User's Guide

Part Number 34811-90001
January 1994

For Warranty and Regulatory information, see the pages behind
the Index.

HP 34811A
BenchLink Software

The HP 34811A BenchLink Software (HP BenchLink/Arb) package provides a communication link between a personal computer (PC) and the HP 33120A Function/Arbitrary Waveform Generator (function generator). HP BenchLink/Arb allows you to create and edit waveforms in a Windows™ environment before transferring them to the function generator. HP BenchLink/Arb's key functions are:

- Create and edit arbitrary waveforms up to 16,000 points in length.

- Combine waveforms using mathematical operators including add, subtract, and multiply.

- Perform other mathematical operations such as clip, absolute, invert, mirror, smooth, and resize.

- Import X/Y (time/voltage pair) waveforms from Mathcad® and other BenchLink applications such as HP 34810A BenchLink/Scope.

- Copy waveforms as a bitmap to paste into other applications.

- Transfer waveforms to the HP 33120A function generator.

- Save waveforms to a file for later use.

HP 34811A
BenchLink Software

Conventions Used in this Guide

Throughout this guide the following typeface and icon conventions are maintained to improve readability and enable you to quickly find the information you need.

Ctrl+C Italics are used to indicate a hot key (shortcut) to perform a task or to give some useful information.

 The Toolbar, Palette Bar, and some paragraphs in this guide contain icons to represent an action.

CANCEL This typeface is used to indicate the label on a button or other control.

b:\setup This typeface indicates that input from the keyboard can be typed literally or indicates a menu command to be selected. For example: "Type **b:\setup**" or "Select **File | Open...** from the Menu Bar". **File | Open...** is separated by a bar because you must first select the File menu, then select Open.

Recommended Reading

This guide assumes that you have some experience using Microsoft Windows. If you don't know how to use the basic features of Windows or are unfamiliar with terms such as click, double-click, resizing, and dragging, you may want to consult your Microsoft Windows User's Guide.

If you are new to the HP 33120A Function/Arbitrary Waveform Generator, please read your user's guide before using HP BenchLink/Arb.

The READBLA.WRI file

This file contains up-to-date information about the HP BenchLink/Arb application. It is installed as an icon in the BenchLink program group during installation. Double-click the icon to view the contents of the file.

In This Book

Chapter 1 - Installation describes how to install HP BenchLink/Arb and configure your instrument for operation.

Chapter 2 - Quick Start describes how to start the software and provides a brief exercise to help you get started using HP BenchLink/Arb.

Chapter 3 - Using HP BenchLink/Arb describes how to use HP BenchLink/Arb for creating, editing, printing, and saving arbitrary waveforms as well as transferring waveforms to the HP 33120A Function/Arbitrary Waveform Generator.

Chapter 4 - Feature and Function Reference describes the features and functions available for editing and creating waveshapes.

Chapter 5 - Using with Other Applications describes how to use HP BenchLink/Arb with other Windows applications. Special file formats are described.

Chapter 6 - Error and Information Messages lists possible HP BenchLink/Arb error and information messages with explanations and suggested solutions.

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Chapter 5 – Using With Other Applications

1

Installation

This chapter describes how to install and configure HP BenchLink/Arb to run on your computer.

Before beginning the installation process, verify that your system meets the following minimum requirements.

Equipment Required

Personal Computer Requirements

- IBM (or compatible) 386 or 486 PC.
- 3.5" 1.44 Mb floppy disk drive (high density).
- Microsoft compatible mouse (bus or serial).
- Color VGA or SVGA display.
- 4 MB memory.
- 1.4 MB free disk space (additional space is required for storage of waveforms).
- Microsoft Windows version 3.1 or higher.
- Microsoft MS-DOS version 5.0 or higher.
- Either RS-232 or IEEE-488 (HP-IB/GPIB) interface (as described below).

Computer Interface Requirements

IEEE-488 Interface Requirements. To use an IEEE-488 interface with HP BenchLink/Arb you must have an HP-IB[1] cable (HP 10833X) and one of the following IEEE-488 interface cards already installed in your computer:

- HP 27209A HP-IB
- HP 82335A/B HP-IB
- National Instruments AT-GPIB
- National Instruments GPIB-PCII/IIA

RS-232 Requirements. To use RS-232 with HP BenchLink/Arb you must have an RS-232 cable and an available Asynchronous Serial (COM) port on your PC.

RS-232 cables and adapters are described in the HP 33120A User's Guide

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[1] HP-IB is Hewlett-Packard's implementation of IEEE-488.2.

Installing the HP BenchLink/Arb Software

1 Insert the HP BenchLink/Arb floppy disk in your computer disk drive.

2 Save any work in progress. Close unneeded applications.
Select **File | Run** at the Program Manager. Type **A:\setup** in the
COMMAND LINE text box and press ENTER or click OK. Change the drive
letter if needed (i.e., **B:\setup**).
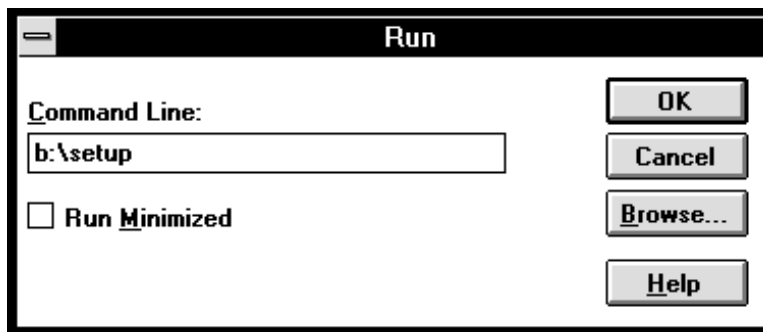
3 During the installation process, the setup program will prompt you for
the directory to receive the files. Press ENTER to accept the default
installation directory. Type a new drive and directory in the INSTALL TO:
text box if needed.
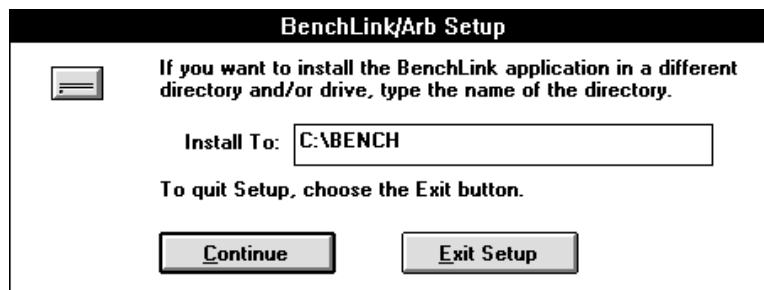
4 The installation program will create a new program group in the
Program Manager and add the HP BenchLink/Arb and Arb Readme icons
to the group.

If you encounter problems

- Check the system and interface requirements listed on page 8.

- If you are using RS-232, be sure you are using the correct cable. Interface cables are described in detail in the HP 33120A User's Guide.

- Check the error messages contained in Chapter 6.

- If your PC is configured to use extended memory management (such as EMM386.EXE) and you are using a Hewlett-Packard HP-IB Interface card, you must ensure that the memory management does not conflict with the interface card. The installation section of your HP-IB interface card user's manual describes configurations to avoid this problem.

- If you are using an IEEE-488 Interface card, ensure you have correctly installed the interface software before running HP BenchLink/Arb. Either an HPIB.DLL or GPIB.DLL file must be located in your HP BenchLink/Arb directory, the Windows directory, or a directory included in the PATH command in your AUTOEXEC.BAT file. For specific details, refer to your IEEE-488 Interface card installation guide.

To Change the HP BenchLink/Arb Icon

You can change the HP BenchLink/Arb icon appearance in the BenchLink program group.

1 Click the HP BenchLink/Arb icon in the BenchLink program group to select it (do not start the application).

2 Select FILE | PROPERTIES... in the Windows program manager menu bar. The Program Item Properties dialog box is displayed.
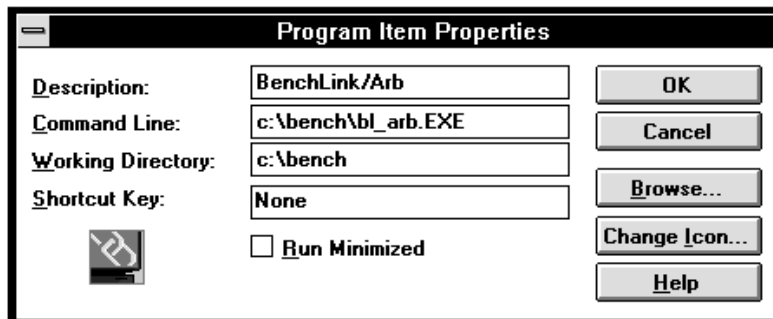
3 Click the CHANGE ICON... button. The Change Icon dialog box is displayed.
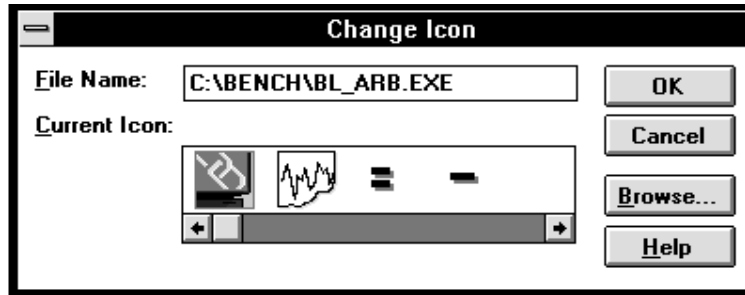
4 Scroll through the available icons and double click on the icon you want or highlight the icon and click OK. You will be returned to the Program Items Properties dialog box which will now show the new icon. Click OK.

You can also select other icons from other program files. Refer to your Windows documentation for complete details about changing   icons.

Freeing Disk Space

After installation you may wish to remove unnecessary files to free hard disk space on your computer. The following table describes files installed by HP BenchLink/Arb that may be safely removed to recover disk space.

File	Directory[1]	Use	When to remove
*.ARB	\BENCH\SAMPLES\	Waveform files	If you no longer need sample waveform files.
ARBINST.EXE	\WINDOWS\	Installation program	After HP BenchLink/Arb has been successfully installed.
READBLA.WRI	\BENCH\	Configuration information about HP BenchLink/Arb and product information added or changed since this manual was printed	After HP BenchLink/Arb has been successfully installed and you do not plan to change your computer configuration (removal not recommended).
BL_ARB.HLP	\BENCH\	Help File	If you do not wish to use on-line help (removal not recommended).

[1] These listed directories assume the default directories were used for installation of Windows and HP BenchLink/Arb.

To Remove HP BenchLink/Arb

To remove the HP BenchLink/Arb program from your computer hard disk:

1 Delete all the files in the directory containing HP BenchLink/Arb
(the default directory is \BENCH).

> *CAUTION* If you have other HP BenchLink applications (i.e.,
> HP BenchLink/ Scope) and delete all the files in the \BENCH
> directory, you will also delete the other applications. Check the
> READBLA.WRI file for a list of files installed by HP
> BenchLink/ Arb.

2 Delete the \BENCH directory.

3 Delete all files with the .ARB extension. Use Windows File Manager to
search your hard disk for these files.

4 Delete the BENCHLNK.INI file from the Windows directory.

> *CAUTION* Do not delete this file if you have other BenchLink
> applications.

5 Delete the BenchLink program group and all icons from the Windows
Program Manager.

> *CAUTION* You may also delete all files with the .PRN or .CSV
> extension if you are sure these files are not used by another
> application. Use the Windows File Manager to search for these
> files.

2

Quick Start

2

This chapter provides an overview of HP BenchLink/Arb and gives a few exercises to help you get started using the software. This chapter does not describe all the features and functions of HP BenchLink/Arb. Chapter 4 describes the features and functions.

HP BenchLink/Arb Components

Title Bar

Menu Bar

Toolbar

Palette Bar

Tick Marks (∇)

waveform edit window

Wave View Window (with zoom locator box)

Status Bar
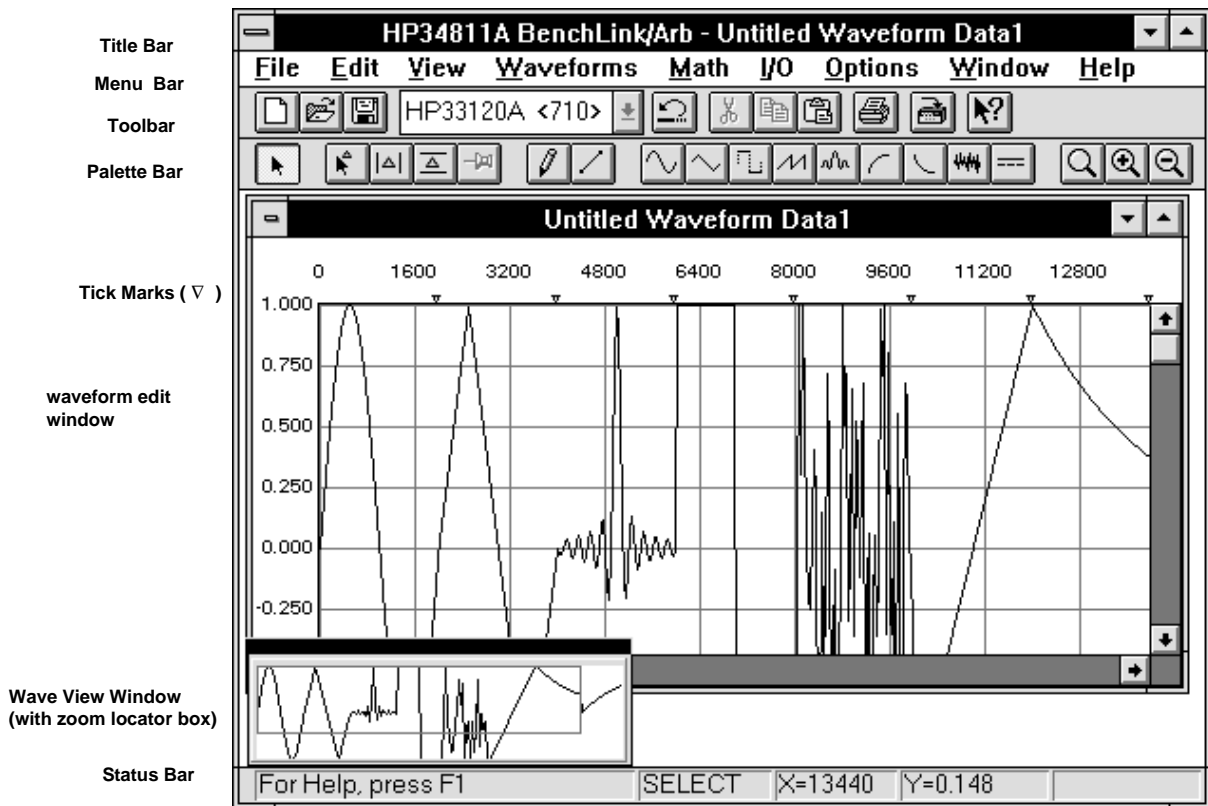
Title Bar

The Title Bar provides the standard Windows Control-menu box and sizing buttons. In the Title Bar, HP BenchLink/Arb displays the name of any active waveform edit window.

2

Menu Bar

The Menu Bar contains pull-down menus. Position your cursor over a menu item and click the mouse button to view the menu choices. You can also use the menus by holding the Alt key and typing the underlined letter of the menu choice (for example, *Alt+F* will display the File menu).

Toolbar

The Toolbar contains icons for quick display of dialog boxes and rapid execution of HP BenchLink/Arb commands. The icons on the Toolbar perform the same tasks as the pull-down menus in the Menu Bar, but do so with a single click.

Palette Bar

The Palette Bar provides quick access to tools used in creating and editing waveforms. Icons allow you to insert new waveform segments into the active waveform window, edit segments already in the waveform window, and to change the view of the waveform by zooming in or out.

Waveform Edit Windows

Waveforms created in HP BenchLink/Arb are displayed in waveform edit windows. Waveforms consist of one or more segments which can be created by inserting standard waveshapes, freehand drawing, line drawing, and performing mathematical operations. Segments can be combined to create virtually any arbitrary waveform you may need.

Wave View Window

The Wave View window allows you to view the entire waveform while you are creating and editing individual segments in the active waveform edit window. Any changes made to the waveform will be reflected in the Wave View window. For convenience, the Wave View window can be placed anywhere on your computer screen.

The Wave View window contains a sampled representation of the waveform, and as such, cannot display every waveform detail. Rather than a precise rendering of the waveform, the Wave View window gives a general 'overview' of the waveform.

Status Bar

The Status Bar provides brief descriptions of the Menu Bar and Toolbar items currently selected and provides specific waveform information depending upon the application mode. It appears at the very bottom of the HP BenchLink/Arb screen and dynamically changes as the various menu commands or modes are selected.

2

Starting and Closing HP BenchLink/Arb

Starting. HP BenchLink/Arb can be started in one of three ways:

- From the BenchLink program group, double-click the BenchLink/Arb icon.

- From the Windows File menu, choose **Run...** and, assuming HP BenchLink/Arb was loaded in a directory named 'bench', enter: **\bench\bl_arb.exe**.

- From the DOS prompt, assuming HP BenchLink/Arb was loaded in a directory named 'bench', type: **win \bench\bl_arb.exe**.

Once started, the HP BenchLink/Arb screen can be positioned, sized, maximized, or reduced to an icon using the standard Windows controls in the Title Bar.

The first time you start HP BenchLink/ Arb, the program will prompt you to enter your name and your company name. This information will appear in the banner screen each time you start HP BenchLink/ Arb.

Closing. You can exit from HP BenchLink/Arb in one of two ways:

- From the HP BenchLink/Arb Menu Bar, choose **File | Exit**.

- Double-click the Windows Control-menu box.

HP BenchLink/Arb will prompt you to save any unsaved waveform windows.

To Create, Save, and Output an Arbitrary Waveform

2

This exercise demonstrates how to use HP BenchLink/Arb. An arbitrary waveform is created, edited, saved, and output to the function generator.

1 Start HP BenchLink/Arb as described on the previous page. You should have an empty waveform edit window displayed.
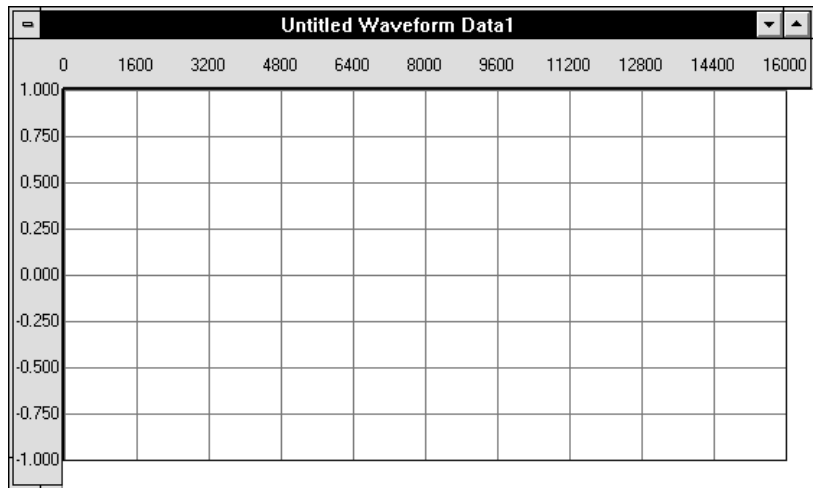
2 Put a sine wave segment in the waveform edit window by clicking the Sine Wave icon.

2
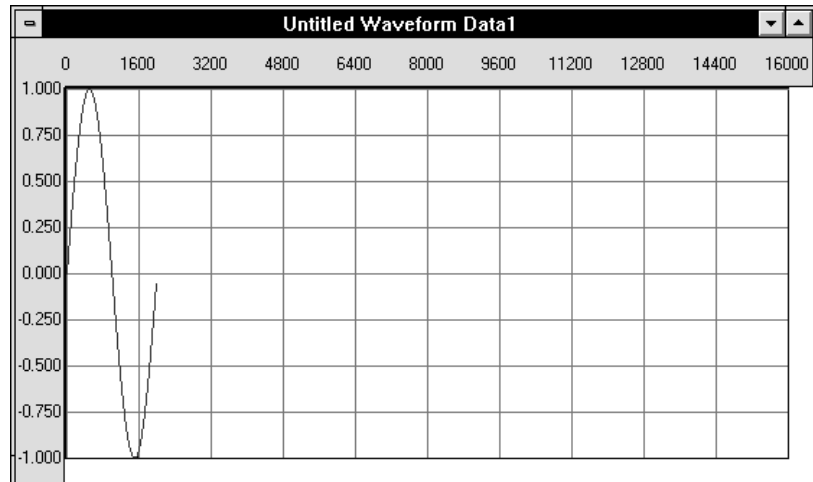
3 Add a triangle wave segment to the sine wave by clicking the Triangle Wave icon. The triangle wave segment is added to the sine wave segment. Notice the tick mark (just above the waveform grids) that shows where the segment begins and ends.
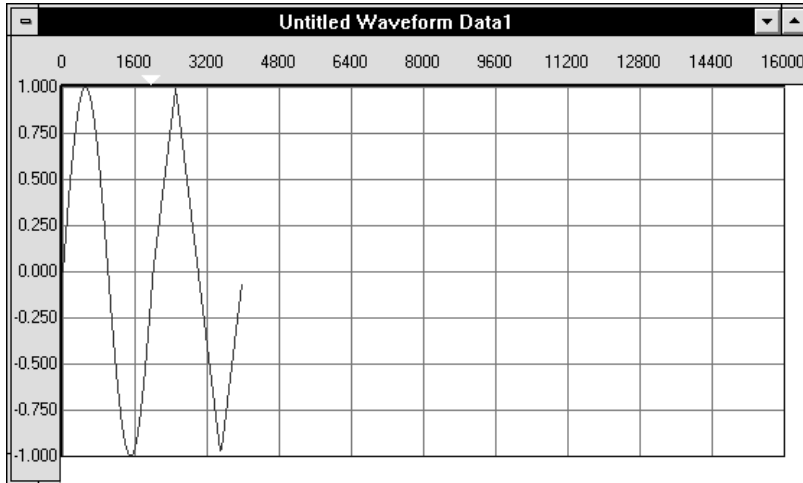
4 Change the triangle wave segment amplitude. Place the cursor anywhere on the triangle wave segment in the waveform edit window and double-click. The Edit Segment dialog box appears.

Set the amplitude to 0.5. Place the cursor in the AMPLITUDE text box and type **0.5** or click the up and down arrows next to the Amplitude text box. Click OK.
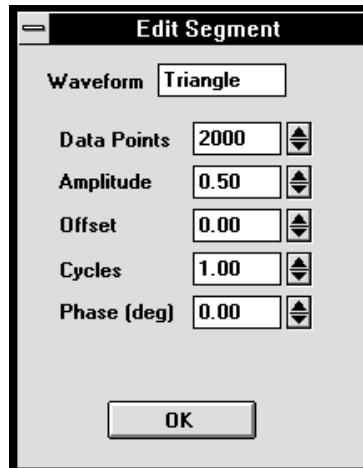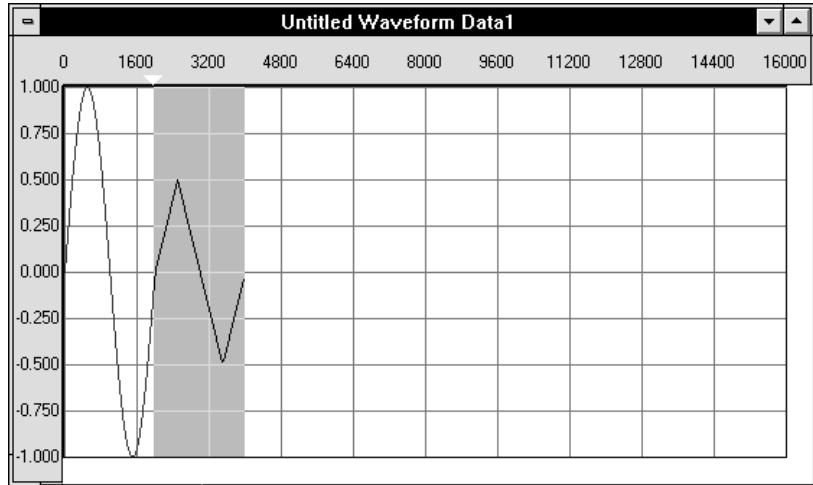
The triangle wave segment amplitude is reduced to 0.5 and the segment is highlighted.

5 Expand the arbitrary waveform to fill the waveform edit window. Click on the **Math** menu choice and then **Expand to Fit** in the drop-down menu.
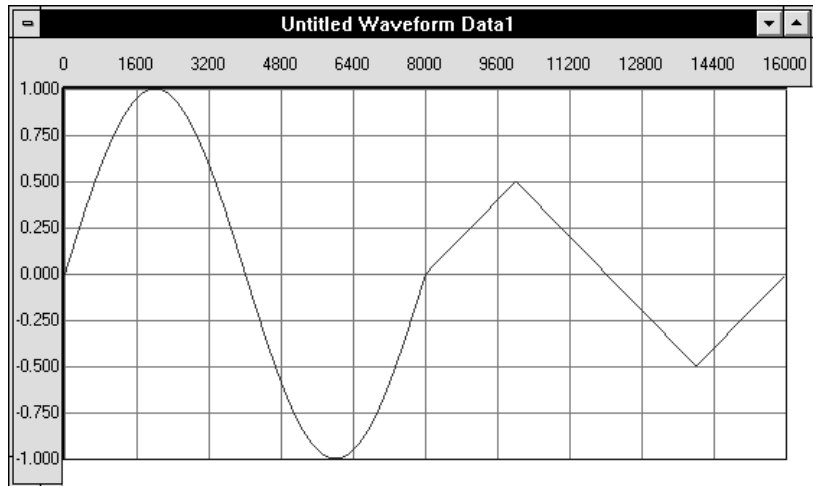
The waveform is expanded to fill all 16,000 data points. The waveform fills the entire window and is now considered arbitrary (you cannot edit the sine wave or triangle wave segments independently).

2

6 Save the new waveform by clicking the Save icon. The Save As dialog box appears.
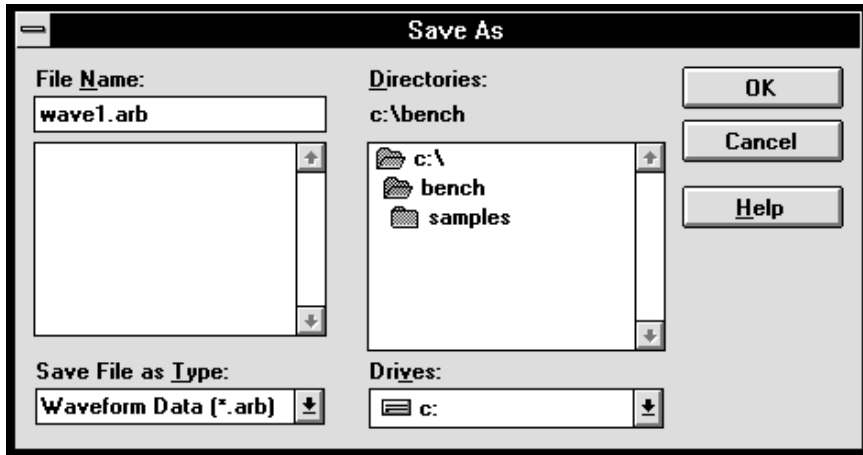
Type the name **wave1.arb** in the FILE NAME text box and click OK. The waveform edit window name changes to reflect the file name.
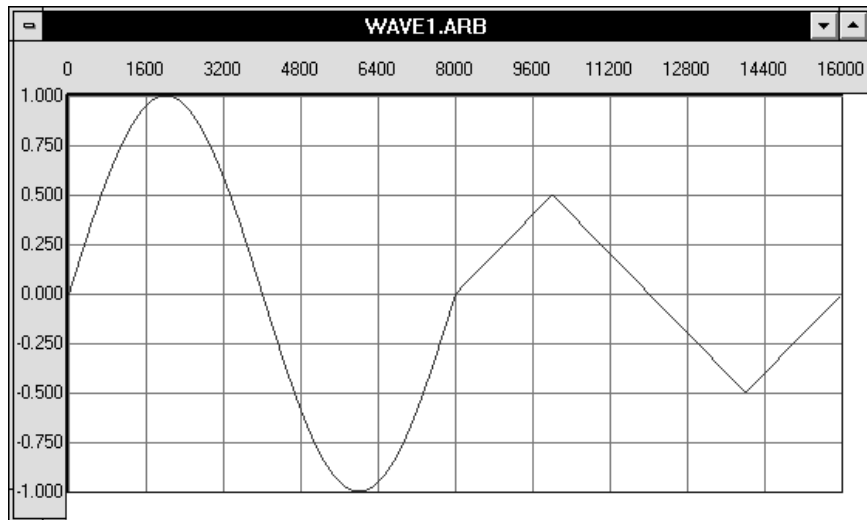
7 Send the new waveform to the function generator. Click the **I/O** menu option and then **Send Waveform...** from the drop-down menu or click the Send Waveform icon. The Send Waveform dialog box appears.

Change the AMPLITUDE value to 1.0 and click OK. The waveform is sent to the function generator. The function generator will output the new waveform once all the data points have been received.
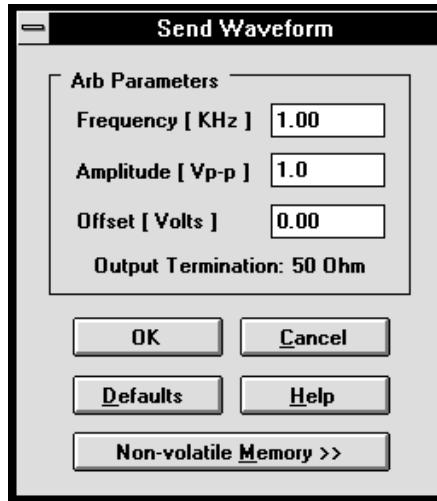
*If the **I/O | Send Waveform ...** menu is not active (gray),
HP BenchLink/Arb did not find a function generator on the specified interface. Check that the function generator is properly connected to the computer and turned on. Refer to the section "Configuring the Interface" in Chapter 3 for more information.*

3

Using HP BenchLink/Arb

This chapter describes procedures, components, and features you will use in HP BenchLink/Arb.

About Arbitrary Waveforms

The waveforms you create in HP BenchLink/Arb are a series of data points. The first point, 0, is given a Y value between -1 and +1. The next point has another Y value, and so on, to the maximum number of data points in your waveform. Taken together, these points make up a *waveshape*.

All the data points in the waveform edit window make up one function generator output cycle. When you send the waveform to the function generator, it will attempt to output all the points at the frequency you specify. For example, if you create a waveform with 10 sine wave segments and set a 1 kHz output frequency when you send the waveform to the function generator, the output will appear to be a 10 kHz sine wave.

The function generator samples the data points at 40 Msamples/second. The maximum output is determined by the sample rate divided by the number of points. A full waveform edit window (16,000 data points) appears to have an upper frequency limit of 2.5 kHz , since 40 Msamples/16,000 = 2500. When higher frequencies are reached, the function generator automatically samples the points so the full wave is output. The function generator will sample no fewer than 8 points per waveshape. Refer to chapter 7 in the HP 33120 User's Guide for additional information about sampling.

When possible, you should always send the maximum number of data points. The more data points you send, the greater the fidelity of the function generator output. HP BenchLink/Arb contains a special function to allow you to expand any waveform to the maximum number of data points.

The relative amplitude (Y values) of your waveform can range from -1 to +1. This is a 'relative' amplitude because the function generator output voltage will be scaled to these values. You set the desired output peak-to-peak voltage when you send the waveform to the function generator. For example, a square wave in the waveform edit window that ranges from -1 to +1 can be output as a 1 volt peak-to-peak waveform. The +1 relative amplitude is scaled to +0.5 volts and the -1 relative amplitude is scaled to -0.5. The square wave will be centered around 0 volts.

Because of this relative amplitude scaling, it is possible to create waveforms that contain unintentional dc offsets. Consider a square wave that ranges from +1 to -0.5. If this waveform is sent to the function generator with a specified output voltage of 1 V peak-to-peak, the square wave will not be centered around 0 V but will have an apparent +0.5 Volt dc offset. The +1 relative amplitude will be scaled to +0.75 V and the -0.5 relative amplitude will be scaled to -0.25 V.

Where possible, your waveforms should range from +1 to -1 in the waveform edit window. HP BenchLink/Arb contains a special function to allow you expand the Y values to the maximum.

The Y values of the starting and ending points in your waveform can also cause unexpected discontinuities if they are not the same value. The function generator output will 'jump' from the ending value to the starting value each cycle. For a smooth waveform output, be sure the starting and ending values are the same.

Small discontinuities within the waveform can be removed by smoothing the waveform. These discontinuities are common with waveforms created by freehand or line drawing modes. HP BenchLink/Arb provides a special smoothing function for this purpose.

3

Creating Waveforms

Waveforms consist of one or more segments of X and Y points which can be created in HP BenchLink/Arb in a number of ways, including drawing the waveform in freehand mode, combining standard waveshapes, applying mathematical operations, and importing X, Y data from other applications. Any of these methods can be combined to create more complex waveforms. Segments can be of many different sizes with the total not exceeding 16,000 points per waveform.

To open a new waveform edit window select **File | New** from the Menu Bar or click the new waveform edit window icon. An untitled waveform edit window is displayed.
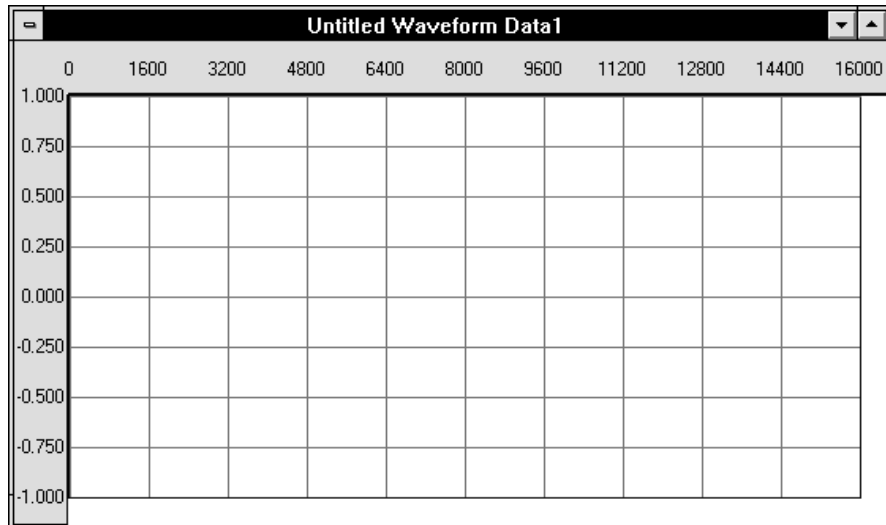
Standard Waveshapes

Standard waveshapes can be inserted in the waveform edit window by selecting commands from the Waveforms Menu or by clicking an icon on the Palette Bar.

If the selection is made from the Waveforms Menu, the New Segment dialog box will appear, allowing you to specify and preview the waveshape characteristics.
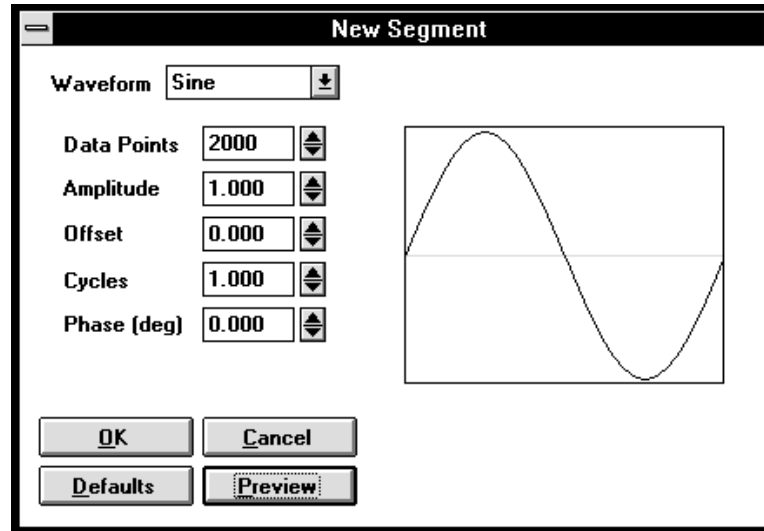
If the selection is made by clicking an icon in the Palette Bar, one
segment of the corresponding waveform will be added to the window with
default values. If the new waveshape segment causes the total points to
exceed 16,000, a warning dialog will appear, informing you that the
segment will not be added. Click OK and try a smaller number of points
or remove part of the existing waveform.

Standard waveshapes and their default parameters are described in
Chapter 4.

Freehand Drawing

Select the Freehand drawing mode by clicking the Freehand icon or by
selecting **Waveforms | Freehand** from the Menu Bar. The standard
cursor changes to a pencil cursor when inside the waveform edit window.
Draw the desired waveform shape by pressing and holding the left mouse
button. Release the mouse button to complete the freehand waveform
segment. Freehand waveform segments are automatically connected to
any pre-existing segments. You will remain in the Freehand drawing
mode until another mode is selected.

You are not allowed to draw over a standard waveshape unless you
thumbtack markers over one (see page 29). Drawing over another
freehand segment will modify the existing points.

3

Line Drawing

Select Line drawing mode by clicking the Line icon or by selecting **Waveforms | Line** from the Menu Bar. Click once in the waveform window to start the line and then move the cursor and click again. Numerous connected lines can be drawn by moving the cursor and clicking again. Double-click at the end of the line in the window, press ESCAPE, or press ENTER to terminate the line. You will remain in the Line drawing mode until another mode is selected.

You are not allowed to draw over a standard waveshape unless you thumbtack markers over one. Drawing over another line segment will modify the existing points.

Editing a Waveform

Waveforms can be edited in multiple ways. Individual segments may be selected and edited, or parts of the waveform may be cut, copied, pasted or cleared from the screen.

Selecting Parts of a Waveform

To select a part or segment of a waveform, click the Edit Select icon. Use the cursor to highlight the area for editing or math operations.

When a portion of a waveform is selected and highlighted, the Status Bar reflects the start and end points of the highlighted area and the total number of points selected. The highlighted area can be adjusted using the arrow keys:

- Right arrow - selects the right side of the highlighted area
- Left arrow - selects the left side of the highlighted area
- Up arrow - increases the highlighted area
- Down arrow - decreases the highlighted area

In normal viewing mode, the up and down arrow keys may not seem to increase or decrease the highlighted area in the waveform edit window. However, the Status Bar will indicate the change and zooming will show the effect more efficiently.

To invalidate a highlighted selection, click past the end of the waveform or click the Edit Select icon.

To highlight an individual segment, hold the SHIFT key and click on the segment. Select multiple segments by holding the SHIFT key while clicking on each segment.

To select the entire waveform (multiple segments) choose **Edit | Select All** from the Menu Bar or hold the SHIFT key and double click in the waveform edit window.

You can also use markers to confine the editing area or to alter standard waveshape segments when using freehand or line drawing mode. Enable the X and/or Y markers by clicking the appropriate icon or select them from the **Edit** menu. Use the **Edit | Set Thumbtacks** command or click the Set Thumbtacks icon to hold the markers in specific locations.

Modifying Standard Waveshape Segments

To modify existing standard waveshape segments, double-click on the desired segment. This will display the Edit Segment dialog box, allowing you to change any characteristics of the selected segment. Changes are displayed immediately in the waveform edit window. Click OK when you have finished making changes.

When standard waveshape segments have been modified by applying math operations or cutting and pasting parts of them, they become 'arbitrary' segments and will display the Resize Data dialog box when double-clicked.

Segments created by freehand or line drawing are considered 'arbitrary' and double-clicking them produces the Resize Data dialog box.

A noise segment is always arbitrary and displays the Resize Data dialog box when double-clicked.

Using the Clipboard

To cut a portion of a waveform or an entire segment, first select it, then choose **Edit | Cut**. The selected portion is added to the Clipboard and may be pasted into a different part of the waveform or another waveform edit window.

Any selected waveform segment or portion of a waveform may be copied to the Clipboard and pasted into other windows or applications. Select the entire waveform or an individual segment and choose **Edit | Copy** or type *Ctrl+C*.

A waveform or segment previously copied to the Clipboard can also be inserted into another waveform edit window. Click on the desired insertion point of the waveform and choose **Edit | Paste** or type *Ctrl+V*.

Waveforms copied to the Clipboard from other BenchLink applications can be pasted into a waveform edit window by selecting **Edit | Paste** from the Menu Bar. The waveform will be inserted as a new segment.

Copying the Active Waveform Edit Window as a Bitmap

To copy the contents of a waveform edit window to another application as a bitmap, choose **Edit | Copy Image** from the Menu Bar. The active waveform edit window contents are placed on the Clipboard as a bitmap and can be pasted into other applications.

Inserting Data Into an Existing Waveform

Data copied to the Clipboard or cut from a waveform edit window can be inserted into an existing waveform by choosing the desired insertion point and selecting **Edit | Paste** or typing *Ctrl+V*.

Clearing Waveforms

Any part of the waveform may be deleted by selecting it and choosing **Edit | Clear** from the Menu Bar or by pressing the DELETE key. Selecting **Edit | Clear All** clears the entire waveform displayed in the active waveform edit window.

Undo

The last command or action performed by HP BenchLink/Arb can be undone by choosing **Edit | Undo** from the Edit Menu, by clicking the Undo icon, or by pressing *Alt+Backspace*.

Performing Waveform Math

The Math menu contains several mathematical functions to be performed on arbitrary waveforms. The first three (add, subtract, and multiply) combine two operands while the remaining functions are performed on a single operand. All of the mathematical operations can be undone if necessary. Choose **Edit | Undo** from the Menu Bar to return the waveform to its original shape.

Add

The **Math | Add...** command performs a point-by-point addition of the selected waveforms.

Subtract

The **Math | Subtract...** command performs a point-by-point subtraction of the selected waveforms.

Multiply

The **Math | Multiply...** command performs a point-by-point multiplication of the selected waveforms.

To perform addition, subtraction, and multiplication operations, one of two sequences must be followed:

- Select two operands (segments or parts of the waveform) on which to perform a mathematical operation. The Clipboard is used to store the first operand.

- Select a segment or part of the waveform as the first operand and use a standard waveshape as the second operand.

3

Performing Math Operations Using the Clipboard

1 Select the first operand. This can be an individual segment or the entire waveform. Copy it to the Clipboard using the **Edit | Copy** command.

2 Select the second operand by highlighting it in the waveform edit window.

3 Select the mathematical function (Add, Subtract, or Multiply). A Math dialog box will appear.
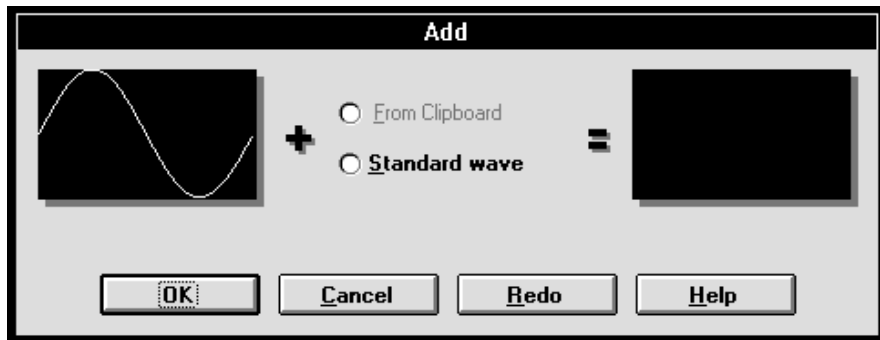
4 The waveform selected for the mathematical operation is displayed in the window on the left. Click the FROM CLIPBOARD button. The waveform previously copied to the Clipboard appears in the middle window and the resulting waveform is displayed on the right.
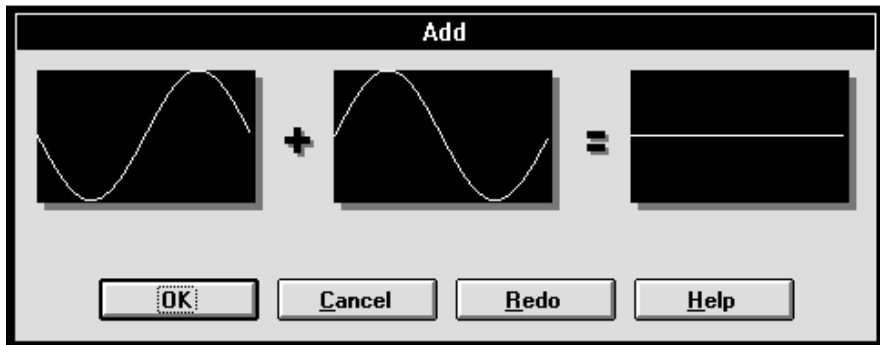
5 If the waveform copied to the Clipboard has a different number of points than the selected waveform, you can click the MATCH LENGTH button. This will adjust the size of the Clipboard waveform to match the first operand. Click it again to undo the match length operation.

6 If, as a result of the math operation, the new waveform exceeds the vertical limits of the window, scale and fit the waveform to the window by clicking the FIT AMPLITUDE button. Click the button a second time to undo the fit operation.

7 Click OK to complete the math operation or CANCEL to abort the process.

Using Standard Waveshapes in Math Operations

1 Select the first operand. This can be an individual segment or the entire waveform.

2 Select the mathematical function (Add, Subtract, or Multiply). The Math dialog box will appear.

3 Click the STANDARD WAVE button. The New Segment dialog box appears, prompting you to select a standard waveshape as the second operand. The number of points in this dialog box cannot be changed. This ensures the number of points in the first operand and the second are identical. Click OK.

4 The first operand of the mathematical operation is displayed in the window on the left. The second operand (a standard waveshape) appears in the middle window and the resulting waveform is displayed on the right.

5 If the resulting waveform is not what was expected, click the REDO button to change the second operand for the math operation.

6 If, as a result of the math operation, the new waveform exceeds the vertical limits of the window, scale and fit the waveform to the window by clicking the FIT AMPLITUDE button. Click the button a second time to undo the fit operation.

7 Click OK to complete the operation or CANCEL to abort the process.

Clipping a Waveform

The **Math | Clip** command clips the present waveform data to the specified Y value.

To perform the clipping function, you must first select the area of the waveform to be clipped using the Y markers. To clip a waveform:

1 Turn on the Y markers using the **Edit | Y Markers** command or click the Y Markers icon.

2 Position the markers to specify the minimum and maximum Y values. Click the Thumbtack icon to set the markers.

3 Click the 'edit select' icon, then click and drag your mouse to highlight the area to be clipped.

4 Select **Math | Clip** from the Menu Bar. The area above and below the markers will be clipped.

Using Absolute

The **Math | Absolute** command changes the sign on all negative Y-value points so that the waveform contains only positive points. Select the waveform or segment on which to perform this operation, then select this command from the Math menu.

Inverting a Waveform

Math |Invert causes the waveform to be flipped vertically. Each point in the selected waveform is multiplied by -1 to get the inverted values. Select the waveform or segment on which to perform this operation, then select this command from the Math menu.

Mirroring a Waveform

The **Math | Mirror** command horizontally rotates the waveform about the center of the selected segment. If the selected waveform contains 2000 points, the rotation would occur at point 1000. Select the waveform data or segment on which to perform this operation, then select this command from the Math menu.

Smoothing a Waveform

The **Math | Smooth** command smoothes rough edges, abrupt transitions, and spikes in the waveform. Select the part of the waveform or segment you wish to smooth before selecting this command.
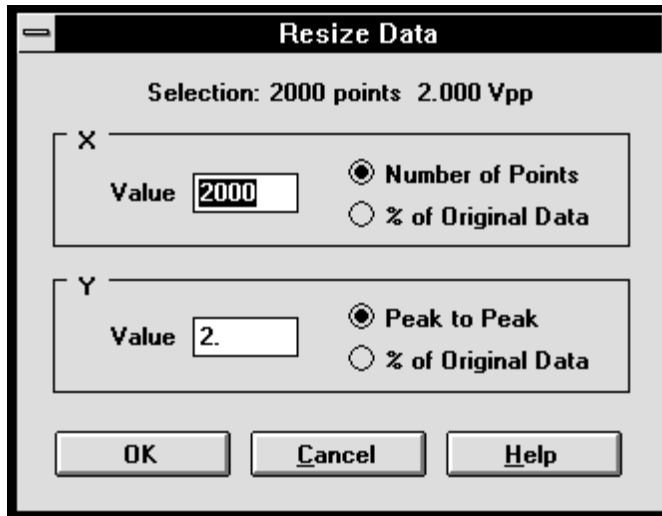
The smoothing algorithm uses a 7 data point 'moving average' technique. The 'smoothed' Y value for the Nth point in the selected waveform segment is determined by averaging the Y values of:

- Up to 3 data points to the left of the Nth point
- The Nth point
- Up to 3 data points to the right of the Nth point

You can undo smoothing operations, or repeat the operation several times for additional smoothing.

Resizing a Waveform

The **Math | Resize...** command expands or compresses waveform data points horizontally or vertically. Select the waveform data on which to perform this operation, then select this command from the Math menu. The Resize Data dialog box appears, displaying current X (point) and Y (relative amplitude) values.

3

```
┌──────────────────────────────────────────────┐
│ ═          Resize Data                         │
├──────────────────────────────────────────────┤
│        Selection: 2000 points  2.000 Vpp       │
│   ┌─ X ─────────────────────────────────────┐  │
│   │                      ◉ Number of Points  │  │
│   │   Value  [2000]      ○ % of Original Data│  │
│   └─────────────────────────────────────────┘  │
│   ┌─ Y ─────────────────────────────────────┐  │
│   │                      ◉ Peak to Peak      │  │
│   │   Value  [2.]        ○ % of Original Data│  │
│   └─────────────────────────────────────────┘  │
│   [   OK   ]    [  Cancel  ]    [  Help  ]      │
└──────────────────────────────────────────────┘
```

3

Percentage of Original Data starts at 100%. The size of the waveform data can be changed by specifying the number of points/amplitude peak-to-peak or percentage of the original size. Pressing ENTER for each new value will automatically change the selected data in the waveform edit window. Click OK to complete the resizing process or CANCEL to return the data to its original size.

> If the total number of points in the arbitrary waveform is at or near the maximum length (16,000 points), HP BenchLink/ Arb will not allow you to expand the waveform or will restrict the number of points or percentage you are allowed to expand.

Expand To Fit

The **Math | Expand To Fit** command stretches the waveform data to fit the entire waveform edit window. The waveform is expanded both horizontally and vertically. The waveform does not have to be selected to perform this operation. The expansion can be undone with the **Edit | Undo** command.

Importing Data Saved From HP BenchLink/Scope

To import data saved by the HP BenchLink/Scope application in either .PRN or .CSV format:

1 Select **File | Import...** from the Menu Bar. The Open dialog box will be displayed, prompting you to enter the filename of the file you wish to open.

2 Choose the appropriate file extension from the file type list, select the desired file and click the OK button. If the file is displayed in the file list, double-click on it to open the file. Click the CANCEL button to abort the command or the HELP button for more information.

3 The file will be opened as a new waveform edit window, properly scaled to display the points. The points may be cut and pasted into another waveform edit window if desired.

Configuring the Interface

When the HP BenchLink/Arb application is started, it searches for any supported IEEE-488 interface hardware and software installed in your PC and any instruments connected to the interface. If an IEEE-488 interface card with connected devices is not found, HP BenchLink/Arb checks the serial ports for any devices.

HP BenchLink/Arb will try to connect to the function generator using HP-IB at address 10 or on serial port COM2 at 9600 baud. If any of these default settings do not match the actual interfaces or devices, select **Options | Configure Interface** to display the Setup Interface dialog box. This dialog contains information relating to the interface type and any devices connected to your PC.
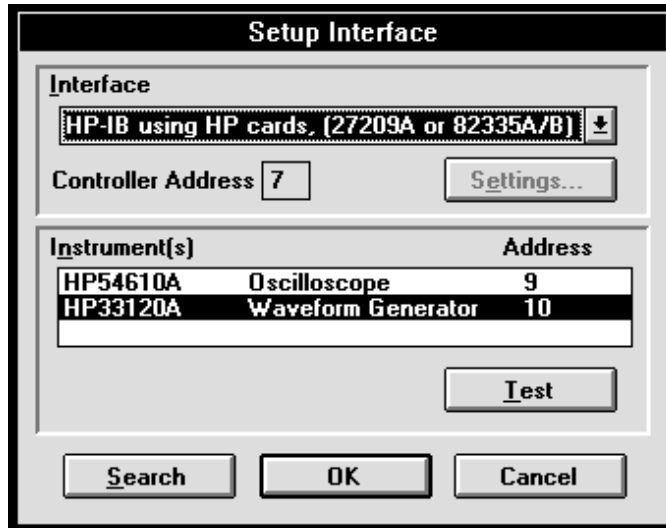
Select the interface type by clicking on the arrow of the INTERFACE drop-down list and clicking on your choice. The controller address or serial port displayed is the IEEE-488 controller address or serial port that HP BenchLink/Arb will use to communicate with your function generator.

3

The **Settings...** option is for RS-232 only and is grayed out for IEEE-488 users. The RS-232 Settings dialog displays serial port (COM2), baud rate (9600), handshake (none), parity (none), character length (8-bits), and stop bits (2-bits) parameters. Changes are allowed only to the serial port parameter.

Any devices found by HP BenchLink/Arb upon initialization are displayed in the INSTRUMENTS list box. Select the function generator by highlighting the choice. Test the interface connectivity by clicking the TEST button. If you are using RS-232, the function generator address refers to the serial port in use.

The SEARCH button is used to initiate a search for all instruments attached via HP-IB cables or a single function generator attached to the COM port identified in the Settings dialog box. All identified instruments will be displayed in the INSTRUMENTS list of the Setup Interface dialog box.

Choose OK to accept changes to the Setup Interface dialog box or CANCEL to abort. Changes made in the Setup Interface dialog box will be used as the default settings the next time you run HP BenchLink/Arb.
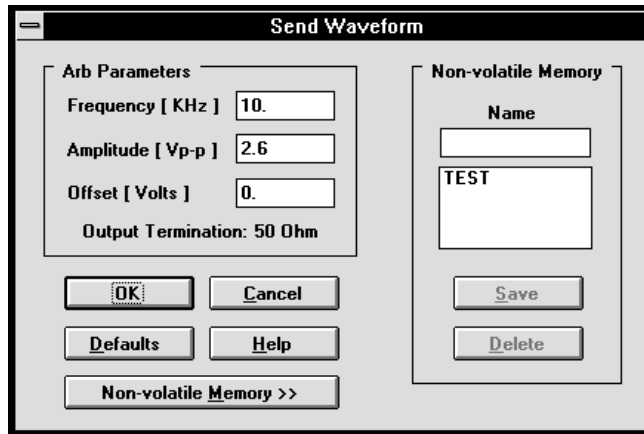
> If you are using an IEEE-488 Interface card, ensure you have correctly installed the interface software before running HP BenchLink/ Arb. Either an HPIB.DLL or GPIB.DLL file must be located in your HP BenchLink/ Arb directory, the Windows directory, or a directory included in the PATH command in your AUTOEXEC.BAT file. For specific details, refer to your IEEE-488 Interface card installation guide.

Transferring Waveforms to the Function Generator

When you have finished creating and editing your waveform, HP BenchLink/Arb can transfer the waveform data to the function generator. To transfer the contents of the active waveform edit window:

1 Select **I/O | Send Waveform...** from the Menu Bar or click the Send Waveform icon. The Send Waveform dialog box appears.

```
┌──────────────────────── Send Waveform ──────────────────────┐
│ ┌─ Arb Parameters ──────────────┐  ┌─ Non-volatile Memory ─┐ │
│ │  Frequency [ KHz ]  [10.    ]  │  │        Name           │ │
│ │                                │  │     [            ]    │ │
│ │  Amplitude [ Vp-p ] [2.6   ]   │  │     ┌───────────┐     │ │
│ │                                │  │     │ TEST      │     │ │
│ │  Offset [ Volts ]   [0.    ]   │  │     │           │     │ │
│ │                                │  │     │           │     │ │
│ │  Output Termination: 50 Ohm    │  │     └───────────┘     │ │
│ │                                │  │                       │ │
│ │  [  OK  ]    [ Cancel ]        │  │     [   Save    ]     │ │
│ │                                │  │                       │ │
│ │  [Defaults]  [ Help   ]        │  │     [  Delete   ]     │ │
│ │                                │  └───────────────────────┘ │
│ │  [  Non-volatile Memory >>  ]  │                            │
│ └────────────────────────────────┘                           │
└──────────────────────────────────────────────────────────────┘
```

This menu command and icon are only available if a function generator is connected to your PC with an IEEE-488 or RS-232 cable, is displayed in the Instrument list on the Toolbar, and there is waveform data in the waveform edit window.

2 From this dialog you can change certain characteristics of the waveform. This dialog box queries the function generator for information about the current frequency, amplitude, offset, and output termination settings. Click OK and the waveform will be sent to the function generator identified in the Instruments list located on the Toolbar or click CANCEL to abort the process. Sending a waveform to the function generator also causes it be output from the instrument.

3 The waveform can be saved in the function generator's non-volatile memory. Click the NON-VOLATILE MEMORY button. Click the Non-volatile Memory NAME text box and type in a name. Click the SAVE button to save the waveform. This command also instructs the function generator to output this waveform. Any existing waveforms will be displayed in the box to the right. Previously saved waveforms can be deleted by selecting the waveform and clicking the DELETE button.

Printing Waveforms

Waveforms can be printed when actively displayed in HP BenchLink/Arb. The waveform does not have to be a saved file to be printed (i.e. it can be an untitled window).

3

1 If more than one waveform edit window is open, ensure the window you want to print is the active window by clicking on it with your mouse.

2 Select **File | Print...** from the Menu Bar or click the Print icon.

3 The Print dialog box is displayed. You may change printer setup information by clicking the SETUP... button. Click the OK button to start the print process or choose CANCEL to abort the print process.
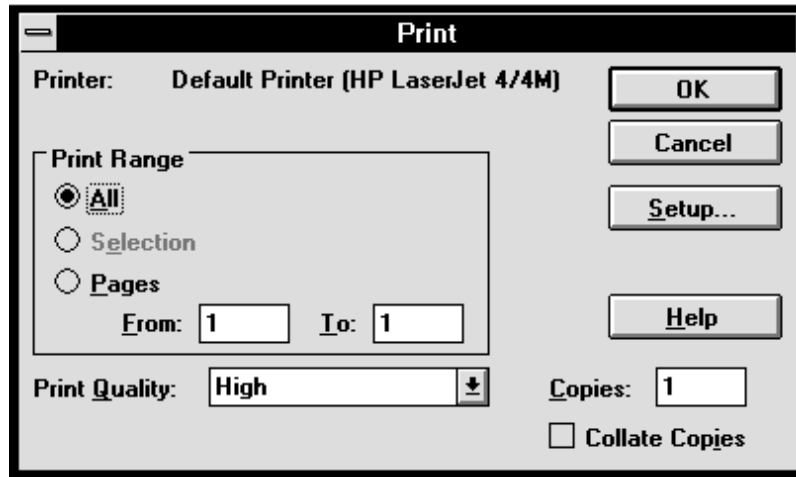
Printer information such as default printer, orientation, and paper size can be selected in the **File | Print Setup...** dialog box.

Waveform edit windows can be previewed before printing by choosing the **File | Print Preview** command from the Menu Bar. This feature allows you to verify your output and make any necessary changes before printing.

Print preview shows layout of the page and does not represent the true resolution of the printout

Saving Waveforms

Arbitrary waveforms can be saved from HP BenchLink/Arb with .ARB, .CSV, .PRN, or .BIN file extensions. The .ARB file format is a binary format used by HP BenchLink/Arb. The .CSV file format contains point/amplitude pairs separated by a comma. The .PRN file format contains point/amplitude pairs separated by a tab. The .BIN format is IEEE-488.2 binary block format. Files saved in the point/amplitude pair formats can be opened in other applications for plotting or further manipulation. To save an untitled arbitrary waveform:

1 Select **File | Save as...** from the Menu Bar or click on the file Save icon. The Save As dialog box will appear.
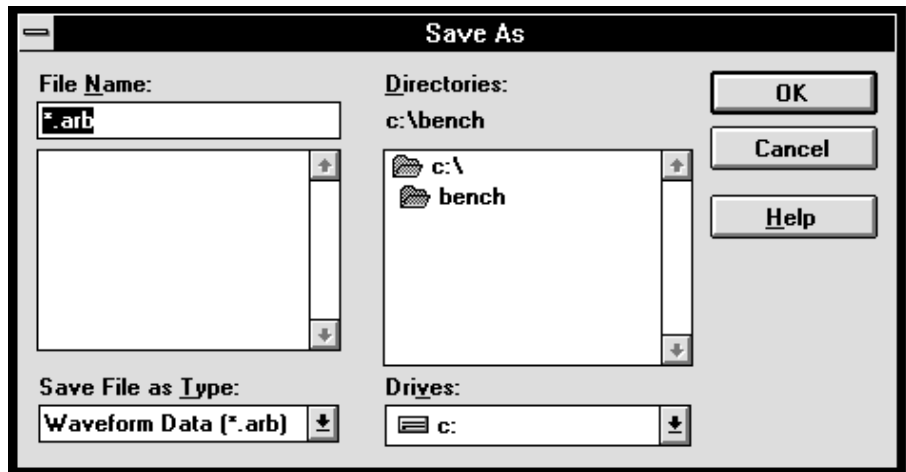
2 Select the desired file format type by clicking on the SAVE FILE AS TYPE drop-down list and click on your choice of .ARB, .CSV, .PRN, or .BIN.

3 Enter the desired filename and click the OK button to save the file to disk.

> If you attempt to exit HP BenchLink/ Arb without saving the new or modified waveform edit window, you will be prompted to do so before exiting the application.

Using HP BenchLink/Arb Help

HP BenchLink/Arb provides an extensive, easy-to-use, context-sensitive help system. Help is available to guide you through the use of dialog boxes and to explain the function of menu commands.

HP BenchLink/Arb help is accessed by selecting **Help | Index** from the Menu Bar. Choosing this command will display a list of key topics and allow you to perform a search of help topics or allow you to jump to others. Jump topics are green, underlined words found in various areas of the help system.

The Help Search menu can also be displayed by selecting **Help | Search...** from the Menu Bar.

To obtain help on specific menu commands or icons, first select the Help icon from the Toolbar, then move the help cursor to the desired menu command or icon and click. The information for that topic is displayed.

Many of the dialog boxes contain a HELP button. This button provides on-line help for the functions in the dialog box. Help can also be obtained by pressing the *F1* key at any time.

If you are new to Help systems and would like a quick, easy-to-use tutorial, select **Help | Using Help** from the Menu Bar. This is a useful guide to using the Help system by written by Microsoft Corporation.

Configuring the HP 33120A Function/Arbitrary Waveform Generator

HP BenchLink/Arb supports both RS-232 and IEEE-488 communications from the PC to the HP 33120A Function/Arbitrary Waveform Generator. This section describes how to set up your function generator so that communications can be established when you run HP BenchLink/Arb.

Using the function generator front panel, the instrument must be placed in the HP-IB or RS-232 interface mode. If using HP-IB, the function generator must be given a unique address.

The HP 33120A Function Generator User's Guide contains complete descriptions of these procedures. The general procedure to set the interface is:

| Shift |
| Menu On/Off | **1**   Turn on the function generator menu.

```
A: MOD MENU
```

| < | | < | **2**   Move across to the I/O Menu.

```
E: I/O MENU
```

| v | | > | **3**   Move down and across to the Interface command.

```
2: INTERFACE
```

| v | **4**   Move down to select HP-IB or RS-232 interface parameters. If choosing RS-232, you must also check the baud rate and parity commands in the I/O Menu. The baud rate default is 9600; the parity default is none with 8 data bits.

| Enter | **5**   Save the changes. For more information about these menus, see your function generator user's guide.

4

4

Feature and Function Reference

4

HP BenchLink/Arb Screen Components

A typical HP BenchLink/Arb screen is shown on page 14.

Title Bar

In the Title Bar, HP BenchLink/Arb displays HP 34811A BenchLink/Arb and the name of the active waveform edit window.

Menu Bar

The Menu Bar offers the following pull-down menus:

- File Menu - contains commands for opening, closing, saving, importing data, and printing waveform edit windows.

- Edit Menu - contains commands for editing waveforms such as cut, copy, paste, undo, clear, and select. Also contains commands for marker display and control.

- View Menu - contains commands for zooming, grid preference, connecting the dots, tick marks, and viewing the waveform edit windows in high resolution mode.

- Waveforms Menu - contains commands for inserting standard waveshapes such as sine, square, and triangle, and commands for freehand and line drawing modes.

- Math Menu - contains commands for mathematical operations such as add, subtract, multiply, clip, absolute, invert, mirror, smooth, and resize.

- I/O Menu - contains a command for sending the contents of the waveform edit window to the function generator.

- Options Menu - contains a command for configuring the PC-to-function generator interface.

- Window Menu - contains commands for standard Windows operations such as cascade, tile, arrange icons, and the viewing of the Toolbar, Status Bar, Palette Bar, and the Wave View window.

- Help Menu - contains commands for the HP BenchLink/Arb Help system including an index, search capability, a help system tutorial, and information about the HP BenchLink/Arb application.

Toolbar

The Toolbar contains icons for quick display of dialog boxes and rapid execution of HP BenchLink/Arb commands. The following icons are displayed in the Toolbar:

Performs the **File | New** command.

Performs the **File | Open...** command.

Performs the **File | Save** command.
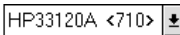
The Instrument drop-down list displays HP and the model number of all devices found on the IEEE-488 bus or serial port. It can also be used to change instrument connections. If another BenchLink application is installed and a supported instrument is selected from this list, HP BenchLink/Arb will attempt to switch to that application and, if necessary, load and start the application. Instruments not supported by BenchLink software will display the device's model number and address. Devices that are not compatible with the IEEE-488.2 standard will be displayed as UNKNOWN with their address. Attempts to switch to non-supported or unknown devices will display a warning dialog.

Performs the **Edit | Undo** command.

Performs the **Edit | Cut** command.

Performs the **Edit | Copy** command.

Performs the **Edit | Paste** command.

Performs the **File | Print...** command.

Performs the **I/O | Send Waveform...** command.

Provides context-sensitive help for selected items.

4

Palette Bar

The Palette Bar is designed to provide quick access to tools used in creating and editing waveforms. The following icons are displayed in the Palette Bar.

Enters the 'edit select' mode. Portions of a waveform are selected by clicking and dragging to highlight the desired area (**Edit | Edit Select**.)

Enters 'marker' mode in which you can select and move X and Y markers by clicking and dragging the mouse (**Edit | Marker Select**).

Enables/disables X Markers (**Edit | X Markers**).

Enables/disables Y Markers (**Edit | Y Markers**).

Thumbtacks markers in their current position (**Edit | Set Thumbtack**).

Enters the freehand drawing mode (**Waveforms | Freehand**).

Enters the line drawing mode (**Waveforms | Line**).

Inserts a sine wave segment (**Waveforms | Sine...**).

Inserts a triangle wave segment (**Waveforms | Triangle...**).

Inserts a square wave segment (**Waveforms | Square...**).

Inserts a ramp wave segment (**Waveforms | Ramp...**).

Inserts a sinc pulse segment (**Waveforms | Sinc...**).

Inserts a segment with a rising exponentially shaped pulse (**Waveforms | Exp Rise...**).

Inserts a segment with a falling exponentially shaped pulse (**Waveforms | Exp Fall...**).

Inserts a random-noise segment (**Waveforms | Noise...**).

Inserts a DC value segment (**Waveforms | DC...**).

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Performs the **View | Zoom** command. Click and drag your mouse to select the zoom area.

Performs the **View | Zoom In** command.

Performs the **View | Zoom Out** command.

Status Bar

The Status Bar is a helpful tool designed to provide brief descriptions of the Menu Bar and Toolbar items currently selected and provides specific waveform information depending upon the application mode. It appears at the bottom of the HP BenchLink/Arb screen and dynamically changes as the various menu commands or modes are selected.

4

menu command information	application mode	waveform information	

For Help, press F1	ZOOM	X=7840	Y=0.945	
For Help, press F1	SELECT	ST=4000	END=7008	Pts=3008
For Help, press F1	LINE	X=2272	Y=0.680	Pts=16000
For Help, press F1	DRAW	X=5824	Y=1.000	Pts=16000
For Help, press F1	MARKERS	Y1=0.523	Y2=0.039	Delta=0.484
For Help, press F1	POSITION	X=11648	Y=-1.000	Pts=0

The Status Bar is separated into 5 different sections:

- menu command information - displays description of the selected menu item.
- application mode - reflects the current operation mode (zoom, edit select, line draw, freehand draw, marker, or position).
- waveform information - displays the X/Y position of the cursor, segment selection boundaries, delta values for markers, or total number of waveform points, depending upon application mode.

Standard Waveshapes

Waveforms can be created using the standard waveshapes available in HP Bench Link/Arb. Each waveshape is inserted as a segment in the waveform edit window, allowing you to vary the size and number of segments in the window or to make the entire waveform one segment.

Selecting a standard waveshape from the Waveforms Menu will display the New Segment dialog box. This dialog allows you to specify pattern characteristics and preview the waveshape before it is inserted as a segment in the waveform edit window. Click the PREVIEW button to display the waveshape while making changes. If you wish to change the type of waveshape currently selected, click the Waveform drop-down list and choose another. The waveform characteristics automatically update to reflect the new pattern you have chosen. Click the DEFAULTS button to return HP BenchLink/Arb's default settings for the selected waveshape.

Clicking a standard waveshape icon on the Palette Bar will automatically insert one segment of the specified waveshape into the waveform edit window. The characteristics of the selected waveshape are set from default parameters. To edit a standard waveshape segment, double-click on it.

|	Type	Parameters	Default	Range
		Data Points	2000	8 to 16000
		Amplitude	1.00	0.00 to 1.00
	Sine wave	Offset	0.00	-1.00 to +1.00
		Cycles	1.00	1.00 to 100.00
		Phase (degrees)	0.00	0.00 to 360.00
		Data Points	2000	8 to 16000
		Amplitude	1.00	0.00 to 1.00
	Triangle Wave	Offset	0.00	-1.00 to +1.00
		Cycles	1.00	1.00 to 100.00
		Phase (degrees)	0.00	0.00 to 360.00
		Data points	2000	8 to 16000
		Amplitude	1.00	0.00 to 1.00
	Square Wave	Offset	0.00	-1.00 to +1.00
		Cycles	1.00	1.00 to 100.00
		Phase (degrees)	0.00	0.00 to 360.00
		Duty Cycle	50.00%	0.00% to 100.00%

Type	Parameters	Default	Range
Ramp Wave	Data points	2000	8 to 16000
	Amplitude	1.00	0.00 to 1.00
	Offset	0.00	-1.00 to +1.00
	Cycles	1.00	1.00 to 100.00
	Phase (degrees)	0.00	0.00 to 360.00
Sinc Pulse $V\frac{sine(m\,\pi)}{(m\,\pi)}$	Data Points	2000	8 to 16000
	Amplitude	1.00	0.00 to 1.00
	Offset	0.00	-1.00 to +1.00
	Cycles	1.00	1.00 to 100.00
	Phase (degrees)	0.00	0.00 to 360.00
	Zero Crossings	10	0 to 100
Exponential Rise $V(1-e^{-bn})$	Data Points	2000	8 to 16000
	Amplitude	1.00	0.00 to 1.00
	Offset	0.00	-1.00 to +1.00
	Cycles	1.00	1.00 to 100.00
	Phase (degrees)	0.00	0.00 to 360.00
	Damping Factor	-5.00	-15.00 to +15.00
Exponential Fall Ve^{-bn}	Data Points	2000	8 to 16000
	Amplitude	1.00	0.00 to 1.00
	Offset	0.00	-1.00 to +1.00
	Cycles	1.00	1.00 to 100.00
	Phase (degrees)	0.00	0.00 to 360.00
	Damping Factor	-5.00	-15.00 to +15.00
Noise	Data Points	2000	8 to 16000
	Amplitude	1.00	0.00 to 1.00
	Offset	0.00	-1.00 to +1.00
DC	Data Points	2000	8 to 16000
	Offset	0.00	-1.00 to +1.00

4

Waveform Edit Windows

Waveforms created in HP BenchLink/Arb are displayed in waveform edit windows. Waveforms consist of one or more segments which can be created by inserting standard waveshapes, freehand drawing, line drawing, and performing mathematical operations. Segments can be combined to create virtually any waveform you may need.

Standard waveshape segments can be inserted in the waveform edit window by clicking the appropriate icon on the Palette Bar to insert one cycle of default parameters or by selecting the Waveforms Menu and choosing a standard waveshape. The menu method allows you to change parameters of the standard waveshape and preview it before it is inserted in the window. After a segment has been inserted, double-clicking on it will display the Edit Segment dialog box to display and change its parameters. After math operations have been performed on a standard waveshape, double-clicking will produce the Resize Data dialog box, allowing you to expand or contract the waveshape in both horizontal and vertical directions.
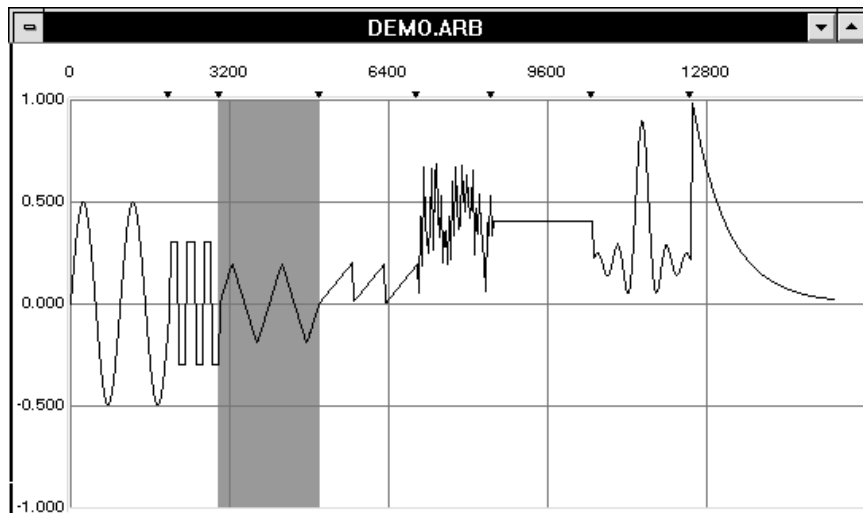
Eight different segments, created from the standard waveshapes, are shown in the figure. The triangle wave segment has been selected and is therefore highlighted.

The waveform edit window contains horizontal and vertical gridlines.
To change the spacing of the horizontal and vertical grid lines select
View | Grid... from the Menu Bar.

The spacing of the vertical (up/down) grid lines is directly affected by the
View | Grid... command. The horizontal spacing (left/right) of the grid
lines is automatically adjusted to standard values (such as 0, 0.25, 0.5,
0.75, or 1.0).

Grid line spacing is specified in terms of the number of screen display
pixels between grid lines. While this spacing also relates to the number of
waveform data points displayed between grid lines, the relationship is
not always one-to-one due to the effects of zooming. Six levels of zooming
are provided (0 - 5), giving the pixel-to-number-of-data-points
relationship in the following table:

4

Zoom Level		Waveform data points per screen display pixel
0	(default - no zoom)	32
1		16
2		8
3		4
4		2
5	(fully zoomed in)	1

For example, if no zoom is in use, a spacing of 100 pixels between vertical
grid lines relates to the display of 3200 (32 X 100) waveform data points
between grid lines. At full zoom, a spacing of 100 pixels between grid
lines results in 100 (1 X 100) waveform data points between grid lines.

To adjust grid line spacing, specify the number of pixels by clicking on
the up/down arrows or type a number in the text box and click OK. Valid
grid sizes range from 50 (default) to 200 pixels.

The waveform edit window can also be displayed in normal or high
resolution viewing mode. Normal mode consists of points that have been
uniformly sampled and chosen for display. High resolution mode displays all
points of the waveform (Select **View | High Resolution** from the Menu
Bar). Operations on the waveform in high resolution mode will take longer
to perform because the display will be updated at a slower rate.

Several windows can be displayed at one time. All new window title bars contain the word 'Untitled', and a number. When the windows are saved, 'Untitled' is changed to the name of the file. The total number of points in each waveform must be a minimum of 8 points and cannot exceed 16,000 points.

Waveform Edit windows can be maximized, reduced to an icon, cascaded or tiled. If HP BenchLink/Arb is reduced to an icon, any waveform edit windows will also be reduced to an icon.

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Wave View Window

The Wave View window allows you to view the entire waveform while you are creating and editing individual segments in the active waveform edit window. Any changes made to the waveform will be reflected in the Wave View window. For convenience, the window can be placed anywhere on your computer screen.

The Wave View window contains a sampled representation of the waveform, and as such, cannot display every waveform detail. Rather than a precise rendering of the waveform, the Wave View window gives a general 'overview' of the waveform.
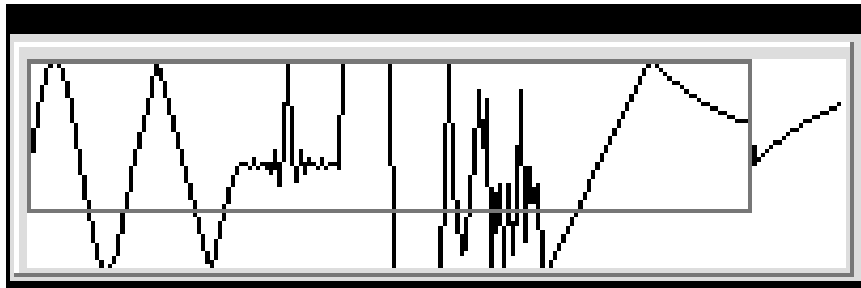
A zoom locator box within the Wave View window shows which part of the overall waveform is currently displayed in the waveform edit window. Move the zoom locator box using a click and drag motion to change the waveform edit window display. Markers are also displayed in the Wave View window (when enabled) to show their location relative to the waveform edit window.

Selection modes

HP BenchLink/Arb uses different selection modes for performing various functions:

Edit Select mode. Parts or segments of the waveform can be selected by clicking the 'edit select' icon found on the Palette Bar. This selection mode allows you to highlight the desired area for editing or math operations.

When you first enter 'edit select' mode and move your mouse in the waveform edit window, the Status Bar reflects the X and Y positions of your cursor as it moves across the window. When a portion of the waveform is highlighted by clicking and dragging the cursor, the Status Bar reflects the start and end points of the highlighted area and the total number of points selected. The highlighted area can be adjusted using the up/down and left/right arrows in the following manner:

- Right arrow - selects the right side of the highlighted area
- Left arrow - selects the left side of the highlighted area
- Up arrow - increases the highlighted area
- Down arrow - decreases the highlighted area

> In normal viewing mode, the up/ down arrow keys may not seem to increase or decrease the highlighted area in the waveform edit window, yet the Status Bar indicates the change in selection. Zooming in will display the results in a more efficient manner.

To invalidate a highlighted selection, click past the end of the waveform or click the 'edit select' icon again.

Selecting a segment. To highlight an individual segment, press the SHIFT key and click on the segment. Continue to hold the SHIFT key to click and select multiple segments. Double-clicking on a segment will display the Resize Data dialog box allowing you to change the vertical and horizontal aspects of the segment. Standard waveshape segments will display the Edit Segment dialog box unless some form of math operation has been performed on them.

Select all. To select the entire waveform consisting of multiple segments, choose **Edit | Select All** from the Menu Bar or press SHIFT and double-click in the waveform edit window.

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|▲| ▲   **Marker mode**. 'Marker' mode is entered by clicking the icon on the
Palette Bar or by choosing **Edit | Marker Select** from the Menu Bar.
This mode automatically enables the X and Y markers. Selecting either X
or Y markers (from the Edit Menu or with icons) also causes the cursor to
change to 'marker' mode. Move the markers using a click and drag
motion, or, for fine adjustment, the arrow keys.

While you are in 'marker' mode, the Status Bar reflects the location of the
X or Y marker pairs as they are positioned in the waveform edit window
and the difference between them. To exit this mode, click the 'marker'
icon again. This disables the markers and enters the 'edit select' mode.
Clicking the 'edit select' icon will exit 'marker' mode and leave the
markers enabled.

Zoom

There are six zoom levels available. In the normal viewing mode (fully
zoomed out) one pixel of the screen equals 32 waveform data points.
Zooming in decreases the number of points equal to one pixel in multiples
of two (e.g. 32, 16, 8, 4, 2, 1). Zooming can be performed in the following
ways:

To zoom into part of a waveform, choose **View | Zoom** from the Menu
Bar or click the Zoom icon. The cursor will change to a magnifying glass.
Click and drag your mouse to define the area to zoom into. When you
release the mouse button, the selected area will be displayed in the active
waveform window. This process can be repeated until you are fully
zoomed in and one pixel equals one data point.

To zoom in one level at a time, choose **View | Zoom In** from the Menu
Bar or click the Zoom In icon. You can zoom in until you reach the level
where one pixel equals one data point.

Click the Zoom Out icon or choose **View | Zoom Out** from the Menu Bar
to zoom out one level at a time. You can zoom out until the entire
waveform is displayed. If you wish to zoom out and display the waveform
in one step, choosing **View | View All** will fit the entire waveform into
the waveform edit window.

> The zoom locator box in the Wave View window outlines the
> portion of the waveform currently displayed in the waveform
> edit window. This box changes as you zoom in and out and can
> be moved by clicking and dragging it.

X and Y Markers

Vertical (X) or horizontal (Y) markers are available in HP BenchLink/Arb to assist you in creating and modifying waveforms. Select **Edit | X Markers** or **Edit | Y Markers** or click their icons to display the X or Y markers. When the markers are first displayed, your cursor will be in the 'marker' mode. The markers can be moved by clicking the mouse on any of the markers and dragging them to the desired location or by using the left and right arrow keys. The X or Y marker positions and the difference between the X or Y marker position is displayed in the Status Bar at the bottom of your HP BenchLink/Arb screen. Markers can be disabled by selecting the appropriate commands from the Edit Menu or by clicking their icons on the Palette Bar.

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Markers can be set and held in a specific position by clicking the Thumbtack icon or by selecting **Edit | Set Thumbtack** from the Menu Bar. Thumbtacked markers can be used to confine the editing area or to alter a standard waveshape segment using freehand or line drawing mode. Drawing is permitted only in the area between the markers and must be started in the marked area. Clicking and drawing outside of this area is ignored.

Grid

The waveform edit window contains horizontal and vertical gridlines. To change the spacing of the horizontal and vertical grid lines select **View | Grid...** from the Menu Bar.

The spacing of the vertical (up/down) grid lines is directly affected by the **View | Grid...** command. the horizontal spacing (left/right) of the grid lines is automatically adjusted to standard values (such as 0, 0.25, 0.5, 0.75, or 1.0).

Grid line spacing is specified in terms of the number of of screen display pixels between grid lines. While this spacing also relates to the number of waveform data points displayed between grid lines, the relationship is not always one-to-one due to the effects of zooming. Six levels of zooming are provided (0 - 5). Refer to the discussion on page 53 for more information about the grid settings.

Scrolling

Use the vertical and horizontal scroll bars to view different portions of the waveform. Scroll bars are needed because, in some cases, the actual waveform physically occupies more space than the window can display at one time. If the waveform fits in the window, no scroll bars will be displayed.

Tick Marks (Segment Identification Markers)

Tick marks are visual aids used to identify the start and end points of a waveform segment. They appear as inverted arrows at the top of the waveform edit window (see the figure on page 14). To enable/disable tick marks, select **View | Tick Marks** from the Menu Bar.

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File Descriptions

.ARB

This file extension is used to designate an arbitrary waveform file saved using the HP BenchLink/Arb application. The .ARB file is saved in a proprietary binary format.

.BIN

HP BenchLink/Arb can save waveform data in IEEE-488.2 binary block format. This format contains a file header and binary data. The waveform data is represented in 12-bit format, sent as two bytes. The file will, therefore, contain twice the number of bytes as waveform data points.

.CSV

The comma-separated values file format includes a point number and corresponding relative amplitude value for each data point in the waveform. The point and amplitude values are separated by a comma. Point values range from 0 to 15,999 and amplitude values range from -1 to +1.

.PRN

The PRN file format includes a point number and corresponding relative amplitude value for each data point in the waveform. The point and amplitude values are separated by a tab. Point values range from 0 to 15,999 and amplitude values range from -1 to +1.

Sample Files

The following sample waveform files were placed in the
\BENCH\SAMPLES directory during installation. Most of these
waveforms were created in HP BenchLink/Arb. The GAUSIAN.ARB
waveform was imported from the Mathcad application and the
HC_GATE.ARB waveform was captured and imported using the HP
BenchLink/Scope application.

Use **File | Open...** or click the File Open icon to open one these files.
Once open, the waveform can be edited, inserted, or copied.

File name	Description	Size (number of points)
DTMF_0.ARB	Telephone Dual Tone Multi-Frequency signal - Key 0	8000
DTMF_9.ARB	Telephone Dual Tone Multi-Frequency signal - Key 9	8000
TWOTONE.ARB	Two tone signal for intermodulation test	8000
PSK.ARB	Phase Shift Key modulated signal	8000
STAIR.ARB	10 step staircase ramp signal	8000
PULSE_10.ARB	10 level sinc wave approximation	8000
PK_SPIKE.ARB	Sine wave with a spike added to each peak	8000
SCR.ARB	Quarter cycle SCR signal	8000
HALF_REC.ARB	Half-wave rectified sine wave	8000
FULL_REC.ARB	Full-wave rectified sine wave	8000
NOISE.ARB	Sine wave with high frequency noise added	8000
NONLIN_1.ARB	Sine wave with third harmonic distortion	8000
GAUSIAN.ARB	Gaussian pulse created in Mathcad and imported	8000
TRAPAZD.ARB	Trapezoidal pulse	4000
SM_DUTY.ARB	0.1% duty cycle square wave signal	4000
SERIAL.ARB	11-bit frame of serial data	4000
RING.ARB	Square wave with ringing	4000
HC_GATE.ARB	74HC family digital signal, captured and imported from HP BenchLink/Scope	4000

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Using With Other Applications

Importing Arbitrary Waveforms From Files

HP BenchLink/Arb can be used to edit waveforms imported from the
HP 34810A BenchLink/Scope application, Mathcad or
Microsoft Excel. Imported files must be in either .CSV or .PRN
point/amplitude pair format.

To import a .CSV or .PRN file:

Files from HP BenchLink/Scope or Microsoft Excel previously saved in
the .CSV or .PRN file format can be imported into a waveform edit
window in the following manner:

1   Select **File | Import...** from the Menu Bar. The Open dialog box will
    be displayed, prompting you to enter the filename of the file you wish
    to open.

2   Choose the appropriate file extension from the file type list, select the
    desired file and click the OK button. If the file is displayed in the file list,
    double-click on it to open the file. Click the CANCEL button to abort the
    command or the HELP button for more information.

3   The file will be opened as a new waveform edit window, properly scaled
    to display the points. The points may be cut and pasted into another
    waveform edit window if desired.

To import a file from Mathcad:

The Mathcad file must be in a tab-separated X, Y format (.PRN) before it
is imported into HP BenchLink/Arb. X values in the data should be
sequential. Y values should be between +1 and -1 since
HP BenchLink/Arb will scale the data to $\pm$ 1 based on the minimum and
maximum values of the data. Use the WRITEPRN function in Mathcad to
produce this type of data file. As an example, a file could appear as:

1	1.0
2	0.4
3	-0.2
4	-1.0
5	-0.3
6	0.5

When the file has been saved in the .PRN file format, it can then be
imported into HP BenchLink/Arb.

Exporting Arbitrary Waveforms to Other Applications

You can export waveforms created in HP BenchLink/Arb to other applications. There are two ways to do this: using the clipboard or by exporting the waveform data.

To Export a Waveform Using the Clipboard

1 Use **Edit | Select All** to highlight the waveform in the waveform edit window and copy it to the Clipboard with **Edit | Copy Image**.

2 Switch to the destination application and use **Insert | Paste** or *Shift+Insert* to put the clipboard contents into the application.

> The Clipboard contents are inserted in a Windows .BMP format.

To Export Waveform Data

1 Select the waveform edit window and choose **File | Save As ...** or click the Save icon.

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2 Select the desired export file format by clicking on the SAVE FILE AS TYPE drop-down list and choosing either .CSV , .PRN, or .BIN.

3 Enter the desired file and click the OK button.

> .CSV files are point/ amplitude pairs separated by a comma. This is a popular format for spreadsheets such as Microsoft Excel.
>
> .PRN files are point/ amplitude pairs separated by a tab character. This format is used by some spreadsheets and programs like Mathcad.
>
> .BIN files are IEEE-488.2 binary block format.

Starting Other BenchLink Applications

HP33120A <710>

IEEE-488 Interface Only. If you select another instrument in the instrument drop-down list, HP BenchLink/Arb will attempt to switch to a BenchLink application that supports the instrument chosen. For example, selecting an HP 54602A will switch to the HP BenchLink/Scope application. If the application is not already running, HP BenchLink/Arb will load the application. A warning dialog is displayed if the instrument selected is not supported or the application could not be found.

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Error and Information
Messages

This chapter lists error and information messages to assist you in the operation of HP BenchLink/Arb. The words in bold type are the message content. The type of message is indicated in the middle column and is followed by the explanation and/or suggested action to be taken. *Number* or *name* indicates that there is more than one number or name that can appear in the message.

Message	Type	Suggested Action
Couldn't start application: *name.exe*	Error Message	This error message indicates HP BenchLink/Arb could not find an application corresponding to the instrument selected from the Toolbar Instrument list. If the instrument is supported by a BenchLink family software product, try starting the named application and try again.
Expected instrument not found.	Error Message	This error message indicates that the instrument described in the HP BenchLink/Arb initialization file did not respond to HP BenchLink/Arb using the current communications setup. Use the Interface Setup dialog box to make changes to the communications settings.
Found a *name* **at address** *number*.	Information Message	This information message indicates that HP BenchLink/Arb has successfully established communications with the function generator at the HP-IB address or COM port specified in the Setup Interface dialog box.
Instrument address or controller settings do not match initialization file. Do you want to change interface settings now?	Information Message	This information message indicates that upon startup, HP BenchLink/Arb did not find the controller or instrument default address(es) as listed in the initialization file. Choose YES to display the Interface Setup dialog box or NO to cancel.
Instrument at address *number* **not responding.**	Error Message	HP BenchLink/Arb was unable to perform the attempted operation with the displayed function generator. Select **Options	Configure Interface...** from the Menu Bar and test the communications to that instrument before resuming.
Interface timed out sending: *name*. **Try again?**	Error Message	This error message indicates that the attached instrument did not respond to a query from HP BenchLink/Arb. Restart HP BenchLink/Arb and try again.

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Message	Type	Suggested Action
No instruments found. Make sure all cables are properly installed and instruments are powered on.	Error Message	This error message indicates HP BenchLink/Arb cannot find an attached function generator. If you are using RS-232, be sure the correct 9- or 25-pin cables have been used, the function generator is powered on, and the RS-232 settings of the function generator match the settings in the **Setup Interface	Settings...** dialog box. If you are using HP-IB, ensure that the cables are securely fastened and the function generator is turned on. Also verify that the function generator interface is set to HP-IB.
Not enough room to paste waveform.	Error Message	This error message indicates the selected waveform cannot be pasted without exceeding the maximum number of points allowed in an HP BenchLink/Arb waveform edit window (16,000). Click OK and select a smaller waveform or open another window to paste the waveform into.
Please enter an integer between *number* **and** *number***.**	Error Message	This error message indicates the number entered in the text box is not acceptable. Change the number to a valid one and click OK.
Save changes to *name***?**	Information Message	This information message indicates that the specified window you wish to close is new or has been changed. Click YES to save the waveform information, NO to delete it, or CANCEL to cancel the command.
The following required files were not found in your \windows\system directory: *(Names)***.**	Error Message	This error message indicates that the named files should be installed by HP BenchLink/Arb. Reinstall HP BenchLink/Arb.
This file already exists. Replace existing file?	Error Message	This error message indicates that the named file will be overwritten by new data if you choose YES.
This instrument is not supported by HP BenchLink/Arb and no other application was associated with this instrument.	Error Message	This error message indicates there is an instrument on the bus that is not supported by an installed HP BenchLink software product. Select a valid instrument before attempting any operations.

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Message	Type	Suggested Action
This segment is too long to be added. Use Resize if you need more space.	Error Message	This error message indicates the selected standard waveshape cannot be inserted without exceeding the maximum number of points allowed in an HP BenchLink/Arb waveform edit window (16,000). Click OK and adjust the existing waveform using **Math | Resize** or open another window to add the segment into.
Too many windows open. Close some and try again.	Information Message	This information message indicates that there are too many open windows in the HP BenchLink/Arb application. A maximum of 8 windows can be opened before this message is displayed.

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Printing History

The Printing History shown below lists all Editions and Updates of this manual and the printing date(s). The first printing of the manual is Edition 1. The Edition number increments by 1 whenever the manual is revised. Updates, which are issued between Editions, contain replacement pages to correct the current Edition of the manual. Updates are numbered sequentially starting with Update 1. When a new Edition is created, it contains all the Update information for the previous Edition. Each new Edition or Update also includes a revised copy of this printing history page. Many product updates or revisions do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

Edition 1 (Part Number 34811-90001) . . . . February 1994

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