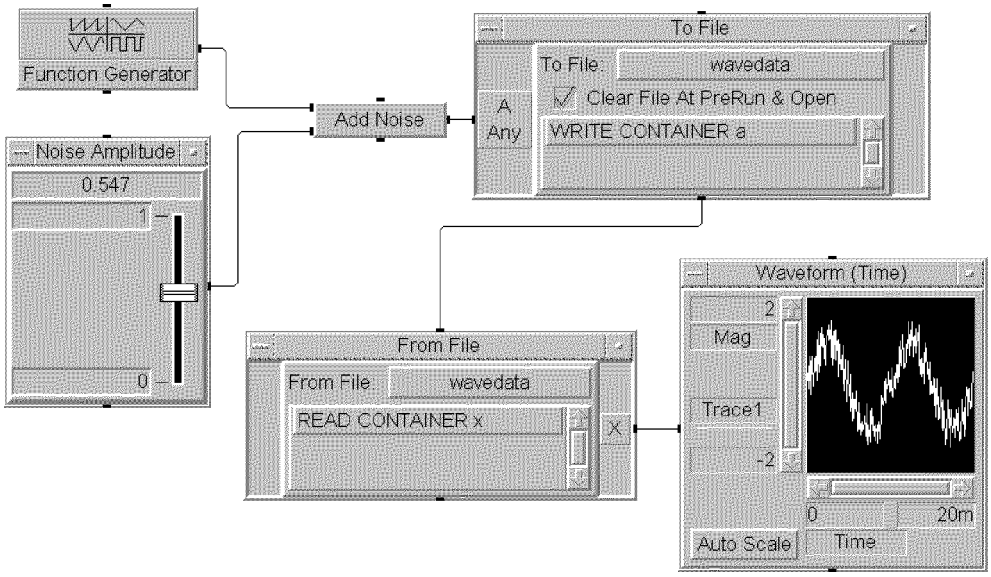
Click on **TEXT** and you'll be given a list of data types to write. Click on **CONTAINER**, and then on **OK** to change the transaction to **WRITE CONTAINER a**. Connect the data output pin of the **AddNoise** UserObject to the data input pin of the **To File** object, as shown in the following figure.



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**.

> **NOTE**
>
> For further information about I/O transactions, refer to *HP VEE Advanced Programming Techniques*. For further information about containers, refer to *Using HP VEE*.

Let's add a **`From File`** object to the program to read the data back. You'll need to change the read transaction to **`READ CONTAINER x`** (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.

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.

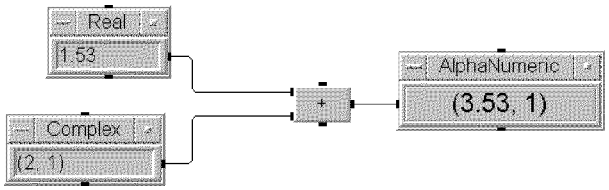
To Use Data Types

HP VEE supports several data types, including text, integer and real numbers, and several types of complex and coordinate numbers. For a complete discussion of data types, refer to *Using HP VEE*. You have already seen how the **+** 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**.
- **+** object:
  Select **Math** ⟹ **+-*/** ⟹ **+**.
- **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 `+` 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.

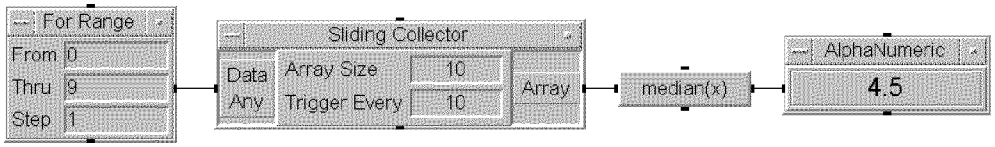
Normally, HP VEE takes care of all data type conversions for you. You won't need to do anything special, but you should be familiar with the conversion rules that HP VEE follows. Refer to *Using HP VEE* for further information.

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` ⟹ `Repeat` ⟹ `For Range`.
- `Sliding Collector` object:
  Select `Data` ⟹ `Sliding Collector`.
- `median(x)` object:
  Select `AdvMath` ⟹ `Statistics` ⟹ `median(x)`.
- `AlphaNumeric` object:
  Select `Display` ⟹ `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.

You can use **Show Exec Flow** and **Show Data Flow** to see how the program executes.

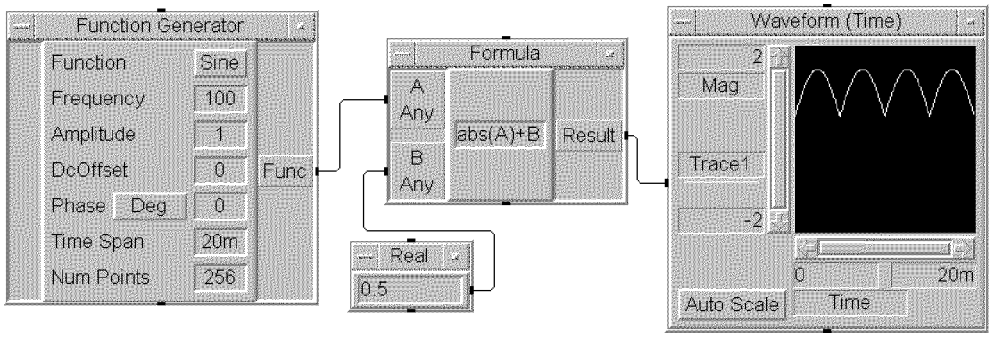
To Use the Formula Object

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 **+** 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 input **A** is a real array and input **B** is a real scalar. HP VEE automatically adds scalar **B** to each element of array **A**.

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. Instrument panel objects require that you install the appropriate instrument driver file before starting HP VEE (refer to Chapter 1).
- 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. These objects also require that you install the appropriate instrument driver file.
- A `Direct I/O` object provides a means of direct communication with an instrument without the use of an instrument driver file.

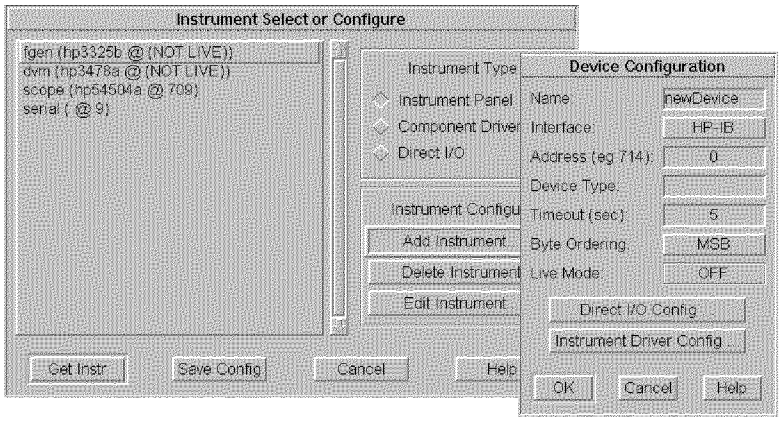
This section introduces the use of instrument panels. For a complete discussion of instrument panels, component drivers, `Direct I/O` objects, and the HP Driver Writer Tool, refer to *HP VEE Advanced Programming Techniques*.

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:

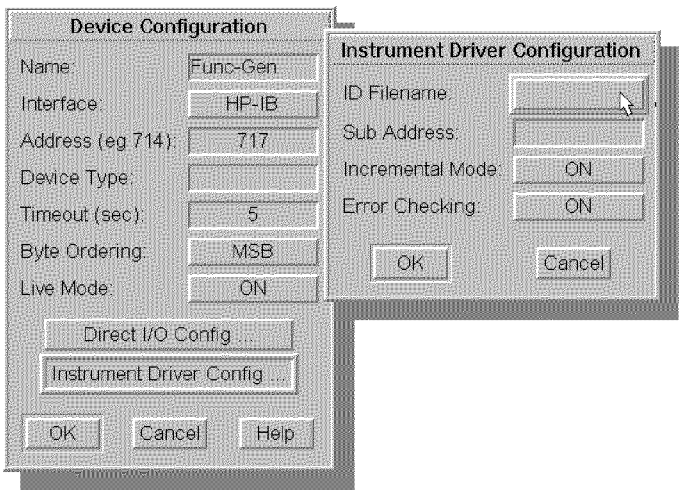
1. Select **I/O ⟹ Instrument**. The **Instrument Select or Configure** dialog box appears. By default, the selections **fgen**, **dvm**, **scope**, and **serial** are present. Please don't delete these. They are used in various examples.
2. The **Instrument Panel** button (in the **Instrument Type** section) should already be selected. If not, click on it. Now click on **Add Instrument**. The **Device Configuration** dialog box should appear:



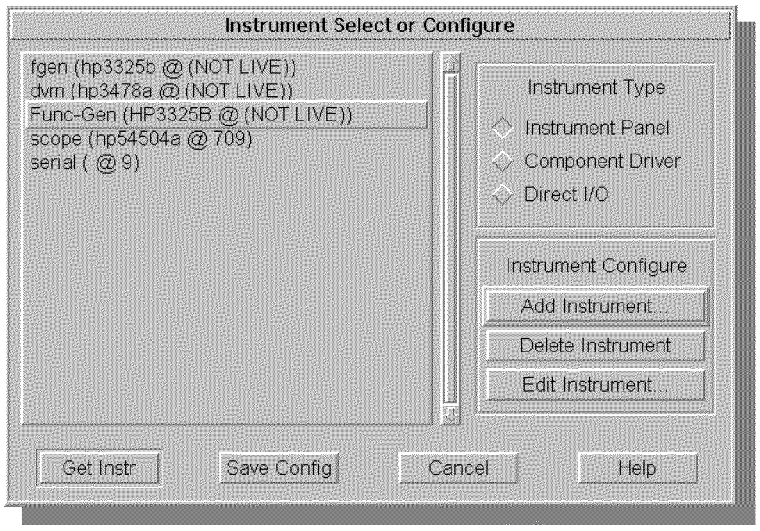
   You'll edit the fields in this dialog box to add a function generator to your list of instrument drivers. However, *when changing values, do not press* Enter. If you do, you'll exit the dialog box. Instead, when you have edited a field, click on the next field you want to edit, or use the Tab key or arrow keys to advance through the fields.
3. Click on the **Name** field and type **Func-Gen** (remember, don't press Enter). Now click on the **Address** field and enter the address of your instrument. Typically, the address for the HP 3325B is **717**.

> **NOTE**
>
> You can use the `Instrument Finder` utility described in Chapter 1 to find the addresses of your instruments. For detailed information on instrument I/O addressing, refer to Appendix A.

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.

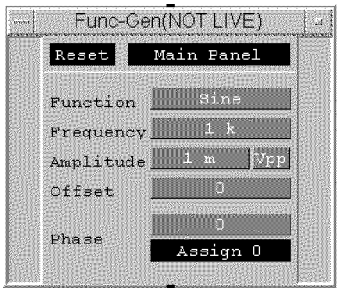
Using an Instrument Panel

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:



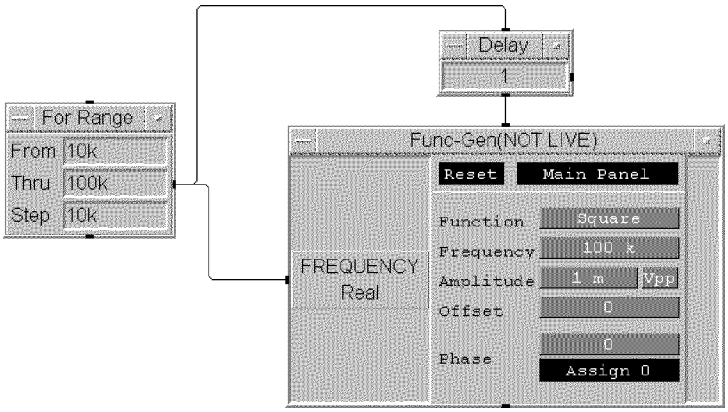
2. Click on **Sine**. A dialog box gives you a series of choices for the **Function** field. Double-click on **Square** to change the shape of the waveform. If a function generator was connected, and live mode was **ON**, this change would also occur on the physical instrument.
3. Click on the **Main 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, place the mouse pointer over the input terminal area in the left margin of the object and press Ctrl+A. A dialog box lists the possible input terminals that you can add. Double-click on **Frequency** to add that terminal.
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:



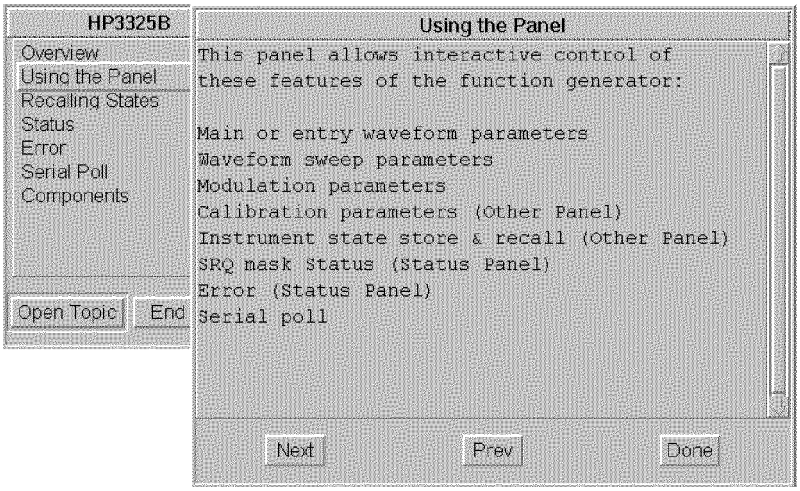
When you run the program, the **For Range** object steps the function generator through frequencies of 10 kHz, 20 kHz, and so forth, up to 100 kHz. Because of the delay object, each step takes 1 second.

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` ⟹ `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 *Using 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` ⟹ `Instruments` . . . and then select the help file (for example, `hp3325b.ih`) for your instrument from the list.

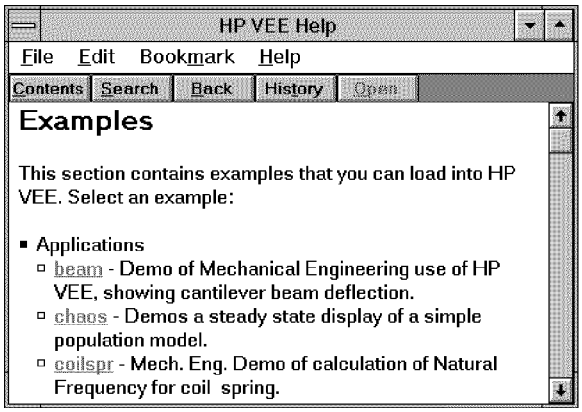
Unlike the other HP VEE help topics, the instrument driver help files do not use the Windows Help system. The following is an example of help for the HP 3325B Function Generator:



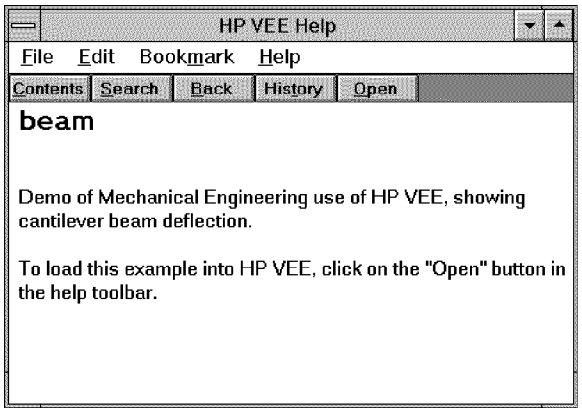
Using Program Examples

HP VEE provides a great number of program examples that demonstrate various HP VEE programming techniques. You'll not only find these examples to be good learning tools, but you may be able to incorporate portions of these examples in your own programs.

The example files are found in the subdirectories under `c:\vee\examples`. However, you can open example files directly from *HP VEE Help*. To do this, select `Examples` from the help `Contents` screen. A scrollable list of examples appears:



Now click on the hypertext link for the example you want. For example, when you click on `beam`, the following screen appears:



To open the `beam` program, click on the `Open` button. If you have a program in the work area, you'll be prompted to save it or discard changes. Once the example is loaded, just click on `Run` to start the program.

What's Next?

Now that you've finished our short introduction to HP VEE's capabilities, you can try some things on your own. You can find information in the following places:

- *Using HP VEE* provides detailed information about the basic HP VEE programming techniques. Several example programs, included with HP VEE, are described.
- *HP VEE Advanced Programming Techniques* provides detailed information about the advanced features of HP VEE. Examples of advanced HP VEE programs are described.
- *HP VEE Reference* provides reference sections for all of the HP VEE features. These reference sections are also provided in *HP VEE Help*.

A

I/O Addressing

I/O Addressing

HP VEE for Windows supports RS-232 serial, HP-IB, and GPIB interfaces. (HP-IB is Hewlett-Packard's implementation of the IEEE-488 interface bus standard. Other implementations are commonly called GPIB.) Also, you can access VXI devices by using an HP E1406 Command Module connected to one of the supported HP-IB or GPIB interfaces. For information about the specific interfaces supported, refer to Chapter 1.

To access an I/O device, determine the correct address and enter it in the `Address` field in the `Device Configuration` dialog box.

NOTE

For information on addressing instruments using dialog boxes, refer to "Configuring Instruments" in Chapter 3 of this manual. For information on finding instrument addresses, refer to "Finding Instruments" in Chapter 1 of this manual. For detailed information on instrument I/O, refer to the *HP VEE Advanced Programming Techniques* manual.

Interface Select Codes and Addresses

The addressing schemes for various types of devices are described in the following sections.

To Address Serial Ports

The four PC serial ports are supported by using select codes 9 – 12:

Select Code	Interface
9 (default)	COM1 serial port
10	COM2 serial port
11	COM3 serial port
12	COM4 serial port

To Address HP-IB and GPIB Interfaces and Devices

HP-IB and GPIB devices are addressed using the following scheme:

SPA[*SA*]

Where:

S is the select code of the HP-IB or GPIB interface.

PA is the primary address of an HP-IB or GPIB device (the valid range is 00 through 31).

SA is the optional secondary address (the valid range is 00 through 31).

Let's look at a couple of examples to see how this works:

- For an HP-IB device at select code 7, primary address 01, enter `701` in the `Address` field of the `Device Configuration` dialog box.
- For a GPIB device at select code 14, primary address 09, secondary address 02, enter `140902` in the `Address` field of the `Device Configuration` dialog box.

HP-IB Select Codes

The select codes for HP-IB interfaces are as follows:

Select Code	Interface
1*	HP 82341 HP-IB Card
2*	HP 82341 HP-IB Card
3	HP 82341 or HP 82335 HP-IB Card
4	HP 82341 or HP 82335 HP-IB Card
5	HP 82341 or HP 82335 HP-IB Card
6	HP 82341 or HP 82335 HP-IB Card
7 (default)	HP 82341 or HP 82335 HP-IB Card
8*	HP 82341 HP-IB Card

* Select codes 1, 2, and 8 are not recommended for the HP 82335 HP-IB Card.

Theoretically, you can have up to eight HP-IB cards in your system, which can be a mix of HP 82335 and HP 82341 cards:

- For an HP 82335 HP-IB Card, the select code is determined by switch settings on the card (the default is 7). If you install more than one HP 82335 card, each card must be set for a unique select code in the range 3 through 7. (Refer to your HP-IB card installation manual for instructions.) Also, you must exclude address space for each card. Refer to "Excluding Address Space (HP 82335 HP-IB Card Only)" later in this appendix.
- For an HP 82341 HP-IB Card, the select code is assigned by the software. The select codes are assigned in the order: 7, 8, 1, 2, 3, 4, 5, and 6.

GPIB Select Codes

The National Instruments GPIB driver configures up to four GPIB cards (all must be of the same type) with the designations GPIB0, GPIB1, GPIB2, and GPIB3. HP VEE assigns select codes to these cards as follows:

Select Code	Interface
14	GPIB0
15	GPIB1
16	(Reserved)
17	GPIB2
18	GPIB3

To Address VXI Devices on the HP-IB or GPIB

Secondary addresses are commonly used to address VXI card cages through the HP-IB or GPIB. If you are using an HP E1406 Command Module in a VXI card cage, the primary address is set by a switch on the command module (default = 09) and the secondary address is the individual VXI device's logical address divided by eight.

For example, assume you have an HP E1406A Command Module (address = 09) in an HP E1401A C-Size High-Power Mainframe connected to the HP-IB at select code 7. If you have an HP E1326B Multimeter in a VXI slot, with its logical address set to 24, you would enter the value `70903` for the address.

The `hpe1300a.cid` and `hpe140x.cid` instrument drivers can help you find the correct address (and sub address for a switch box).

NOTE

Do not enter a sub address value for VXI devices, except for modules in a VXI switch box. Refer to the next section for details.

To Set Address/Sub Address Values

Most HP-IB, GPIB, and VXI devices do not use sub addresses. Do not enter a value in the `Sub Address` field of the `Instrument Driver Configuration` dialog box unless you are accessing a VXI switch box, or one of the card cage devices that uses sub addresses (for example, the HP 3235A Switch/Test Unit or the HP 3488A Switch/Control Unit).

NOTE

Sub address values are used only if you are using an HP Instrument Driver for a device that supports sub addresses. Do not use sub address values if you are using Direct I/O.

Let's look at a couple of examples:

- If you are accessing a module in an HP 3235A Switch/Test Unit, enter the HP-IB or GPIB address of the 3235A itself in the `Address` field of the `Device Configuration` dialog box (for example, `701`). Enter the sub address of the individual module in the `Sub Address` field of the `Instrument Driver Configuration` dialog box. For information on what to put in the `Sub Address` field, refer to the online help for the HP 3235A instrument driver (`Help` ⟹ `Instruments`).
- If you are accessing a module in a VXI switch box, enter the HP-IB or GPIB address of the switch box (for example, `70902`) in the `Address` field, and the sub address of the individual module in the `Sub Address` field. For information on what to put in the `Sub Address` field, refer to the online help for the VXI switch box instrument driver.

Excluding Address Space (HP 82335 HP-IB Card Only)

If you are using an HP 82335 HP-IB Card, which uses memory-mapped I/O addressing, you must exclude the address space required by the HP-IB so that memory manager programs won't try to use that space. *The HP 82341 HP-IB Card and the National Instruments GPIB cards do not use memory-mapped I/O addressing, so this section does not apply to those cards.*

Install the HP 82335 HP-IB Card, following the instructions that came with it. The HP 82335 is pre-set at the factory for select code 7, but the instructions tell you how to change this setting. Normally you should use select code 7. However, if you are using more than one HP 82335 HP-IB card, each card must be set for a different select code in the range 3 through 7.

Once you have installed the HP 82335 HP-IB Card, do the following:

1. Add the appropriate line for your select code to the `[386Enh]` section of your SYSTEM.INI file (in the C:\WINDOWS directory):

For Select Code:	Add to SYSTEM.INI:
3	`EMMEXCLUDE=0CC00-0CFFF`
4	`EMMEXCLUDE=0D000-0D3FF`
5	`EMMEXCLUDE=0D400-0D7FF`
6	`EMMEXCLUDE=0D800-0DBFF`
7 (default)	`EMMEXCLUDE=0DC00-0DFFF`

2. If there is a memory manager DEVICE line (for example, `DEVICE=EMM386.EXE`) in the CONFIG.SYS file (in the root directory), you need to modify it. Add a parameter to exclude the address space (for example, `X=DC00-DFFF` for select code 7), as shown in the following table:

For Select Code:	Modify in CONFIG.SYS:
3	`DEVICE=EMM386.EXE X=CC00-CFFF`
4	`DEVICE=EMM386.EXE X=D000-D3FF`
5	`DEVICE=EMM386.EXE X=D400-D7FF`
6	`DEVICE=EMM386.EXE X=D800-DBFF`
7 (default)	`DEVICE=EMM386.EXE X=DC00-DFFF`

3. Reboot your computer (press Ctrl+Alt+Delete) and restart Windows.

If you have installed multiple HP 82335 HP-IB Cards, you must exclude address space for each of them. For example, if you have installed two cards, set to select codes 3 and 7, you'll need to add both of the following lines to the `[386Enh]` section of SYSTEM.INI:

```
EMMEXCLUDE=0CC00-0CFFF
EMMEXCLUDE=0DC00-0DFFF
```

Also, if your CONFIG.SYS file contains the DEVICE line for EMM386.EXE, you must add parameters to it as shown below:

```
DEVICE=EMM386.EXE X=CC00-CFFF X=DC00-DFFF
```

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
1. A button on a mouse.

2. A graphical object in HP VEE that simulates a real-life pushbutton and 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.

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 a checkmark 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 quickly. Clicking usually selects a menu feature or object in the HP VEE window. See also "Double-Click" and "Drag."

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.

Container
The package that is transmitted over lines and is processed by objects. Each container contains data, the data type, and the data shape.

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

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 a 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
A pre-defined structure that defines how data is grouped together (for example, an array).

Data Type
A pre-defined structure that determines how data is organized and treated by HP VEE (for example, Real or Complex).

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 HP 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 slider).

Entry Field
A field that is typically part of a dialog box or an editable object, and which is used for text entry. An entry field appears recessed. For example, the open view of the `For Range` object has entry fields where you type values that specify the beginning, ending, and step values.

Expression
An equation in an entry field that can contain the input terminal names and any `Math` or `AdvMath` functions. An expression is evaluated at run-time. Expressions are allowed in the `Formula`, `If/Then/Else`, and `Get Values` objects, and in I/O transaction objects.

Grayed Feature
A menu feature that is displayed in gray rather than black, indicating that the feature is not active or not available.

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

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.

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. Objects can be displayed as icons or as open views.

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).

Open View
The representation of an HP VEE object that is more detailed than an icon. Within the open view, you can modify the operation of the object and change the object's title.

Panel View
The view of a program in HP VEE that shows only those objects needed for the user to run the program and view the resultant data. You can create a panel view to meet the needs of your users.

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

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.

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."

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, moves you through a list of data files or other choices in a dialog box, or moves the work area.

Scroll Slider
A rectangular bar that, when dragged, moves you 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.

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

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.

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

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.

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 English-like 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.