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Index
Getting Started

Before You Begin

Before you can use your HP 95LX, the batteries that came in the package with it must be installed. If you haven’t already done so, follow the battery-installation instructions (along with the instructions for adjusting the display contrast, setting the time and date, and filling out the business card) at the beginning of the HP 95LX Quick Start Guide.

How to Use This Manual

This manual is divided into five parts and a set of appendixes:

- Part 1: Getting Started
- Part 2: Lotus 1-2-3
- Part 3: The Personal Information Manager
- Part 4: The HP Financial Calculator
- Part 5: Data Communications
- Appendixes:
  A. Support, Batteries, and Service
  B. MS-DOS Commands
  C. Printing
  D. Using RPN with the Calculator
  E. HP 95LX Character Set
  F. Lotus International Character Set (LIICS)
  G. TigerFox

Whenever you need information on a particular topic, go to the appropriate part of the manual. In addition to the table of contents at the beginning of this manual, there is a detailed subject index in the back of the manual to help you find information quickly and easily.
1. Application keys
2. Plug-in card slot (drive A)
3. Card-eject slide switch
4. Menu key
5. Backup battery cover
6. I/R port (I/R radiates through the plastic)
7. Serial port
8. AC adapter
9. ON key

Hardware Features
Your HP 95LX is a powerful, yet portable computer. It is so portable that it fits in the palm of your hand, enabling you to do your computing anytime, anywhere. Among its hardware features are:

- A rugged “durmshell” design, which protects the keyboard and display when you’re on the go.
- A large, 40x16 display.

1-2 Getting Started
- A plug-in card slot, which enables you to use plug-in cards just like you would floppy disks on your PC.
- An infrared (I/R) port for wireless HP 95LX to HP 95LX communications.
- A serial port for HP 95LX communications to a PC, a printer, or other serial devices.
- A typewriter keyboard layout with a "sticky" shift key—you don’t need to hold down & while you press another key; you press it once to activate it and then press the other key. Shifted key definitions are shown in yellow on the keyboard.
- A separate numeric keypad for fast and easy numeric entry.

Software Features
The second row on the HP 95LX keyboard contains a set of blue application keys. These keys enable you to run the HP 95LX built-in applications.

- Pressing [ ] starts the File application, which lets you manipulate directories and files, including the transfer of files to and from another PC (chapter 20).
Pressing (3) starts the Data Communications application, which lets you use your HP 96LX as a terminal (chapter 31).

Pressing (4) starts the Appointment Book, which enables you to schedule and track appointments and "to do" list items (chapter 17).

Pressing (5) starts the Phone Book, which allows you to store and retrieve names, phone numbers, and other pertinent information (chapter 18).

Pressing (6) starts the Memo Editor, which enables you to create and edit memos, notes, letters, and other documents (chapter 19).

Pressing (7) runs Lotus® 1-2-3® (chapters 2 through 16).

Pressing (8) runs the Financial Calculator (chapters 22 through 21).

Pressing (7) START (2) starts the Setup utility, which you use to configure various aspects of your system (chapter 21).

---

**Note**

Keep in mind as you learn about and use the built-in HP 96LX applications that help is always available within any of the applications by simply pressing the (F1) key (CTRL F1 in Datacomm).

---

A special feature of the HP 96LX software is the ability to switch from one application to another without having to close the first application. That makes it easy to intermix your work temporarily and then find your place again with a minimum of disruption. For example, you could find yourself in the middle of editing a 1-2-3 worksheet when you want to check an appointment and phone number. You would simply press (3) to get into the Appointment Book to check your appointment; then press (5) to get into the Phone Book; and then when you're done, press (7) to get back into 1-2-3 exactly where you left off.

---

1-4 Getting Started
Managing HP 95LX Memory

Lotus 1-2-3, the Financial Calculator, and the other built-in applications reside in ROM (Read-Only Memory). You can’t erase or overwrite ROM—x’s permanent. The temporary type of memory that you can erase and overwrite is called RAM (Random-Access Memory). In RAM you store programs, data files (for example, 1-2-3 worksheets), text files, etc.

When you’re running an application, the part of RAM being used as your work area is called system RAM.

When you’re finished working and want to save the file you worked on, you can save it to any other part of RAM called the RAM disk, or you can save it to a plug-in RAM card.

- The RAM disk is designated drive C, and you use it like you use a hard disk on a PC. When your HP 95LX was shipped, the size of the RAM disk was set to 256K bytes. (You can change the size of the RAM disk by following the instructions in chapter 21.)
- The plug-in RAM card is designated drive A, and you use it like you use a floppy disk on a PC (see “Using RAM Cards” later in this chapter).

If you find your files on the RAM disk or RAM card become cluttered and keeping track of them difficult, you can divide them into directories and subdirectories for a more logical order. For example, a RAM card directory structure might look like this:
To save a new 1-2-3 worksheet called Q1.WK1 in the above structure, you would respond to the 1-2-3 Save prompt with:

```
6t=BUDGETS\1991\Q1.WK1
```

That would put the Q1.WK1 file with the other 1991 budget files in the subdirectory 1991, which is in the directory BUDGETS, which is on drive A.

**Note**

Your EP 95LX was shipped with a directory on the RAM disk called ..DAT. You should not remove or rename this directory because it is automatically used by several of the built-in applications.

MS-DOS directory- and file-naming conventions and limitations are described in appendix B.

1-6 Getting Started
Using RAM Cards

A RAM card plugged into your HP 95LX is designated drive A:, and you use it just like you would use a floppy disk on your PC. The previous example showed how you might save a worksheet to a file named QL.WK1 on a RAM card.

Caution

RAM cards supplied by Hewlett-Packard for the HP 95LX conform to the PCMCIA 1.0 and JEIDA 4.0 standards. Other suppliers’ RAM cards may also conform to these standards, yet they could significantly shorten battery life in your HP 95LX. Therefore, we recommend that you use only HP RAM cards to ensure high quality, safe performance, and long battery life.

The HP 95LX supports RAM cards of up to 2 megabytes.

Inserting and Removing RAM Cards

To insert a card, hold it with the HP logo on top and push it in the slot on the left side of the HP 95LX until you feel that it won’t go in any further. A fully-inserted card is almost flush with the HP 95LX case.
To remove a card, slide the card eject switch to the left and pull the card out.

Preparing a RAM Card for Use

Before you can use a new RAM card, you must prepare it for use. (The following instructions are for new RAM cards. If you need to change the battery in a RAM card you’ve used before, refer to “Changing a RAM Card Battery” in appendix A.)

Installing the Battery in a New RAM Card. To install the battery in a new RAM card:

1. Locate the battery tray lock on the RAM card.
2. Unlock the RAM card battery tray.

3. Pull the battery tray out of the card.
4. Insert the 3-volt CR2025 coin cell into the battery tray. Be sure the "+" on the battery is on the same side as the "+" on the battery tray.

5. Insert the battery way back into the card—be sure the "+" side faces the front of the RAM card—and relock the battery holder.

1-10 Getting Started
6. Write the date on the back of the card using a fine-point, permanent marker. The date is important because you should replace the RAM card battery a year after you install it.

Setting the Write-Protect Switch. The write-protect switch lets you protect the contents of the RAM card from being accidentally overwritten or erased. The switch is located next to the battery lock and has two positions:

- **Read-only.** The contents of the RAM card can be read, but cannot be changed or erased.
- **Read/write.** You can write information to the RAM card and erase its contents.

Set the switch to the position you want. (For a new card you need to set it to read/write for formatting.) You can operate the write-protect switch while the card is installed; however, the switch labels are not visible. It might help you to remember that the position closest to the side of the card protects your data (read-only).
Inserting the Card into the HP 95LX. Holding the RAM card with the HP logo on top, insert it into the plug-in slot until you feel that it won’t go in any further. A fully-inserted card is almost flush with the HP 95LX case.

Formatting the RAM Card. The last step before using a RAM card is formatting it.

1. Make sure the write-protect switch is set to read/write.
2. Press [SET UP].
3. Select Format and follow the instructions on the screen. (If you want to exit this screen without formatting the card, press [CTRL-S] or [CTRL-BREAK].)
1. When the formatting is complete, select Quit to exit the Setup utility.

At this point, the RAM card is ready for use.

Resetting Your HP 95LX

If your HP 95LX fails to respond to keystrokes or otherwise behaves unusually, you should reset it by doing a system reset. You perform a system reset by pressing \texttt{CTRL}, \texttt{ALT}, and \texttt{DEL} at the same time.

\textbf{Caution} \hspace{1cm} Resetting the system erases the contents of system RAM (but not the RAM disk). Therefore, any files or changes to files not already saved will be lost.

If a system reset doesn't work, as a last resort you can attempt a hard reset by pressing \texttt{CTRL}, \texttt{ALT}, and \texttt{DEL} at the same time. You will be asked whether or not you want to initialize the RAM disk, which erases its contents. If you type \texttt{y} (for yes) and press \texttt{ENTER}, a hard reset will occur; if you type \texttt{n} (for no) and press \texttt{ENTER}, a system reset is attempted and the time and date are reset.

\textbf{Caution} \hspace{1cm} A hard reset erases the contents of system RAM and the RAM disk. Therefore, you should use this procedure with the understanding that any open files as well as any files saved on the RAM disk will be lost.

Also, a hard reset causes any HP 95LX settings you changed via the Setup Utility to revert to their default states.
Activating Password Protection

You can protect your HP 95LX from being used by other people by setting a password. You can implement the password so that it operates in one of two ways:

- **Auto-lock mode**: Whenever the HP 95LX is turned off, times out, or is reset by a system reset, you must enter the password before you use it.
- **Manual-lock mode**: While holding down [ALT], press and release [OFF] to activate password protection. When the HP 95LX times out, is reset, or is turned off by just pressing [OFF], you do not need to enter the password to use the machine.

When password protection is activated and you turn on your HP 95LX, you must respond to the prompt by typing your password and pressing [ENTER] before you can use the unit.

A password can contain any combination of up to 12 characters (except control characters). Also, a distinction is made between uppercase and lowercase letters—for example, John as a password is different than John, John, or even John.

---

**Caution**

Take care that you remember your password, If you forget it, the only way to regain use of your HP 95LX is to remove the main batteries and backup battery and then reinstall them. Removing all the batteries at once causes all files saved in the RAM disk to be lost.

---

To set or change a password:

1. Close all open applications (use [MENU] Quit).
2. Press [ESC] to start the File.
3. Select [MEMORY] System to get the MS-DOS command prompts.
4. Type PASSWORD and press [ENTER].
5. Follow the instructions on the screen. (Remember to press [ENTER] after each response to a prompt.)

When you first set a password, it is automatically implemented in manual-lock mode—password protection is activated only when you press [OFF] to turn the machine off. You can change this to auto-lock mode, or deactivate password protection altogether, by following the next procedure.

1-14 Getting Started
To change the mode or deactivate password protection:

1. Close all open applications (use **File** Quit).
2. Press **Esc** to start the Filer.
3. Select **File** System to get the MS-DOS command prompt.
4. Do one of the following:
   a. Type `PASSWORD /A` to implement auto-lock mode.
   b. Type `PASSWORD /M` to implement manual-lock mode.
   c. Type `PASSWORD /D` to deactivate password protection.
5. Press **Enter**. (If you’re deactivating password protection, you’ll need to enter the password at this point.)
Using 1-2-3

This chapter explains the basic concepts you need to know to work with Lotus 1-2-3. For example, the chapter explains how to move around a 1-2-3 worksheet, enter data, select commands from 1-2-3 menus, specify ranges for commands and formulas, and work with 1-2-3 files—enough information to get you started quickly using 1-2-3.

Press [F2] to start your 1-2-3 session.

Note

Throughout the 1-2-3 documentation we direct you to press slash (/) to access 1-2-3 commands. The most convenient slash is probably the key labeled [MENUS] (with the / printed below it) on the bottom of the IBM 3159 keyboard. However, you can also use the divide key on the number pad. (You may also access 1-2-3 commands by pressing [F2]).

The 1-2-3 Screen

1-2-3 divides the screen into three areas: the worksheet area, the control panel, and the status line.
The HP 95LX screen displays 40 characters across and 16 rows of text, this is different from the 80 by 25 display that is common on a PC.

Note
Some macros that were written assuming an 80 x 25 display may exhibit unexpected behavior on the HP 95LX. (For example, `[PGUP]`, `[PDON]`, `[BLEFT]`, and `[BRIGHT]` commands assume an 80-column display and may not function properly in a macro on the HP 95LX.)

The following sections describe each area of the screen.

The Worksheet Area

The worksheet area, which occupies the largest section of the screen, is where you enter and calculate data. It displays the section of the worksheet you are currently working on. In the screen above, the worksheet area displays part of an income statement.

The worksheet is a grid with a maximum size of 8192 rows and 256 columns. Each intersection of a row and column forms a cell, in which you can store information.

A row number identifies a row in the worksheet. The number (from 1 to 8192) appears in the left border of the worksheet.
A column letter identifies a column in the worksheet. Columns are lettered A-Z, then AA-AZ, then BA-BZ, and so on to IV (letters appear in the top border of the worksheet).

A cell is a unit of the worksheet that stores data—formed by the intersection of a column and a row.

The cell pointer is a rectangular highlight that appears on one cell in the worksheet, identifies it as the current cell, and can move to any cell in the worksheet.

The current cell contains the cell pointer and indicates your location on the worksheet.

**Note**

Error messages appear in a box in the center of the screen when 1-2-3 detects a mistake or cannot perform a task. If an error message appears, press HELP (F1) for a description of the error message and why it occurs; or press ESC or ENTER to clear the error and continue work.

---

**The Control Panel**

The control panel consists of three lines of information.

The first line of the control panel displays information about the current cell and the mode, or state, of 1-2-3. As the far left of the first line of the control panel, 1-2-3 displays the address of the current cell.
A cell address consists of the column letter and row number of a single cell. For example, B5 is the address for the cell at the intersection of column B and row 5.

After the cell address, 1-2-3 displays the following setting information for the current cell, from left to right:

- The **cell format**, which controls the way 1-2-3 displays values in the cell (if you used /Range Format to change the default cell format).
- The cell’s **protection status** (if any), which determines whether you can make changes to the cell when worksheet protection is on. 1-2-3 displays an if you used /Worksheet Global Protection Enable to turn worksheet protection on.
- The cell’s **column width**, which determines the number of characters 1-2-3 displays in the cell (if you used /Worksheet Column to change the default column width).

After the settings information, 1-2-3 displays the entry in the current cell, if any.

Our example shows cell B5 formatted as Currency with 0 decimal places, worksheet protection on, and a column width of 10. The cell contains the entry 3600000.

At the far right of the first line of the control panel, 1-2-3 displays the **mode indicator**, which tells you what mode, or state, 1-2-3 is currently in. For example, when 1-2-3 is waiting for you to type or select a command, 1-2-3 is in READY mode and the mode indicator displays READY. For a complete list of the various 1-2-3 modes, see “Mode Indicators” later in this chapter.

**Note**

1-2-3 also uses the mode indicator to display indicators you create with the advanced macro command (INDICATE). (For more information, see (INDICATE) in chapter 13.)

The second line of the control panel displays the current entry (when you are creating or editing it), or it displays menus (a list of commands that appear when you press MENU) in READY mode.

### 2.4 Using 1-2-3
Note

Because the HP 95LX screen is narrower than a full-size PC, 1-2-3 on the HP 95LX uses two lines for the menu choices.

The rectangular highlight that appears on one of the commands in the menu is called the menu pointer. The second line of the control panel may also display prompt or requests for information that 1-2-3 needs to complete the command you have selected.

The third line of the control panel displays more menu selections or may be empty.

The Status Line

The status line is the last line of the screen. 1-2-3 uses the status line to display various status indicators.

A status indicator appears on the screen when you use certain 1-2-3 keys and when a particular program condition exists. For example, the CAPS indicator tells you that the CAPS lock is on. For a complete list of indicators, see "Status Indicators" later in this chapter.

Using 1-2-3  2-5
1-2-3 Indicators

An indicator is a highlighted word that 1-2-3 displays to provide you with information about the program or special keys. 1-2-3 has two types of indicators: mode and status.

Mode Indicators

During a 1-2-3 work session, a mode indicator is always visible at the far right of the first line of the control panel. It tells you what mode, or state, 1-2-3 is currently in. The various 1-2-3 modes are described below.

<table>
<thead>
<tr>
<th>Mode Indicator</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDIT</td>
<td>You pressed EDIT (F2) to edit an entry.</td>
</tr>
<tr>
<td>ERROR</td>
<td>1-2-3 is displaying an error message. Press HELP (F1) to display a Help screen that describes the error; or press ESC or ENTER to clear the error message.</td>
</tr>
<tr>
<td>FILES</td>
<td>1-2-3 is displaying a menu of file names in the control panel. Press NAME (F3) to display a full-screen menu of file names.</td>
</tr>
<tr>
<td>FIND</td>
<td>You selected /Data Query Find, or pressed QUERY (F7) to repeat the last /Data Query Find you specified, and 1-2-3 is highlighting a database record that matches your criteria.</td>
</tr>
<tr>
<td>FRMT</td>
<td>You selected /Data Pane Format-Line Edit to edit a format line.</td>
</tr>
<tr>
<td>HELP</td>
<td>You pressed HELP and 1-2-3 is displaying a Help screen.</td>
</tr>
<tr>
<td>LABEL</td>
<td>You are entering a label.</td>
</tr>
<tr>
<td>MENU</td>
<td>You pressed slash (MENU) and 1-2-3 is displaying a menu of commands.</td>
</tr>
<tr>
<td>NAMES</td>
<td>1-2-3 is displaying a menu of range names, graph names, or attached add-in names.</td>
</tr>
<tr>
<td>POINT</td>
<td>1-2-3 is prompting you to specify a range or you are creating a formula by highlighting a range.</td>
</tr>
</tbody>
</table>

2-6 Using 1-2-3
READY  1-2-3 is ready for you to enter data or select a command.

STAT  You selected /Worksheet Status or /Worksheet Global Default Status and 1-2-3 is displaying the corresponding status screen.

VALUE  You are entering a value (a number or formula).

WAIT  1-2-3 is completing a command or process.

---

**Status Indicators**

Status indicators appear in the status line at the bottom of your screen when you use certain 1-2-3 keys and when a particular program condition exists. The various 1-2-3 status indicators are described below.

<table>
<thead>
<tr>
<th>Status Indicator</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calc</td>
<td>Formulas in the worksheet need to be recalculated; press \texttt{CALC (F3)}.</td>
</tr>
<tr>
<td>Cap</td>
<td>The \texttt{CAPS} lock key is on.</td>
</tr>
<tr>
<td>Circ</td>
<td>The worksheet contains a formula that refers to itself (occurs only when the recalculation order is Natural, which is the default setting). You can use /Worksheet Status to get information about the circular reference.</td>
</tr>
<tr>
<td>End</td>
<td>1-2-3 is pausing during a macro.</td>
</tr>
<tr>
<td>End</td>
<td>The \texttt{ESC} key is on.</td>
</tr>
<tr>
<td>Learn</td>
<td>The amount of computer memory available for entering new data has fallen below 4096 bytes. If you continue to enter data without first increasing the amount of available memory, you may get a Memory Full error. For ways to increase available memory, see chapter 1.</td>
</tr>
</tbody>
</table>

Using 1-2-3  2-7
Our

The key is off. Instead of inserting the character you type to the left of the cursor, 1-2-3 writes over (called overstriking) the character at the cursor.

Ro

The worksheet has read-only status (you cannot save any changes you make unless you save the worksheet with a new file name).

Scr

The lock key is on. Using the pointer-movement keys scrolls the worksheet in the direction indicated, instead of moving the cell pointer.

Set

A macro being executed in single-step mode is waiting for user input.

Step

Single-step mode has been turned on, once invoked, macros are processed one step at a time.

Undo

You can press UNDO ([ALT-]) to cancel any changes made to your worksheet since 1-2-3 was last in READY mode.

1-2-3 Keys

This section contains descriptions of all the keys you can use in 1-2-3: keys for moving around (pointer-movement keys), function keys, and special keys.

Key Conventions

The 1-2-3 documentation uses the following conventions when indicating keys for you to press:

- When there is a hyphen between two keys, such as [ALT-F3], press and hold down the first key, press the second key, and then release both keys.
- When two keys are separated by a space, such as [END HOME], press the first key, release it, press the second key, and release it.

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Keys for Moving Around

The pointer-movement keys allow you to move around in 1-2-3. These keys have different effects depending on the 1-2-3 mode. In READY and POINT modes, for example, you use the pointer-movement keys to move the cell pointer around the worksheet. In EDIT mode, however, you use the pointer-movement keys to move the cursor in the second line of the control panel so you can edit an entry.

The pointer-movement keys and the effect of pressing these keys in a particular mode are described below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>READY and POINT</td>
<td>Moves cell pointer left one column.</td>
</tr>
<tr>
<td></td>
<td>MENU and HELP</td>
<td>Moves menu pointer left one item. If menu pointer is highlighting first item in a menu or Help screen, pressing 1 moves it to last item.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer to next name.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Moves cursor left one character.</td>
</tr>
<tr>
<td></td>
<td>VALUE</td>
<td>When pressed after typing - / * ( or * in a formula, switches 1-2-3 to POINT mode.</td>
</tr>
<tr>
<td>2</td>
<td>READY and POINT</td>
<td>Moves cell pointer right one column.</td>
</tr>
<tr>
<td></td>
<td>MENU and HELP</td>
<td>Moves menu pointer right one item. If menu pointer is highlighting last item in a menu or Help screen, pressing 2 moves it to first item.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer right to next name.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Moves cursor right one character.</td>
</tr>
<tr>
<td></td>
<td>VALUE</td>
<td>When pressed after typing - / * ( or * in a formula, switches 1-2-3 to POINT mode.</td>
</tr>
<tr>
<td>Name</td>
<td>Mode</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 🔧 | READY and POINT
HELP FILES and NAMES EDIT VALUE FIND | Moves cell pointer up one row. Moves menu pointer up one topic. Moves menu pointer up to previous line of names. Completes editing and moves cell pointer up one row. When pressed after typing a + / * in a formula, switches 1-2-3 to POINT mode. Moves cell pointer to previous record that meets criteria. |
| 🔧 | READY and POINT
HELP FILES and NAMES EDIT VALUE FIND | Moves cell pointer down one row. Moves menu pointer down one topic. Moves menu pointer down to next line of names. Completes editing and moves cell pointer down one row. When pressed after typing a + / * in a formula, switches 1-2-3 to POINT mode. Moves cell pointer to next record that meets criteria. |
| 🔧 | READY FILES and NAMES EDIT | Moves cell pointer left one screen. Moves menu pointer to first name in current line. Moves cursor left five characters. |
| 🔧 | READY and POINT
HELP FILES and NAMES EDIT | Moves cell pointer left one screen. Moves menu pointer to first name in current line. Moves cursor left five characters. |

2.7 Using 1-2-3
<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVER RIGHT</td>
<td>READY</td>
<td>Moves cell pointer right one screen.</td>
</tr>
<tr>
<td>OVER</td>
<td>POINT</td>
<td></td>
</tr>
<tr>
<td>FILES and</td>
<td>NAMES</td>
<td>Moves menu pointer to last name in current line.</td>
</tr>
<tr>
<td>END</td>
<td>READY</td>
<td></td>
</tr>
<tr>
<td>POINT</td>
<td></td>
<td>Moves cursor right five characters.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Must be used in combination with another pointer-movement key.</td>
</tr>
<tr>
<td>MENU</td>
<td></td>
<td>Moves menu pointer to last item.</td>
</tr>
<tr>
<td>HELP</td>
<td></td>
<td>Moves menu pointer to help topic.</td>
</tr>
<tr>
<td>FILES and</td>
<td>NAMES</td>
<td>Moves menu pointer to last menu.</td>
</tr>
<tr>
<td>END</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEXT</td>
<td></td>
<td>Moves cursor to end of entry.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td></td>
</tr>
<tr>
<td>READY and</td>
<td></td>
<td>Moves cell pointer to last record that meets criteria.</td>
</tr>
<tr>
<td>POINT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Moves cell pointer left to intersection of a blank and a notblank cell.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Moves cell pointer right to intersection of a blank and a notblank cell.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Moves cell pointer up to intersection of a blank and a notblank cell.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Moves cell pointer down to intersection of a blank and a notblank cell.</td>
</tr>
<tr>
<td>END</td>
<td>POINT</td>
<td>Moves cell pointer to lower right corner of the worksheet.</td>
</tr>
</tbody>
</table>

Using 1-2-3 2-11
<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POIN</strong></td>
<td>READY and POINT</td>
<td>Moves cell pointer to cell A1.</td>
</tr>
<tr>
<td></td>
<td>MENU</td>
<td>Moves menu pointer to first item.</td>
</tr>
<tr>
<td></td>
<td>HELP</td>
<td>Moves menu pointer to first topic.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer to first name.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Moves cursor to first character of entry.</td>
</tr>
<tr>
<td></td>
<td>FSID</td>
<td>Moves cell pointer to first record that meets criteria.</td>
</tr>
<tr>
<td><strong>CC ON</strong></td>
<td>READY and POINT</td>
<td>Moves cell pointer down one screen.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer down one line or moves it down one screen in a full-screen menu.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Completes editing and moves cell pointer down one screen.</td>
</tr>
<tr>
<td><strong>SET UP</strong></td>
<td>READY and POINT</td>
<td>Moves cell pointer up one screen.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer up one line or moves it up one screen in a full-screen menu.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Completes editing and moves cell pointer up one screen.</td>
</tr>
<tr>
<td><strong>SU</strong></td>
<td>READY</td>
<td>Moves cell pointer right one screen.</td>
</tr>
<tr>
<td></td>
<td>FILES and NAMES</td>
<td>Moves menu pointer to last name in the current file.</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>Moves cursor right five characters.</td>
</tr>
</tbody>
</table>
Function Keys

You use the function keys on your keyboard to perform special operations. Each function key, except 
(F9)
performs two operations: one when you press only the function key, and another when you hold down ALT
and then press the function key.

<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>POINT</td>
<td>Cycles a cell or range address between relative,</td>
</tr>
<tr>
<td></td>
<td>EDIT</td>
<td>absolute, and mixed.</td>
</tr>
<tr>
<td>APPS</td>
<td>READY</td>
<td>Activates add-in program assigned to key, if any</td>
</tr>
<tr>
<td>APPS</td>
<td>READY</td>
<td>Activates add-in program assigned to key, if any</td>
</tr>
<tr>
<td>APPS</td>
<td>READY</td>
<td>Activates add-in program assigned to key, if any</td>
</tr>
<tr>
<td>APPS</td>
<td>READY</td>
<td>Activates add-in program assigned to key, if any</td>
</tr>
<tr>
<td>APPS</td>
<td>READY</td>
<td>If no add-in program is assigned to key, displays</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the Add-in menu. Otherwise, activates add-in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>assigned to key</td>
</tr>
<tr>
<td>CALCS</td>
<td>READY</td>
<td>Recalculates all formulas in worksheet.</td>
</tr>
<tr>
<td></td>
<td>VALUE</td>
<td>Converts a formula to its current value.</td>
</tr>
<tr>
<td></td>
<td>HTVT</td>
<td></td>
</tr>
<tr>
<td>COMPOSE</td>
<td>READY,</td>
<td>When used in combination with alphanumeric</td>
</tr>
<tr>
<td></td>
<td>EDIT,</td>
<td>keys, creates international characters and other</td>
</tr>
<tr>
<td></td>
<td>LABEL</td>
<td>characters you cannot enter directly from</td>
</tr>
<tr>
<td></td>
<td></td>
<td>keyboard.</td>
</tr>
</tbody>
</table>

Using 1-2-3 2-13
<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDIT</td>
<td>READY</td>
<td>Puts 1-2-3 in EDIT mode and displays contents of the current cell in control panel, so you can edit entry.</td>
</tr>
<tr>
<td>EDIT</td>
<td></td>
<td>Switches between EDIT and LABEL modes, if entry displayed in control panel is a label; or EDIT and VALUE modes, if entry displayed in control panel is a value.</td>
</tr>
<tr>
<td>GOTO</td>
<td>READY</td>
<td>Moves cell pointer directly to cell or named range you specify.</td>
</tr>
<tr>
<td>GRAPH</td>
<td>READY</td>
<td>Displays current graph.</td>
</tr>
<tr>
<td>HELP</td>
<td></td>
<td>Displays a 1-2-3 Help screen related to task you are performing.</td>
</tr>
<tr>
<td>HELP</td>
<td></td>
<td>Displays first Help screen you viewed.</td>
</tr>
<tr>
<td>ERROR</td>
<td></td>
<td>Displays a Help screen that explains error message.</td>
</tr>
<tr>
<td>LEARN</td>
<td></td>
<td>Turns on learn feature and records subsequent keystrokes in learn range. Press LEARN again to turn off learn feature.</td>
</tr>
<tr>
<td>NAME</td>
<td>POINT</td>
<td>Displays a menu of named ranges.</td>
</tr>
<tr>
<td>NAME</td>
<td>FILES</td>
<td>Switches between displaying a menu of names in third line of control panel and displaying a full-screen menu of names.</td>
</tr>
<tr>
<td>NAME</td>
<td>NAMES</td>
<td>Switches between displaying a menu of names in third line of control panel and displaying a full-screen menu of names.</td>
</tr>
<tr>
<td>VALUE</td>
<td></td>
<td>When pressed after typing 4 - / * ( or * in a formula), displays a menu of named ranges.</td>
</tr>
<tr>
<td>QUERY</td>
<td>READY</td>
<td>Repeats last /Data Query you specified.</td>
</tr>
<tr>
<td>FIND</td>
<td></td>
<td>Switches 1-2-3 between FIND mode and READY mode.</td>
</tr>
<tr>
<td>RUN</td>
<td>READY</td>
<td>Displays a list of range names so you can select the name of the macro you want to run. If you press CSE after pressing RUN, 1-2-3 switches to POINT mode so you can highlight the first cell of the macro you want to run.</td>
</tr>
<tr>
<td>STEP</td>
<td></td>
<td>Turns on STEP mode, which executes macros one step at a time for debugging. Press STEP again to turn off STEP mode.</td>
</tr>
<tr>
<td>Name</td>
<td>Mode</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>TABLE</td>
<td>READY</td>
<td>Repeats last /Data Table you specified.</td>
</tr>
<tr>
<td>UNDO</td>
<td>READY</td>
<td>Cancels any changes made to worksheet since 1-2-3 was last in READY mode.</td>
</tr>
<tr>
<td>WINDOW</td>
<td>READY</td>
<td>Moves cell pointer between the two windows created with /Worksheet Window.</td>
</tr>
<tr>
<td></td>
<td>MENU</td>
<td>Turns off display of settings sheets. Press WINDOW again to redisplay settings sheets.</td>
</tr>
</tbody>
</table>

**Special Keys**

There are other keys on your keyboard that have important uses in 1-2-3.

<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT</td>
<td>READY</td>
<td>Runs a macro when used in combination with a single-letter macro name.</td>
</tr>
<tr>
<td>0 (Backspace)</td>
<td>POINT</td>
<td>If cell pointer is not anchored, pressing 0 returns cell pointer to wherever it was before 1-2-3 entered POINT mode. If cell pointer is anchored, pressing 0 removes highlighting, restores cell pointer, and returns cell pointer to wherever it was before 1-2-3 entered POINT mode.</td>
</tr>
<tr>
<td>HELP</td>
<td></td>
<td>Displays previous Help screen.</td>
</tr>
<tr>
<td>FILES</td>
<td></td>
<td>Displays a menu of subdirectories within displayed directory.</td>
</tr>
<tr>
<td>CANCEL</td>
<td></td>
<td>Erases character to left of cursor.</td>
</tr>
<tr>
<td>CTRL</td>
<td>EDIT</td>
<td>Makes letter keys produce uppercase letters.</td>
</tr>
<tr>
<td>CTRL</td>
<td></td>
<td>When used in combination with certain keys, changes their function.</td>
</tr>
<tr>
<td>BREAK</td>
<td>EDIT</td>
<td>Erases character at cursor.</td>
</tr>
<tr>
<td>Mode</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>ENTER</td>
<td>Completes an entry, a command, or part of a command.</td>
<td></td>
</tr>
<tr>
<td>CLEAR</td>
<td>Clean error message from screen.</td>
<td></td>
</tr>
<tr>
<td>POINT</td>
<td>If cell pointer is anchored, pressing CLEAR removes highlighting and unanchors cell pointer.</td>
<td></td>
</tr>
<tr>
<td>MENU</td>
<td>Returns to previous menu or command step.</td>
<td></td>
</tr>
<tr>
<td>HELP</td>
<td>Leave help system and returns you to the prior screen in 1-2-3 where you were when you originally pressed HELP.</td>
<td></td>
</tr>
<tr>
<td>FILES</td>
<td>Erase default extension 1-2-3 (displays press HELP a second time unless displayed default drive and directory. Pressing CLEAR a third time returns you to previous menu.</td>
<td></td>
</tr>
<tr>
<td>EDIT, VALUE, and LABEL</td>
<td>Cancel current entry.</td>
<td></td>
</tr>
<tr>
<td>ESC</td>
<td>Clean error message from screen.</td>
<td></td>
</tr>
<tr>
<td>EDIT</td>
<td>Switches between inserting new text (to left of cursor) and editing over existing text.</td>
<td></td>
</tr>
<tr>
<td>READY</td>
<td>Displays 1-2-3 main menu.</td>
<td></td>
</tr>
<tr>
<td>POINT</td>
<td>If cell pointer is unanchored, pressing CLEAR (period) anchors cell pointer. If cell pointer is already anchored, pressing CLEAR changes position of free cell in highlighted range.</td>
<td></td>
</tr>
<tr>
<td>OPTION</td>
<td>Switches pointer-movement keys between moving cell pointer and scrolling entire spreadsheet.</td>
<td></td>
</tr>
</tbody>
</table>

When used in combination with another key on a compatible Subset of keyboard, produces upper-case symbol on 1-2-3.
<table>
<thead>
<tr>
<th>Name</th>
<th>Mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>__</td>
<td>READY</td>
<td>Displays 1-2-3 main menu.</td>
</tr>
<tr>
<td>__</td>
<td>LABEL,</td>
<td>Inserts a space in an entry.</td>
</tr>
<tr>
<td>__</td>
<td>VALUE,</td>
<td></td>
</tr>
<tr>
<td>__</td>
<td>EDIT</td>
<td></td>
</tr>
<tr>
<td>__</td>
<td>MENU</td>
<td>Moves menu pointer right one item. If menu pointer is highlighting last item in a menu, pressing __ moves menu pointer to first item.</td>
</tr>
</tbody>
</table>

**Using 1-2-3 Menus**

To tell 1-2-3 what you want to do, select a series of commands from menus. You can select commands by highlighting or by typing.

**Selecting a Command by Highlighting**

When you press / (MENU) to display the 1-2-3 main menu, a rectangular highlight called the menu pointer appears in the second line of the control pane. You can select a command by moving the menu pointer to the command you want (highlighting it) and then pressing ENTER.

- Press __. (The 1-2-3 main menu appears.)
- Use any of the following keys to move the menu pointer to the command you want to select:
  - Moves the menu pointer left one item. If menu pointer is highlighting the first command in the menu, moves it to the last command in the menu.
  - Moves the menu pointer right one item. If menu pointer is highlighting the last command in the menu, moves it to the first command in the menu.
  - Moves the menu pointer to the first command in the menu.
  - Moves the menu pointer to the last command in the menu.

Using 1-2-3  2-17
3. Press **ENTER** to select the highlighted command. (1-2-3 may then require you to select a command from a submenu or respond to a prompt.)

**Selecting a Command by Typing**

Selecting a command by typing is faster than the highlighting method. You will find this method useful once you are familiar with the 1-2-3 menus.

1. Press **MENU**. (The 1-2-3 main menu appears.)
2. Type the first letter (uppercase or lowercase) or character of the command you want to select. (To complete the command, 1-2-3 may require that you select a command from a submenu or respond to a prompt.)

**Canceling a Command**

When selecting commands, if you change your mind or realize that you have made a mistake, press **ESC** to back up one menu level or command step at a time.

If you want to completely stop a procedure and return to READV mode, press **CTRL BREAK**.

**Responding to Prompts**

Often when you select a command, 1-2-3 requires you to supply more information—through additional menu choices or prompts. You may enter specific information in the second line of the control panel in several ways:

- If 1-2-3 displays a menu of names (for example, when you select /File Retrieve), move the menu pointer to the name you want to select (or type your selection) and press **ENTER**.
- If 1-2-3 suggests a response to the prompt (for example, when you select /File Save), press **ENTER** to accept the suggested response. Alternatively, type a new response and press **ENTER**. (You may, however, need to press **ESC** one or more times to clear the suggested response before you can type a new one.)

2-18 Using 1-2-3
If 1-2-3 does not display a menu or suggest a response (for example, when you select /Print Printer Options Reader), type the necessary information and press ENTER.

If 1-2-3 displays a prompt asking you to enter a range (for example, when you select /Copy), specify a range using one of the methods described in "Specifying a Range" later in this chapter.

Settings Sheets

Some 1-2-3 commands, such as /Graph, require you to select lower-level commands to specify a number of settings. In such cases, 1-2-3 displays a settings sheet.

A settings sheet is a status screen that shows you the current settings for all the options associated with a task. You cannot directly change settings in the settings sheet. You must change settings by selecting the appropriate commands from the menu that appears above the settings sheet.

For instance, you might want to create a bar graph with labels along the axes, titles, a legend, grid lines, and more. You specify each one of these settings by selecting a separate command from the /Graph menu. As you do this, your selections (or changes) appear in the graph settings sheet immediately.
Entering and Editing Data

When you enter data in a cell, 1-2-3 classifies every entry as one of two types: labels or values. Labels are text entries. Values are number and formula entries.

To enter data in a cell, follow this procedure:

1. Move the cell pointer to the cell in which you want to enter data.
2. Type the data you want to enter in the cell, up to 240 characters.
3. Do one of the following:
   - Press (ENTER) to complete the entry (the cell pointer remains in the same cell).
   - Press one of the pointer-movement keys to simultaneously complete the entry and move the cell pointer. The cell pointer moves to another cell, just as it does when you use the pointer-movement key in READY mode.
   - Press (ESC) if you want to cancel the entry.

When you start typing an entry, 1-2-3 determines whether the entry is a label or value based on the first character you type and changes the mode indicator to LABEL or VALUE accordingly. For example, if the first character you type is a letter, one of the label prefixes """, "", \, or }, or a special character such as { } k l or @, 1-2-3 displays LABEL in the mode indicator. If the first character is a number (0 through 9) or one of the numeric symbols + - @ . ( # or $, 1-2-3 changes the mode indicator to VALUE.

As you type an entry, 1-2-3 displays the characters in the second line of the control panel. When you press (ENTER) or one of the pointer-movement keys to complete the entry, 1-2-3 checks the data before entering it in the worksheet to make sure you typed a valid label or value.

If the entry is valid, 1-2-3 enters the data in the current cell. If the entry is not valid, 1-2-3 switches to EDIT mode and displays the data in the second line of the control panel for editing. For information on editing data, see "Editing an Entry" later in this section.
Labels

A label is a text entry. It can include any combination of characters in the Lotus International Character Set (LICS), including numbers and numeric symbols. For example, Caroline Wilson, 1620 Hill Road, 606-999-0001, and $19,803 can all be entered as labels.

Use the following guidelines when entering labels:

- To create a label that begins with a number (0 through 9) or one of the numeric symbols +, –, %, or $, precede the entry with one of the label prefixes described in the next section, "Label Prefixes."

  For example, to enter the label 1620 Hill Road, you must type a label prefix before typing the actual entry. Otherwise, 1-2-3 assumes you are entering a value (the mode indicator displays VALUE).

- Even if an entry does not begin with a number or numeric symbol, you may want to precede the entry with a label prefix to change the way 1-2-3 positions the label in the cell or to control whether 1-2-3 prints the label.

  For example, to center the label Wilson in the cell, you must type the label prefix \ before typing the actual entry, or 1-2-3 will automatically use the default (left justified). 1-2-3 does not display the label prefix in the cell but does display it in the control panel when you highlight that cell.

- The entry cannot be longer than 240 characters.

Label Prefixes

Besides allowing you to enter labels that 1-2-3 would usually recognize as values, label prefixes also allow you to control the way 1-2-3 aligns labels in cells and to control whether or not 1-2-3 prints a label. Each label prefix produces a different result.

The following table lists the label prefixes and their effects on labels.

<table>
<thead>
<tr>
<th>Prefix Key</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>\</td>
<td>Aligns the label with the left edge of the cell (default alignment for labels).</td>
</tr>
<tr>
<td>`</td>
<td>Aligns the label with the right edge of the cell.</td>
</tr>
<tr>
<td>#</td>
<td>Centers the label in the cell.</td>
</tr>
<tr>
<td>%</td>
<td>Repeats the characters in the label to fill the cell.</td>
</tr>
</tbody>
</table>

Using 1-2-3 2-21
The split vertical bar (|) is also a label prefix. It is used primarily for embedded setup strings and /Data Parse format lines (see Chapter 5). If used as a label prefix for a label that is located at the beginning of a row of data, the | tells 1-2-3 not to print the row. If, however, the label is located elsewhere in a row (such as between other labels), the label will be left-aligned and will print.

**Long Labels**

When a label is longer than the cell’s column width, it is called a long label and 1-2-3 displays as much of the label as it can.

- If cells to the right of the label are blank, 1-2-3 displays the part of the label that overlaps those cells.
- If cells to the right of the label contain data, 1-2-3 does not display the overlapping part of the label.

**Values**

A value is an entry that begins with a number (0 through 9) or one of the numeric symbols + – @. ( # or $). The entry can be a number or a formula.

**Numbers**

You can enter any number from \(10^{-99}\) to \(10^{99}\). The number of significant digits 1-2-3 displays in a cell depends on the cell format, column width, and the magnitude of the number. If you enter a number with more digits than 1-2-3 can display, 1-2-3 rounds the number.

Use the following guidelines when entering numbers:

- Begin the entry with a number (0 through 9) or one of the numeric symbols + – @. ( # or $).

  If you begin a number with a $, 1-2-3 enters the number but does not display the $. You must change the format of the cell to include a currency symbol. See “Displaying Values in the Worksheet” later in this chapter.

- Do not include spaces or commas in the entry. (Later you can change the format of the cell to include commas. See “Displaying Values in the Worksheet” later in this chapter.)

- Do not type more than one decimal point.

2-22 Using 1-2-3
The entry cannot be longer than 240 characters.

It is possible to enter numbers in scientific notation. For example, to enter 60000000000000000000000 you can type 6.022303. The correct format for entering a number in scientific notation is to type a positive or negative number followed by m, e or E, and an exponent from -99 to 99.

Formulas

A formula is an entry that performs a calculation. You can enter several types of formulas in 1-2-3: numeric formula, string formula, and logical formula. These types of formulas and methods for entering formulas are described in detail in "Working with Formulas" later in this chapter.

The number of decimal places 1-2-3 displays for a calculated value depends on the cell format. Regardless of how many decimal places 1-2-3 displays for the value, 1-2-3 calculates the value to a precision of 15 decimal places (unless you use @ROUND to specify a different precision). For more information, see @ROUND in chapter 14.

Displaying Values in the Worksheet

1-2-3 always right aligns numeric values in cells. Unlike labels, you cannot change their alignment. You can, however, control the way 1-2-3 displays values by setting the cell format with /Worksheet Global Format or /Range Format. For example, 1-2-3 can display the value 2.47 as $2, 2.47, 247%, or 2.47E+00, depending on the cell format you specify. We've listed various format possibilities below:

- 2.47: General
- 2: Fixed, 0 decimal places
- 2.47: Fixed, 2 decimal places
- 2.470: Fixed, 3 decimal places
- 2: Currency, 0 decimal places
- $2.47: Currency, 2 decimal places
- 247%: Percent, 0 decimal places
- 247.00%: Percent, 2 decimal places
- 2E+00: Scientific, 0 decimal places
- 2.47E+00: Scientific, 2 decimal places

For details on formatting values and cell format choices see /Range Format in chapter 11 or /Worksheet Global Format in chapter 13.

Using 1-2-3 2-23
Long Values

A **long value** is a displayed value that is wider than the cell's column width minus 1. For example, in a cell with a column width of 9 that has been formatted as **Currency with 2 decimal places**, 1990 is a long value because it contains nine characters ($1,990.00).

1-2-3 treats long values differently from the way it treats long labels. Unlike long labels, 1-2-3 does not overlap long values into adjacent blank cells, nor does it display only a part of the value when adjacent cells contain data. Instead, 1-2-3 handles long values as follows:

- If the cell in which you enter a long value is formatted as General and the integer part of the value exceeds the cell's column width, 1-2-3 displays the value in scientific notation. For example, in a nine-character wide cell, the value 123456789.99 appears as 1.2E+09.
- If the cell is formatted as anything other than General or is not wide enough to display the value in scientific notation, 1-2-3 displays asterisks across the cell instead of the value. To display the value, widen the column with **Worksheet Column Set-Width** or **Worksheet Global Column-Width** (chapter 13).

Entering Dates

Entering a date in 1-2-3 requires two steps:

- Entering a date number (a value that corresponds to the date).
- Assigning the cell a date format.

1-2-3 assigns an integer to each of the 73,050 days from January 1, 1900 to December 31, 2099, inclusive. These integers (1 through 73050, consecutively) are called date numbers. For example, the integer 5 corresponds to January 5, 1990; the integer 54235 corresponds to September 23, 1990.

You can enter a date number using a date function, which calculates the date number for a date you specify as the argument for the function. For example, to enter the date number for September 23, 1993, you could enter **@DATE(93,9,23)** in the worksheet. 1-2-3 calculates the date number automatically, in this case, 54235. For information on date functions, see "Date and Time Functions" in chapter 14.
To display the date rather than the date number, use /Range Format Date to change the cell's format to one of the five date formats. For example, if you format the cell as Date 1, 1-2-3 displays the date number 34235 as 23-Sep-93. Or, if you format the cell as Date 3, 1-2-3 displays Sep-93.

The advantage of using a date function to enter a date is that you can change the format in which the date is displayed at any time, and you can use date arithmetic to calculate differences between dates.

**Entering Times**

Entering a time in 1-2-3 requires two steps:

- Entering a time number (a value that corresponds to the time).
- Assigning the cell a time format.

1-2-3 assigns a decimal number to each second from midnight
00:00:00 AM inclusive. These decimal numbers are called time
numbers. For example, the decimal number .5 corresponds to 12:00:00
PM (noon); the decimal number .999035 corresponds to 11:59:00
PM. You can enter a time number using a time function (which
calculates the time number for a time you specify as the argument
for the function). For example, to enter the time number for
11:59 PM, enter @TIME(23,59,0) in the worksheet. 1-2-3 calculates the
time number automatically, in this case, .999035. For information on date
functions, see "Date and Time @Functions" in chapter 14.

To display the time rather than the time number, use /Range Format Date Time to change the cell's format to one of the four time formats. For example, if you format the cell as Time 1, 1-2-3 displays the time number .999035 as 11:59:00 PM. Or, if you format the cell as Time 2, 1-2-3 displays 23:59:00.

**Editing an Entry**

Editing an entry means altering existing data rather than replacing it
with entirely new data. You can edit an entry either as you type it or
after you have entered it in a cell.

**Editing As You Type**

You can edit an entry in three ways as you type it:

**Using 1-2-3 2-25**
To erase characters to the left of the cursor, press \( \text{DEL} \).

To erase everything you typed and start again, press \( \text{ESC} \).

To change part of what you typed, press \( \text{EDIT} \) to enter EDIT mode and use the editing keys in the table that follows.

**Editing a Completed Entry**

- Move the cell pointer to the cell and press \( \text{EDIT} \).
- Use the editing keys to change the entry, and then press \( \text{ENTER} \), \( \text{PG UP} \), or \( \text{PG DN} \) to save the changes.

The table below lists the keys you can use in EDIT mode.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{DEL} )</td>
<td>Moves cursor right one character.</td>
</tr>
<tr>
<td>( \text{BACK} )</td>
<td>Moves cursor left one character.</td>
</tr>
<tr>
<td>( \text{UP} )</td>
<td>Completes editing and moves cell pointer up one row.</td>
</tr>
<tr>
<td>( \text{DOWN} )</td>
<td>Completes editing and moves cell pointer down one row.</td>
</tr>
<tr>
<td>( \text{TAB} )</td>
<td>Erases character to left of cursor.</td>
</tr>
<tr>
<td>( \text{TAB} )</td>
<td>Moves cursor right five characters.</td>
</tr>
<tr>
<td>( \text{DEL} )</td>
<td>Moves cursor left five characters.</td>
</tr>
<tr>
<td>( \text{DEL} )</td>
<td>Erases current character.</td>
</tr>
<tr>
<td>( \text{DEL} )</td>
<td>Moves to last character in entry.</td>
</tr>
<tr>
<td>( \text{DEL} )</td>
<td>Completes editing.</td>
</tr>
<tr>
<td>( \text{DEL} )</td>
<td>Erases all characters in entry.</td>
</tr>
<tr>
<td>( \text{INS} )</td>
<td>Moves to first character in entry.</td>
</tr>
<tr>
<td>( \text{INS} )</td>
<td>Switches between inserting text (INS mode), and writing over existing text (OVR mode).</td>
</tr>
<tr>
<td>( \text{PG UP} )</td>
<td>Completes editing and moves cell pointer up one screen.</td>
</tr>
<tr>
<td>( \text{PG DN} )</td>
<td>Completes editing and moves cell pointer down one screen.</td>
</tr>
</tbody>
</table>
Working with Ranges

A range is a rectangular block of adjacent cells. It can be a single cell, a row, a column, or several rows and columns, as long as all the cells are adjacent to one another.

Use ranges to perform operations on more than one cell at the same time. To use a range in a command or formula, you need to specify the range.

Specifying a Range

You can specify a range in three ways: type the range address, use a range name, or highlight the range.

Typing a Range Address

A range address consists of the cell addresses of the two most distant cells in the range, separated by one or two periods. This address tells 1-2-3 where the range begins and ends and follows these guidelines:

- If a range is a group of adjoining cells in a single column or row, the range address consists of the cell addresses of the two opposite ends of the range, for example, B3.B9 or A1.D1.
- If a range is a group of adjoining cells that spans several columns or rows, the range address consists of the cell addresses of two diagonally opposite corners of the range. For example, to specify the range whose corner cells are B5, D10, D3, and D9, you could type B5.D9, B9.D3, D9.B3, or D3.B9 and then press Enter.
- If a range is a single cell, the range address consists of that cell address as both the starting and ending point of the range. To specify a single cell range, however, you only need to type the cell address once. For example, to specify the range B3.B3, you could type B3 and press Enter.

You can use either uppercase or lowercase letters when typing the range address, but after you type the range address 1-2-3 always displays it in uppercase letters. Also (unless it’s a formula), regardless of which set of corner cells you use and whether you type one or two periods, 1-2-3 displays the range address as the upper left and lower right corner cells of the range, separated by two periods.
Using a Range Name

/Range Name Create and /Range Name Labels assign a name to a specified range. You can use range names in place of range addresses in commands and formulas. For example, if you want to move the data in A54..B88 and you have assigned the name SALES to that range, you can specify SALES instead of A54..B88 as the range to move. You can also use SALES in any function that takes a range name or address as an argument; for example, to calculate the sales total, you can use =SUM(SALES).

Whenever a command prompts you for a range, you can specify a range name by typing the range name and pressing ENTER. Alternatively, you can press NAME (F3) to display a menu of range names that exist in the current worksheet, and then select a range name by highlighting it and pressing ENTER.

Highlighting a Range

When 1-2-3 is in POINT mode, you can specify a range by highlighting it. To highlight a range, you must first anchor the cell pointer by moving it to a corner cell in the range and pressing (period). This cell is now the anchor cell.

Some commands that prompt you for ranges (such as /Copy, /Move, and /Range Format) automatically anchor the cell pointer in the current cell. When 1-2-3 asks you to specify a range, you can tell if the cell pointer is anchored by looking at the prompt in the control panel. A single cell address (such as B3) means the cell pointer is not anchored, while a range address (B3..B3) means it is anchored.

If 1-2-3 automatically anchors the cell pointer and you want to highlight a range that starts somewhere else, press ESC to unanchor the cell pointer, move the cell pointer to the appropriate cell, and press (to make it the anchor cell).

Once a corner of the range you want to highlight is anchored, use the pointer-movement keys to expand the highlight until it covers the range. As you expand the highlight, 1-2-3 displays the address of the highlighted area in the control panel. When you have highlighted the entire range, press (ENTER) to complete the range specification.
If you change your mind and want to highlight a different range, press \( \text{Esc} \) to remove highlighting from the range, unanchor the cell pointer, and return the cell pointer to wherever it was before 1-2-3 entered POINT mode; or, press \( \text{Esc} \) to remove highlighting and unanchor the cell pointer without moving it.

The following table lists the keys you can use to highlight a range when 1-2-3 is in POINT mode:

<table>
<thead>
<tr>
<th>Key</th>
<th>Unanchored Range</th>
<th>Anchored Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Makes current cell the anchor cell.</td>
<td>Moves anchor cell clockwise from one corner of highlighted range to next.</td>
</tr>
<tr>
<td>0</td>
<td>Returns cell pointer to wherever it was before 1-2-3 entered POINT mode.</td>
<td>Removes highlighting, unanchors cell pointer, and returns cell pointer to wherever it was before 1-2-3 entered POINT mode.</td>
</tr>
<tr>
<td>( \text{Esc} )</td>
<td>If you are using a command, returns you to previous menu or prompt; if you are entering a formula, returns 1-2-3 to EDIT mode.</td>
<td>Removes highlighting and unanchors cell pointer.</td>
</tr>
</tbody>
</table>

**Remembered Ranges**

With some commands, such as /Print [Printer or File] Range and /Data Fill, 1-2-3 “remembers” the most recent range you specified. The next time you select the same command, 1-2-3 automatically highlights the range you last specified and displays its address in the control panel. Press \( \text{Enter} \) to accept that range, or press \( \text{Esc} \) or 0 to clear the remembered range and specify a different range using one of the three ways previously described.
Working with Formulas

A formula is an entry that performs a calculation using numbers, other formulas, or strings. The calculation can be a simple mathematical operation, such as subtracting one number from another, or a more complicated operation, such as determining the net present value of a series of future cash flows.

When you enter a formula, 1-2-3 displays the value that results from the calculation in the cell. For example, if you enter the formula 25+5, 1-2-3 displays the value 30 in the cell. When the cell pointer is in the cell, however, 1-2-3 displays 25+5 in the first line of the control panel. (To display formulas in cells instead of their results, use /Range Format Text or /Worksheet Global Format Text.)

You can use range addresses and range names in formulas to include worksheet data in your calculations. When you create a formula this way, 1-2-3 automatically changes the value of the formula if you change any value in the referenced cells. For example, suppose you enter the formula A2+B2+C2 in cell C4. When A2 and B2 contain the values 15 and 5, the formula results in the value 30. 1-2-3 automatically changes the result of the formula, however, if you change the entry in either B2 or C2. For more information, see "Using Cell and Range References in Formulas" later in this section.

Types of Formulas

1-2-3 lets you enter three types of formulas: numeric, string, and logical. You can also enter @functions, which are built-in formulas in 1-2-3 that perform numeric, string, or logical calculations. For a complete description of the 1-2-3 @functions, see chapter 14.

- **Numeric formulas** calculate numeric values using one or more of the arithmetic operators (+ - * / and ^) and/or @functions. 1-2-3 can calculate any numeric formula whose value is between 10^-308 and 10^308, but the value must be between 10^-99 and 10^99 for 1-2-3 to display it in the worksheet. When a formula's value is less than 10^-99 or greater than 10^99, 1-2-3 displays asterisks across the cell that contains the formula.

The formula 2*A16 calculates a numeric value by multiplying the value in cell A16 by 2.

2-30 Using 1-2-3
The formula @SUM(B16..B32)/2 calculates a numeric value by dividing the sum of the values in B16..B32 by 2.

- **String formulas** calculate string values, using the string operator ampersand (&) and/or @functions.

  If D4 contains the label Robinson, the formula ="Dear Mr. and Mrs. "&D4 produces the string value *Dear Mr. and Mrs. Robinson* by concatenating the text in quotation marks (called a literal string) with the content of D4.

  If F16 contains the label *1989 NET PROFITS*, the formula =LOWER(F16) returns the string value *1989 net profits* by converting the content of F16 to lowercase.

- **Logical formulas** are statements that return either 1 (the statement is true) or 0 (the statement is false). Logical formulas use the logical operators = < > <= >= <> #AND# #OR# and #NOT#. And/or @functions.

  The formula =A12>=500 returns 1 (true) if cell A12 contains a value greater than or equal to 500; otherwise, the formula returns 0 (false).

  The formula =ISSTRING(J26) returns 1 if cell J26 contains a string value; otherwise, the formula returns 0.

### Entering Formulas

Use the following guidelines when entering a formula:

- A formula can begin with a number or one of the numeric symbols + − * / % or $. In addition, the # symbol can be used to begin a logical formula.

- When the first element in a formula is a cell address, range name, or file reference, begin the formula with $ or $. For example, +B7/B8, =$B$6, $B$SALES/17, (SALES-EXPENSES), and +<<BUDGET:WK1>>B7 are all valid formulas.

- When a string formula starts with a literal string, begin the formula with + or (For example, +"Ms. "&LAST and ("Ms. "&LAST) are both valid formulas.

- A formula cannot contain spaces except within literal strings in string formulas (as shown in the previous item).

- A formula can contain up to 240 characters.
You can use the following types of data in a formula:

- **Numbers** (for example 450, -92, 7.1E12, date numbers, and time numbers).
- **Literal strings** (for example, `Budget for or TOTAL`).
- **@Functions** (for example, `@SUM(A1..A8)`).
- **Cell and range addresses** (for example, B12, FF23..FH33).
- **Range names** (for example, `JANSALES`, `BUDGET`).

### Order of Precedence

The following table shows the arithmetic, string, and logical operators you can use in formulas and their order of precedence. Precedence numbers represent the order in which 1-2-3 performs operations in a formula. The lower the precedence number, the earlier 1-2-3 performs the operation. Operations with the same precedence number are performed sequentially from left to right.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Operation</th>
<th>Precedence Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>- or +</td>
<td>Exponentiation</td>
<td>1</td>
</tr>
<tr>
<td>* or /</td>
<td>Identification of value as negative or positive</td>
<td>2</td>
</tr>
<tr>
<td>+ or -</td>
<td>Multiplication or division</td>
<td>3</td>
</tr>
<tr>
<td>= or &lt;&gt;</td>
<td>Addition or subtraction</td>
<td>4</td>
</tr>
<tr>
<td>&lt; or &gt;</td>
<td>Equal-to or not-equal-to tests</td>
<td>5</td>
</tr>
<tr>
<td>&lt;= or &gt;=</td>
<td>Less-than or greater-than tests</td>
<td>5</td>
</tr>
<tr>
<td>&gt; or =</td>
<td>Less-than-or-equal-to test</td>
<td>5</td>
</tr>
<tr>
<td>#NOT#</td>
<td>Greater-than-or-equal-to test</td>
<td>5</td>
</tr>
<tr>
<td>#AND#</td>
<td>Logical-NOT test</td>
<td>6</td>
</tr>
<tr>
<td>#OR#</td>
<td>Logical-AND or logical-OR tests</td>
<td>6</td>
</tr>
<tr>
<td>&amp;</td>
<td>String concatenation</td>
<td>7</td>
</tr>
</tbody>
</table>

2-32 Using 1-2-3
You can override the order of precedence by enclosing an operation in parentheses. 1-2-3 performs operations inside parentheses first. Within each set of parentheses, precedence numbers apply. You can nest one set of parentheses inside another set and create as many nesting levels as you want.

**Using Cell and Range References in Formulas**

The primary reason for using formulas in 1-2-3 is to perform calculations with worksheet data. Use either of the following methods to include a cell or range reference in a formula:

- Type the cell address, range address, or range name in the formula.

  For example, to add the values in cells B2 and C1, you can enter `B1+C1` or `SUM(B1..C1)`. If B1 and C1 have the range names `INSTOCK` and `ONORDER`, you can also enter `+ INSTOCK + ONORDER`.

  If the cell you are referencing is in another file, precede the cell’s address or range name with a file reference (see "Linking Files" later in this chapter). For example, to create a formula in the current worksheet that uses the value in D25 in a worksheet named `BALANCES.WK1`, you enter `= <B25 @ BALANCES > W K1 > D25`.

- Highlight the cell or range while typing the formula.

  After typing `+ - / *` in a formula, you can press `&/\()` to enter POINT mode. Highlight the cell or range you want to include in the formula and type the next operator (or press `ENTER` to complete the formula). The cell pointer returns to the cell in which you are entering the formula.

  To enter the formula `+B3+D3` in J22, you would move the cell pointer to J22, type `, press `&/\(` to enter POINT mode, move the cell pointer to B3, type `+`, press `&/\(` to enter POINT mode, move the cell pointer to D3, and press `ENTER` to complete the formula. 1-2-3 automatically returns the cell pointer to J22.

  To create the formula `@SUM(B3..D3)`, you would type `&/\()` and then press `&/\()` to enter POINT mode, move the cell pointer to B3, type `, to anchor the cell pointer, highlight the range B3..D3, type `)`, and press `ENTER` to complete the formula.

Using 1-2-3 2-33
If the specified cell or range in a formula has a range name, 1-2-3 automatically substitutes the name for the address in the formula. If the specified cell or range has more than one range name, 1-2-3 displays the range name that is alphabetically first.

You can use three types of cell and range references in a formula: relative, absolute, and mixed. The type of reference you use determines what happens when you copy the formula with /Copy. Each type of reference is described in the following sections.

Relative References

A relative reference is a cell or range reference that 1-2-3 interprets as a location relative to the current cell. The reference can be an address or range name. To create a relative reference in a formula, simply type the address or range name, such as B1, D25, D30, or PROFITS.

When you use a relative reference in a formula, 1-2-3 uses the reference to determine the position of the specified cell or range relative to the cell that contains the formula. For example, when you enter the formula =B1+B2 in cell B4, 1-2-3 interprets the formula as "add the contents of the cell three rows above to the contents of the cell two rows above."

If you copy the formula =B1+B2 from B4 to C4, 1-2-3 still interprets the formula as "add the contents of the cell three rows above to the contents of the cell two rows above." Therefore, 1-2-3 adjusts the relative cell references so the formula becomes =C1+C2.

Absolute References

Sometimes when you copy a formula, you want 1-2-3 to keep the original cell or range reference in the copied formula. To keep the original cell or range reference in a formula, regardless of where that formula is copied, you use an absolute reference.

An absolute reference can be an address or range name. To create an absolute address, type a $ in front of both the column letter and row number of the address (for example, $F$2 or $A$95..$B$10). To create an absolute range name, type a $ in front of the range name (BDATE).
Cell F2 contains the interest rate and cells D5-D8 contain the principal values. To perform the calculations, you enter the formula =D5*$F$2 (to multiply the value in D6 by the interest rate in F2) in F5, and then copy that formula to cells F6-F8. When you copy the formula from F5 to cells F6-F8, 1-2-3 keeps the F2 reference in each formula because it is an absolute reference. It does, however, change the D5 reference to D6, D7, and D8, respectively, because D5 is a relative reference.

**Mixed References**

Sometimes when you copy a formula that references a cell, you want part of the cell address to stay the same in the copied formula and part of the address to change. For example, you may want the column letter to stay the same and the row number to change. You do this by using a mixed cell address in the formula.

Mixed references can be created only with addresses, not with range names. To create a mixed reference, precede the absolute part of the address (the column letter or the row number) with a $ (for example, $C1 or C$4).
The table (B7..E10) in our next illustration calculates a series of interest amounts depending on the principal value and interest rate. To create the table, enter in cell B7 a formula containing two mixed references: =A1*$B$5. $A7$ refers to the principal value for the calculations in row 7 ($1,000). When you copy the formula from B7 to the rest of the table, column letter A remains the same (all principal values are in column A), but the row number for the principal value changes depending on which row the formula is in.

Original formula

Copied formula

$B$5 refers to the interest rate for the calculations in column B (14.0%). When you copy the formula from B7 to the rest of the table, the column letter changes, but row number 5 remains the same (all interest rates are in row 5).

Using ABS and to Change Reference Types

When entering or editing a formula, press <INS> when the cursor is on or immediately to the right of a cell address or range address. 1-2-3 cycles the address through the different reference types—in the same order, regardless of whether the original address type is relative, absolute, or mixed.

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The following table shows how pressing \( \texttt{ABS} \) changes the address \( C5 \) after you type \( +C5 \).

<table>
<thead>
<tr>
<th>Control panel display</th>
<th>Press ( \texttt{ABS} ) to get</th>
</tr>
</thead>
<tbody>
<tr>
<td>(+C5)</td>
<td>$C5 \ (absolute address)</td>
</tr>
<tr>
<td>(+SC5)</td>
<td>$C5 \ (mixed address with absolute row reference)</td>
</tr>
<tr>
<td>(+CS1)</td>
<td>$C5 \ (mixed address with absolute column reference)</td>
</tr>
<tr>
<td>(+S)</td>
<td>$C5 \ (relative address)</td>
</tr>
</tbody>
</table>

A range name is a relative reference unless you type a \$ in front of the name. For example, if you are using the range name \( \texttt{SALES} \) in a formula and you want it to be an absolute reference, type \( \$S\texttt{ALES} \). You cannot create a mixed reference with a range name.

---

**Working with Files**

To keep a permanent record of the work you do during a 1-2-3 session, you must save your worksheet. You can save your file on the built-in RAM, on a plug-in card, or on a peripheral.

Unless you save a worksheet in a file, your work is preserved only as long as the worksheet remains in memory. (If you select /Quit and have not saved the worksheet in a file, 1-2-3 will ask you if you want to do so before you end the session.)

Once you create a worksheet file (with /File Save or /File Extract), you can read the file (copy the file from disk into memory with /File Retrieve) at any time. When you do, 1-2-3 displays the file exactly as it was when you last saved it.

**Note**

You can easily transfer files between another computer and the HP 91 LX with the HP 1001A Connectivity Pack. For more information see chapter 20.

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Types of Files

In addition to creating worksheet files in 1-2-3, you can create text, graph, and backup worksheet files.

**Text or print files**, which you create with /Print File, store worksheet data in text or ASCII format. For details, see /Print File in chapter 9.

**Graph files**, which you create with /Graph Save, store 1-2-3 graphs in a picture format for use with other programs. For details, see /Graph Save in chapter 7.

**Backup files** store previous versions of worksheets. When you select /File Save or /File Xtract, specify the name of an existing worksheet file, and then select Backup from the menu 1-2-3 displays. 1-2-3 creates a backup file of the version of the worksheet stored on disk before writing over the existing worksheet (.WK1) file with your changes. For details, see /File Save or /File Xtract in chapter 8.

Specifying a File

When you use a 1-2-3 command that prompts you for a file name, 1-2-3 displays a list of files in the current directory (the directory specified with /File Directory or /Worksheet Global Default) that are of the appropriate type. For example, if you select /File Retrieve, 1-2-3 displays a menu of worksheet files in the current directory; or if you select /Graph Save, 1-2-3 displays a menu of graph files in the current directory. To see a full-screen menu of file names instead of just one line, press NAME (F3).

You can specify a file to use by highlighting the file name and pressing ENTER to select it or by typing a file name.

If you want to use a file in another directory, you need to specify a path. To specify a worksheet file named BOSTON that is stored on drive C in the subdirectory named 1989 in the directory named BUDGETS, type

```
C: \BUDGETS \1989 \BOSTON \1
```

For more information on how to specify paths, see the sections that follow.

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Path

The path supplies two pieces of information: the drive name and the directory name where the file is located.

The drive name tells 1-2-3 where the file is located. A drive name always consists of a letter followed by a colon, for example, A: or C:.

If the file is located on the current drive, you do not need to specify a drive name. For example, if drive C is the current drive, you can specify the file using the path \BUDGETS\1988-BOston\1K1.

Note

- Drive C: is the internal RAM disk
- Drive A: is the plug-in card.
- Drive B: refers to a peripheral.

The directory name tells 1-2-3 in which directory the file is located. If the file you are specifying is in a subdirectory (a directory included in another directory), the path will include more than one directory name. You must use a backward (\) to separate each directory name from the next. In addition, you must use a \ to separate the last directory name from the file name.

If the file is located in the current directory, you do not need to specify a directory name. For example, if \BUDGETS\ in the current directory but 1988 is not the current subdirectory, you can specify the file by typing 1988-\BOSTon\1K1.

File Name

Every file in a directory has a unique name, which you assign when you first create the file. It is a good idea to try to use file names that are descriptive so you can easily remember them.

- Use any combination of letters, numbers, underscores (-), and hyphens (-) in file names. Uppercase and lowercase letters are equivalent.
- Do not use more than eight characters in a name (1-2-3 ignores extra characters).
- Do not use the names AUX, CON, COM1, COM2, LPT1, NUL, or PRN. (These names are reserved by the system; see the MS-DOS reserved names table in appendix B.)
- Do not include spaces in a file name.
You can include extended Lotus International Character Set (LICS) characters in a file name. Be aware, however, that the codes for extended LICS characters are not the same as for extended code page 850 characters. For example, the LICS code for A in 218 and the code page 850 code for the same character is 132. File names containing extended LICS characters will be displayed differently by 1-2-3 and by your operating system. In addition, your operating system will convert file names to uppercase based on the extended code page 850 characters, not the extended LICS characters.

File Extension

A file extension is an optional suffix you can add to a file name. It consists of a period (.) followed by one to three characters. File extensions let you group files into categories by giving more information about what is in the file. If you do not provide your own extension, 1-2-3 automatically adds an extension to the file name, depending on the file type:

<table>
<thead>
<tr>
<th>File Type</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backup worksheet file</td>
<td>.BAK</td>
</tr>
<tr>
<td>Print or text file</td>
<td>.PRN</td>
</tr>
<tr>
<td>Graph file</td>
<td>.PIC</td>
</tr>
<tr>
<td>Worksheet file</td>
<td>.WK1</td>
</tr>
</tbody>
</table>

Using Wild Card Characters in File Names and Extensions

When 1-2-3 prompts you for a file name, you can display a menu of files with similar names or extensions by including wild card characters ('*' and '?') in your response to the prompt.

The asterisk (*) wild card character represents any number of consecutive characters in a file name or extension. For example, to have 1-2-3 list all files with the extension .WK5, you would type *.WK5 at the file name prompt and press ENTER. To have 1-2-3 list all files that begin with B and have the extension .W1, you would type B?.W1 at the file name prompt and press ENTER.
The question mark (?) wildcard character represents any single character in a file name or extension. For example, to have 1-2-3 list all worksheet files with names that begin with \textit{LOT}, have any single character in the next position, and have \textit{DEPT}, and have the default 1-2-3 Release 2.2 extension .WK1, you would type \texttt{LOT\*DEPT.\?\?K?} at the file name prompt and press [ENTER]. Some possible files listed could be \texttt{LOT1DEPT.WK1}, \texttt{LOTXDEPT.WK1}, and \texttt{LOTYDEPT.WK1}.

---

**Linking Files**

The 1-2-3 file linking feature allows you to use values from cells in other worksheets in the current worksheet (the worksheet file currently in memory). You create a link between two files by entering a linking formula in one file that refers to a cell in the other file. The file in which you enter the formula is called the target file because it receives the data. The file that the formula refers to is called the source file because it supplies the data.

Once the two files are linked, 1-2-3 copies the value of the cell in the source file (the source cell) to the cell in the target file (the target cell). The value of the target cell is automatically updated whenever you retrieve the target file (or select /File Admin Link-Refresh while you are working on the target file).

When you use /File Directory, 1-2-3 will update any linking formula in which the source file reference does not include a path.

File linking saves you the effort of manually updating every worksheet affected by a change in another worksheet. One of the most useful applications of file linking is the consolidation of data from a number of worksheets in a summary worksheet. The illustration below shows an example of how you can use file linking to consolidate data from different worksheet files.
The file ACMESUM.WK1 contains links to three cells (A4, B4, and C4) in the worksheet for each division: EAST.WK1, CENTRAL.WK1, and WEST.WK1. This results in a summary worksheet that contains nine links that consolidate the sales data for the different divisions.
If you change the data in any of the worksheets for the divisions, the values in AOMEKSUM.WK4 will be automatically updated the next time you retrieve the file or select /File Admin Link-Refresh.

You can also use the linking feature to create links to cells that depend on other linked cells. For example, suppose your company has three divisions and that each division has three operating subsidiaries. Right now each subsidiary maintains its own profit-and-loss statement. In addition to these profit-and-loss statements, however, you want each division to maintain a profit-and-loss statement (subconsolidations) and you want a consolidated company profit-and-loss statement. Note the following chart.
It is important to be aware that if the data you are linking to depends on other linked cells, you can get incorrect results unless you update the file in an "upward" order. That is, if you think of the linked files
being organized in a hierarchical structure like the one shown above, you must always start updating at the level where you are making changes and work to the top level. For example, if you want to change data in the Paris profit-and-loss statement, you must do the following to make sure the values in the consolidated company profit-and-loss statement are correct:

1. Use /File Retrieve to retrieve PARIS.WK1.
2. Make the necessary changes and then save the file under the same name using /File Save Replace.
3. Use /File Retrieve to retrieve DIV2.WK1 and save the file under the same name using /File Save Replace. (This updates the subconsolidation worksheet for Division 2.)
4. Use /File Retrieve to retrieve PSLSUM.WK1 and save the file under the same name using /File Save Replace.

This updates the consolidated company profit-and-loss statement.

Creating a Link

A link is crossed through the use of a linking formula, a formula that refers to a cell in another file. To create the linking formula, use the following format:

`<file reference>> cell reference`

The file and cell reference can be entered in either uppercase or lowercase letters, but 1-2-3 will always display them in all uppercase letters.

Follow these steps when entering the formula:

1. Move the cell pointer to the target cell.
2. Type `*` (plus) to begin the formula.
3. Enter a file reference enclosed in `<< >>` (double angle brackets).

A file reference must always include the name of the source file. In some cases it may also be necessary for you to supply other information:

- If the source file does not have the default file extension .WK1, you must include the appropriate file extension. (For example, if the source file is a 1-2-3 Release 1A worksheet named INKSALES.WK5, you would enter the file reference `<<INPSALES.WK5>>`.)
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4. If the source file is not in the default directory (the directory specified with /File Directory), you must include a directory name to tell 1-2-3 where to look for the file. For example, if the current directory is C:// and the file you want to link to, UKSALES.WK1, is stored in a directory named C://DATA, you could enter the file reference +("C:\123DATA\UKSALES")

5. If the source file is not in the default drive (the drive specified with /File Directory), you must include a drive name to tell 1-2-3 where to look for the file. For example, if the current drive is C: and the file you want to link to, UKSALES.WK1, is in the root directory on a RAM card in drive A, you could enter the file reference +("A:\UKSALES")

6. Enter a cell reference: either the address of the source cell or its range name.

7. If you enter a range address, 1-2-3 uses only the cell in the upper left corner of the range as the source cell. For example, if you enter the formula +("C:\123DATA\UKSALES">A16) 1-2-3 changes the formula to +("C:\123DATA\UKSALES">A16) when you press [ENTER].

8. If you enter a range name that represents a multiple cell range as the source file, 1-2-3 uses only the top cell in the upper left corner of the range as the source cell although it always displays the range name in the formula. For example, if you enter the formula +("UKSALES">A24:B24) and QTR1 defines the range A24:B24 in the source file, 1-2-3 uses only A24 as the source cell.

5. Press [ENTER] to complete the formula. When you press [ENTER] to complete the linking formula, 1-2-3 checks to make sure the source file you referenced exists. If any of the following conditions exist, 1-2-3 displays an error message and will not enter the formula in the worksheet:

- The source file and/or directory do not exist.
- The specified drive is not ready.
- The specified range name does not exist, the source file.
- The source file is a password protected worksheet.
- The data in the file cannot be read by 1-2-3.

If 1-2-3 is able to locate the source file and cell, it copies the value of that cell into the target cell.

6. In order to make a link permanent, use /File Save to save the worksheet.
Restrictions for Linking Files

You should be aware of the following restrictions before you try to link files:

- 1-2-3 expects the source file you reference in a linking formula to have a specific internal file format and order. If you are trying to reference a file created with another program and the file will not link correctly, retrieve the file in 1-2-3 (/File Retrieve) and then use /File Save to save the file in the proper file format.
- You cannot include a linking formula in another formula.
- If the source cell contains a formula, 1-2-3 copies the value of the formula to the target cell rather than the formula itself.
- If you did not include a path as part of the file reference and the source file is no longer in the default directory (for example, if you used /File Directory or /Worksheet Global Default Directory to change the default directory), 1-2-3 displays ERR in the target cell.
- If you erase or rename the source file referenced in a linking formula, 1-2-3 displays ERR in the target cell the next time you retrieve the target file.
- If you delete or reset a range name referenced in a linking formula, 1-2-3 displays ERR in the target cell the next time you retrieve the target file.
- If you reference a cell address in a linking formula, and you subsequently move the source cell to a different location in the source file, 1-2-3 does not adjust the linking formula. For example, if you enter the formula =<<<<BALANCE, INCOME>>>C15 and then move the data in C15 to J6, when you retrieve the target file, 1-2-3 will display the value of C15 and not J6.

(For this reason, it is good practice to use Range Name Create to name the source cell and then use that range name as the cell reference in the linking formula. This will maintain the correct link if you move the source cell.)
- If you enter a linking formula in a cell and later enter the identical linking formula in another cell, 1-2-3 displays the value of the first formula rather than retrieving the current value of the source cell. For example, if you enter the formula =<<<<TOTAL SALES, INCOME>>>A5 in cell A5 and later enter =<<<<TOTAL SALES, INCOME>>>A5 in cell J50, 1-2-3 displays the value of A5 in J50. If you select /File Admin Link-Refresh, 1-2-3 will update both formulas with the value of the source cell.

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Tips for Linking Files

The following tips provide additional information to help you link files:

- The linking formulas you enter in a Release 2.2 worksheet can refer to source cells in 1-2-3 Release 1.0 or 2.01 worksheet files (.WK1 files), 1-2-3 Release 1A worksheet files (.WKS files), or Symphony Release 1.1, 1.2, or 2.0 worksheet files (.WK1 and .WK2 files). Just include the appropriate file reference and cell reference in the linking formula. For example, the formula =C1+CO2 [A9, WKS]@B15 refers to cell B15 in a 1-2-3 Release 1A file.
- You can use absolute, relative, and mixed reference cell references in a linking formula (see "Using Cell and Range References in Formulas" earlier in this chapter). If you copy the linking formula to another location in the target file, 1-2-3 will adjust cell references in the copied formulas properly.
- If you have a large number of links in a worksheet, it may take a little longer than usual to retrieve the file because 1-2-3 must update each link.
- A linking formula uses 32 bytes of memory. If the source cell referenced in a linking formula contains a numeric value, no additional memory is used. If the source cell contains a label or string formula, 1-2-3 uses 25 bytes of memory for the link, the number of bytes (characters) in the label or string, plus 1 byte. In addition, each unique range name included in a linking formula uses 16 bytes of memory, the number of bytes (characters) in the range name, plus one byte.
- If 1-2-3 runs out of memory while updating linking formulas, the program displays a MEMORY RUN-OUT error message. 1-2-3 updates as many linking formulas as it can before it runs out of memory. Any linking formulas that still need to be updated evaluate to ERF. To resolve this condition, you must free up some memory.
- If the data you are linking to depends on linked cells, you can get incorrect results. For example, if worksheet A depends on worksheet B, and worksheet B depends on worksheet C, the changes you make in worksheet C are not reflected when you retrieve worksheet A. You must retrieve and save worksheet B before you retrieve worksheet A.

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Using the Clipboard with 1-2-3

The Clipboard enables you to copy and paste text in 1-2-3. Once on the clipboard, data can also be pasted to other applications or data from other applications can be pasted to 1-2-3. To display the Clipboard keys, in READY mode press [CTRL]. The function key names will temporarily overwrite the status line at the bottom of the screen.

Follow these steps to copy worksheet data:

1. In READY mode, press [CTRL].
2. Press COPY ([CTRL] [F2]). 1-2-3 invokes POINT mode.
3. Move the cell pointer cell by cell in the worksheet to specify the range you wish to copy. Please note the following when you specify a range:
   - Row and column headings cannot be copied.
Each row of 1-2-3 information is copied as one line of text even if
it traverses data in cells in multiple columns.

There is no utility for viewing the Clipboard contents separately.

Press END. (The original range remains on the screen, and a
copy is stored in the Clipboard buffer.)

Move the cell pointer to the upper-left corner of the destination
location, either in the same worksheet or in another file.

**Caution**

Make sure the area is empty or contains unimportant data. The Clipboard contents overwrite any data in
the destination location.

6. Press PASTE (CTRL-V).

**Note**
The Clipboard contents will be written as text; to convert the pasted numbers to values, use /Data
Paste.

---

**Using the UNDO Feature**

When the undo feature is on, you can press UNDO (ALT-Z) when
1-2-3 is in READY mode to cancel the most recent operation that
changed worksheet data and/or settings. In addition, if you change
your mind about what you just unred, you can press UNDO again and
1-2-3 will undo the effect of the undo operation! Remember, UNDO
must be turned on if you want to use it.

Initially the UNDO feature is off. You can turn it on with /Worksheet
Global Default Other Undo Enable.

**Note**

UNDO consumes memory, so turning it off if you
don’t need it permits you to have a larger worksheet
in memory.

---

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You can tell whether or not you can use the undo feature by looking for the UNDO indicator on the status line at the bottom of your screen. If the UNDO indicator is not displayed, pressing UNDO will have no effect.

The undo feature is an important safeguard against time-consuming mistakes. For example, suppose you accidentally write over a complicated formula by entering a number in the same cell as the formula. If the UNDO feature is on, you can cancel the mistake by pressing UNDO immediately after entering the number; 1-2-3 erases the new entry and restores the formula in the cell.

What You Need to Know to Use UNDO

Although the undo feature is a valuable tool, you should not use it until you read the remainder of this section. This section provides important details about how the undo feature works; unless you are familiar with these details, you may get unexpected results when you use UNDO.

- UNDO works only when you are working in 1-2-3 and 1-2-3 is in READY mode.
- Initially, the UNDO feature is off, but you can turn it on with /Worksheet Global Default On: Undo Enable. If you then use /Worksheet Global Default Update to modify the 1-2-3 configuration file, UNDO will automatically be turned on whenever you start 1-2-3.
- Any series of 1-2-3 commands performed after you press slash (/) to display the main menu and before 1-2-3 returns to READY mode is a single undoable operation. For example, if you select /Graph, complete a series of Graph commands without leaving the /Graph menu and then return 1-2-3 to READY mode, pressing UNDO cancels the entire series of Graph commands you completed.
- If you press UNDO after running a macro, 1-2-3 returns your worksheet data and settings to the state they were in prior to running the macro, regardless of how many individual changes the macro made. If you did not run the macro from READY mode, 1-2-3 returns the worksheet data and settings to the state they were in when you last left READY mode, before running the macro.
- If you press UNDO immediately after 1-2-3 finishes running an autoreexecute (\(\hat{b}\)) macro, 1-2-3 undoes the effects of the macro and the /File Retrieve operation.

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In order to undo your last operation, 1-2-3 must reserve a portion of memory to keep a copy of the worksheet. This reduces the amount of available memory.

If you turn off the UNDO feature, retrieve a worksheet or attach an add-in, and then try to turn on UNDO, you will not be able to do so if any part of the UNDO buffer is in conventional memory. 1-2-3 cannot reserve the memory it needs for the UNDO buffer once you have retrieved a worksheet, or attached an add-in. To turn on UNDO in this situation, save the worksheet with /File Save, erase it with /Worksheet Erase or detach the add-in with /Add-In Detach, turn on UNDO with /Worksheet Global Default Other Undo Enable, and then retrieve the worksheet or attach the add-in again.

When Does 1-2-3 Back Up the Worksheet?

1-2-3 creates a temporary backup copy of the worksheet (this includes worksheet data, range names, and settings) when you press any key that might lead to a worksheet change. This allows 1-2-3 to restore your work to its previous state if you press UNDO (F2). For example, 1-2-3 backs up the worksheet when you press to display the main menu, press a character that begins a label or value, or press TABLE (F3) or QUERY (F7). 1-2-3 does not wait for you to complete a command or cell entry before backing up the worksheet.

Therefore, if you press to select a new command but then press (ESC) because you decide you want to undo your previous operation, you will not be able to because 1-2-3 backed up the worksheet again as soon as you pressed (ESC).

1-2-3 does not back up the worksheet when the key you press cannot lead to worksheet changes. For example, 1-2-3 does not back up the worksheet when you press a pointer-movement key (such as or or (PGUP)) or when you press a function key that cannot change the worksheet, such as (F5).
In addition to the pointer-movement keys (see "Keys for Moving Around" earlier in this chapter), 1-2-3 does not back up the worksheet if you press any of the following keys in READY mode:

- APP1 (ALT 24)
- APP2 (ALT 25)
- APP3 (ALT 26)
- MENU (ALT 27)
- NAME (ALT 28)
- TOOL (ALT 29)
- UNDO (ALT 30)
- HELP (ALT 31)
- GRAPH (ALT 32)
- STEP (ALT 33)
- LABEL (ALT 34)
- WINDOW (ALT 35)

If 2-3 also does not back up the worksheet if you press APP1 (ALT 24), APP2 (ALT 25), or APP3 (ALT 36) and there is no add-in program assigned to the key.

**What Operations Can't You Undo?**

Some 1-2-3 commands (such as /File Save and /File Erase) create, modify, or delete files on disk. When you press UNDO to undo one of these commands, 1-2-3 undo's any changes to the state of the worksheet (this includes worksheet data, range names, and settings).

1-2-3 cannot, however, undo the changes the command made to files on disk. Similarly, if you press UNDO after using /Print Printer 1, 1-2-3 undo's any changes you made to 1-2-3 print settings with the Print [Printer or File] commands, but it cannot undo any changes the command had on your printer's internal settings.

Although you can press UNDO to undo the changes you make to most 1-2-3 settings, there are a few exceptions:

- The Help access method (/Worksheet Global Default Other Help).
- The current file's reservation status, if you use /File Admin Reservation Get or Release to change it.

1-2-3 will restore the previous settings but will not undo any other changes made by the command.

---

Using 1-2-3 3-53
Using the 1-2-3 Help System

1-2-3 provides Help screens that you can view any time during a 1-2-3 session by pressing HELP (F1). The 1-2-3 Help system is context-sensitive—when you press HELP, 1-2-3 displays a screen that describes what you are currently doing in the program.

Each Help screen includes additional Help topics that are displayed with a cursor (pointer). Use the pointer-movement keys to select a topic, and press ENTER. You can select as many screens as you need. When you finish using HELP, press ESC to return to the worksheet at the same place you left it.

The following table lists the keys you use to move through Help topics and to other Help screens:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Moves pointer up one topic.</td>
<td>END</td>
<td>Moves pointer to the next topic.</td>
</tr>
<tr>
<td>Y</td>
<td>Moves pointer down one topic.</td>
<td>ENTER</td>
<td>Displays Help screen for highlighted topic.</td>
</tr>
<tr>
<td>C</td>
<td>Moves pointer left one topic.</td>
<td>HELP</td>
<td>Displays Help screen you saw when you first pressed HELP.</td>
</tr>
<tr>
<td>B</td>
<td>Moves pointer right one topic.</td>
<td>HOME</td>
<td>Move pointer to first topic.</td>
</tr>
<tr>
<td>D</td>
<td>Displays previous Help screen.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.54 Using 1-2-3
The Add-In Commands

The Add-In commands let you use 1-2-3 add-in applications. Add-ins are programs, created by Lotus and other software developers, that you can run while you are using 1-2-3 and that provide 1-2-3 with additional capabilities. You never have to leave the worksheet to use an add-in. The program actually becomes part of 1-2-3.

You cannot undo /Add-In Attach, Clear or Detach.

Remember that you can press HELP (F1) to get information about the command you are using.

The Add-In commands are described in the following sections.
Add-In Command Descriptions

The following section describes the individual commands.

/Add-In Attach

Use /Add-In Attach to load an add-in program into memory. Add-ins remain in memory until you detach them with /Add-In Detach.

/Add-In Clear, /Worksheet Global Default Other Add-In Cancel, or until you end the current 1-2-3 session.

An attached add-in is not activated until you select /Add-In Invoke or press the key you have assigned to the add-in.

Follow these steps to load an add-in program into memory:

1. Select Add-In Attach.

2. 1-2-3 displays a list of files with an .AEN extension in the root directory (C:\). [Note: This step is not clearly described in the image.]

3. If you want to display files in a different drive and/or directory, press ESC to clear the file names, edit the drive and/or directory name, and then press ENTER.

4. Specify the file name of the add-in you want to attach and press ENTER.

5. Select the key you want to use to invoke the add-in.

6. Assign the add-in to APPS (ALT (1)).

7. Assign the add-in to APPS (ALT (2)).

8. Assign the add-in to APPS (ALT (3)).

9. Assign the add-in to APPS (ALT (4)).

10. Assign the add-in to APPS (ALT (5)).

Once you assign an add-in to a key, that key will no longer appear in the menu during the current 1-2-3 session unless you detach the add-in.

3-2 The Add-In Commands
/Add-In Clear

Use /Add-In Clear to remove all attached add-in programs from memory, freeing the memory they occupied. (You cannot remove add-in functions until you end the 1-2-3 session.)

/Add-In Detach

Use /Add-In Detach to remove an attached add-in program from memory, freeing the memory it occupied.

Note

You cannot detach add-in functions. Once attached, they remain in memory until you end the 1-2-3 session. (For more information, see your add-in documentation.)

Follow these steps when using /Add-In Detach:

1. Select /Add-In Detach.
2. 1-2-3 displays a menu of all attached add-ins.
3. Specify the file name of the add-in you want to detach and press ENTER.

/Add-In Invoke

Use /Add-In Invoke to activate an add-in program that you have attached with /Add-In Attach. If you assigned the add-in to a key, you can also use that key to invoke the add-in.

1. Select /Add-In Invoke.
2. 1-2-3 displays the names of all attached add-ins.
3. Specify the name of the add-in you want to invoke and press ENTER.
The Copy Command

Worksheet Range Copy Move File Nest Graph Data System Addon Quiz

The Copy command lets you copy single cell entries to other cells or ranges; copy ranges to ranges; and copy formulas to other cells or ranges. Cell formats are copied along with the data.

Before you use /Copy to copy formulas, be sure that the cell reference in the formula corresponds to the type of copy you intend: relative, absolute, or mixed.

- If a formula contains relative cell references, 1-2-3 adjusts the references in the copied formula to refer to the new worksheet location.
- If a formula contains absolute cell references, 1-2-3 retains the specific cell or range address.
- If a formula contains mixed cell references, as it copies the formula, 1-2-3 adjusts the relative part of the cell reference and retains the absolute part.

Range names may be either relative or absolute—they cannot contain mixed references.

Remember that you can press HELP (F1) to get information about the command you are using.

Follow these steps to copy data:

1. Select /Copy
2. Specify the range you want to copy FROM and press ENTER
3. Specify the range you want to copy TO and press ENTER

The Copy Command 4-1
Consider these things when you specify a TO range:

- If you are copying a range from one location to another, you need to specify only the upper left cell in the TO range.
- If your TO and FROM ranges overlap, you may get unexpected results.
- If the FROM range is one cell and the TO range is larger than one cell, 1-2-3 makes multiple copies of the same data.
- The TO range can be any unprotected area of the worksheet.

Because 1-2-3 writes over existing data when it copies to your specified range, make sure that the TO location is blank or contains unimportant data. To avoid possible data loss from writing over existing data, save the worksheet before using /Copy. If you make a mistake when copying data and the undo feature is on, press UNDO (and [ ESC ]).

4-2 The Copy Command
Data Commands

The Data commands let you sort, compile, analyze, and manipulate groups of similarly organized data in a worksheet. You can use the Data commands to do any of the following:

- Enter values in a range in a specified sequence (/Data Fill).
- Perform "what-if" analysis on a table of data to show the results of a formula when the data the formula depends on changes such as possible mortgage payments given a range of interest rates (/Data Table).
- Locate all the entries in a mailing list with an address in a specified city (/Data Query).
- Find out the frequency of sales over a certain figure in a database of sales records (/Data Distribution).
- Convert an imported text file into accurate cell entries, distinguishing values from labels (/Data Parse).
To avoid possible data loss from writing over existing data, save your worksheet before using the Data commands. If you make a mistake and the undo feature is on, press UNDO $(\text{Ctrl} \text{ })$ immediately to restore the worksheet to its original state.

Remember that you can press HELP $(\text{F1})$ to get information about the command you are using.

1-2-3 Databases

A 1-2-3 database is a range of related data organized in rows and columns in a worksheet. A worksheet can contain many different databases.

A field is a category (column head) that each record in the database has in common.

A record is a single row collection of information about one item in a database.

In a 1-2-3 database, each row is a record and each column is a field.

The top row of a database contains the field names, one per column. The field names are the labels that identify the fields in the database.

When you create a database, remember these rules:

- The first row of the database must contain the field names. Subsequent rows must contain the records. Do not insert any blank rows or divider lines between the field names (the first row) and the records.
- The entries in a field must be either all labels or all values. Do not enter values in some records and labels in other records for the same field.
- Field names must be unique within a database.
- A database can contain up to 596 fields and 8,191 records.

5-2 Data Commands
Data Command Descriptions

The following section describes the Data commands.

/Data Distribution

Use /Data Distribution to calculate frequency distribution of the values in a range. A frequency distribution counts how many of the values in a range (the values range) fall within specified numeric intervals (the bin range).

1. You must create a values range and a bin range in the worksheet before you select /Data, Distribution.

2. Make certain that the values you want to analyze (the values range) are in a range. 1-2-3 ignores blank cells and cells that contain labels. Cells containing ERR (error) and NA (not available) will be counted at the top and bottom of the distribution range.

3. To create a bin range, find two empty adjacent columns. In the first column you must enter the values, or intervals, you want 1-2-3 to use to distribute the data. You will specify this first column as the bin range. 1-2-3 will use the empty adjacent column to the right to enter the frequency distribution when you select the command. You can use any values (including formulas) in the bin range, providing each value within the range is unique, and providing the values are in ascending order, with the smallest value at the top. Do not include labels, blank cells, or formulas that result in ERR or NA in the bin range or you may get unexpected results.


5. Specify the values range and press ENTER.

6. Specify the bin range and press ENTER.

1-2-3 places the frequency values in the column to the right of the bin range. The last frequency value in the column appears in the row below the last row of the bin range. The numbers in the column to the right of the bin range represent how many values in the values range are less than or equal to the adjacent value in the bin range, but greater than the preceding value. The last number is the number of values in the values range that are greater than the last value in the bin range. (To create a bin range with equal intervals, use /Data Fill.)
5-4 Data Commands

Use /Data Fill to enter a sequence of equally spaced values in a specified range.

These are the terms you need to know:

- **The fill range** is the range that you want 1-2-3 to fill with sequential values.
- **The start value** is the first value 1-2-3 enters in the fill range.
- **The step value** is the increment between each of the values in the sequence.
- **The stop value** is the value 1-2-3 uses as a limit for the sequence.

1-2-3 enters the start value in the first cell of the fill range. The program continues to enter a value in each cell of the range, adding the step value to each previous value, until it fills the range or reaches the stop value. 1-2-3 fills cells column by column, from left to right.

Follow these steps to use /Data Fill:

1. Select /Data Fill.
2. Specify the fill range and press enter.
3. Specify the start value and press enter.
4. Specify the step value and press enter.
5. Specify the stop value and press enter.

The start value can be any value (including a formula), a cell, or a range name that evaluates to a value. If you do not specify a start value, 1-2-3 uses the default value (0) or the most recent value entered.

The step value can be any value (including a formula), a cell, or a range name that evaluates to a value. If you do not specify a step value, 1-2-3 uses the default value (1) or the most recent value entered.

The stop value can be any value (including a formula), a cell, a range address, or a range name that evaluates to a value. If you do not specify a stop value, 1-2-3 uses the default value (191) or the most recent value entered. If you specify a positive step value, you must specify a stop value that is greater than the start value. If you specify a negative step value, you must specify a stop value that is less than the start value. (If 1-2-3 reaches the stop value...
before it fills the range. 1-2-3 erases the remaining cells in the range.)

**Data Matrix**

Use /Data Matrix to invert or multiply matrices so you can solve simultaneous equations.

**Data Matrix Invert**

Use /Data Matrix Invert to create the inverse of a square matrix. If you attempt to use /Data Matrix Invert with a matrix that has no inverse, 1-2-3 displays an error message.

1. **Select** /Data Matrix Invert.
2. Specify the matrix range you want to invert and press **ENTER**.
   
   The matrix range must have the same number of columns and rows, and can contain up to 80 columns and 80 rows.

3. Specify the output range (the range in which you want 1-2-3 to enter the results of the inversion) and press **ENTER**.

   You can specify either the entire range or only the upper left cell of the range.

**Data Matrix Multiply**

Use /Data Matrix Multiply to multiply the columns of one matrix with the rows of a second matrix and create a third matrix that contains the results of the multiplication. When you multiply matrices, there must be the same number of columns in the first matrix as there are rows in the second matrix.

Although 1-2-3 performs various calculations when you select /Data Matrix Multiply, 1-2-3 does not actually create and store the formulas in the worksheet when you select the command.

Follow these steps when you use /Data Matrix Multiply:

1. **Select** /Data Matrix Multiply.
2. Specify the first range you want to multiply and press **ENTER**.
   
   (1-2-3 can multiply any matrix of values up to a maximum of 256 rows by 256 columns.)

3. Specify the second range you want to multiply and press **ENTER**.
4. Specify the output range (the range in which you want 1-2-3 to enter the results of the multiplication) and press **ENTER**. (You can specify either the entire range or only the upper left cell of the range.)

**Example: Solving Simultaneous Equations with /Data Matrix.** You can use both /Data Matrix commands to solve simultaneous equations in 1-2-3. The equations should contain the x and y on one side of the =, and the constants on the other side. For example, use the following procedure to solve these equations:

\[5x + 7y = 17\]
\[7x - 3y = 1\]

1. Create two matrices; one that corresponds to the x and y coefficients in your equations (the numbers 5 and 7 in both the equations above), and one that corresponds to the constants (17 and 1 in the equations above).
2. Select /Data Matrix Invert.
3. Specify the matrix that corresponds to the x and y coefficients as the range you want to invert and press **ENTER**. (In the illustration, A1..B5 is the range you want to invert.)
4. Specify an output range and press **ENTER**. (In the illustration, the output range is A9.) 1-2-3 performs a matrix inversion.
5. Select /Data Matrix Multiply.
6. Specify the inverted matrix as the first range to multiply and press **ENTER**. In our example the inverted matrix is A9..B0.
7. Specify the range containing the constants as the second range to multiply and press **ENTER**. In our illustration, D1..D5 contains the constants.
8. Specify an output range and press **ENTER**. The output range we show is D9..D10.

5-6  **Data Commands**
The result of the matrix multiplication is the solution to the equations. In our example, x=1 and y=2.

/Data Parse

Use /Data Parse to convert an imported text file into separate columns of data. 1-2-3 treats data you import with /File Import Text as long labels. The labels are contained in one column, even though the data may extend across several columns. /Data Parse is best used with similarly structured data that can easily be separated into columns and rows.

If the data in the text file contains quotes around labels and separates numbers with commas, you do not need to use /Data Parse after you import the file. For further information, see /File Import Numbers.

You can view or print imported data when it appears as long labels, but you cannot calculate with the numbers each label contains, nor can you easily move any part of the label. To be able to work with the imported data, you must separate the data within the long labels into individual cells using /Data Parse.

When you select /Data Parse, 1-2-3 displays a settings sheet listing the location of the input column and the output range. These are the ranges 1-2-3 will use when you are ready to parse the data with /Data Parse Go. You enter the ranges by selecting /Data Parse Input-Column and /Data Parse Output-Range.
Format Lines

A format line determines the way 1-2-3 parses the label below the format line into individual entries, separating the label whenever there are one or more spaces. For example, 1-2-3 would parse the three-word label Average Monthly Sales into three separate pieces, because the spaces after Average and Monthly indicate the beginning of a new entry.

The pieces into which 1-2-3 breaks up the label are called data blocks. The format line is a label, preceded by the split vertical bar (|) label prefix. The characters in the format line indicate the data type and the width of each data block in the long label below it. A long label is a cell entry that appears to occupy several columns but actually is a single cell entry whose contents extend into adjacent columns. The data type is the type of data—label, value, date, or time—within a data block.

Format lines can contain the following symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Represents the first character of a date block.</td>
</tr>
<tr>
<td>L</td>
<td>Represents the first character of a label block.</td>
</tr>
<tr>
<td>S</td>
<td>Skips the data block immediately below the symbol when parsing. You enter the skip symbol (S) when you edit a formal line. Use this symbol when your labels include a data block you do not want 1-2-3 to parse. For example, in the example below, if you do not want to include the value 3456 in the parsed entries, you would edit the format line so replace the V above that block with an S.</td>
</tr>
<tr>
<td>T</td>
<td>Represents the first character of a time block.</td>
</tr>
<tr>
<td>V</td>
<td>Represents the first character of a value block.</td>
</tr>
<tr>
<td>&gt;</td>
<td>Represents characters in a data block. For example, 1-2-3 displays a value block that is four characters wide as V&gt;&gt;&gt; .</td>
</tr>
<tr>
<td>*</td>
<td>Represents blank space that can become part of a data block if the block in any label requires extra characters.</td>
</tr>
</tbody>
</table>

5-8 Data Commands
1-2-3 creates the following format line in cell A2 for the unparsed label in cell A3:

- **Label block**: 1>"Revenues" 3450 700
- **Value block**: (A2.50)

If you select /Data Parse Go with the format line shown in the previous illustration, 1-2-3 enters Revenues as a label in one column, 3450 as a value in the next column, 500 as a value in the third column, and 700 as a value in the fourth column.

Remember to include as many character symbols (> or *) as the longest label in any one block, or you may lose data.

Follow these steps when using /Data Parse:

1. Position the cell pointer in the cell that contains the first long label you want to parse.

   1-2-3 analyzes the label in the current cell, inserts a row, creates a format line in the cell that contains the cell pointer, and moves the range of data down one row. The characters in the format line reflect the data type and width of each of the data blocks in the cell below it. 1-2-3 uses the format line to guess how it should parse the label. 1-2-3 treats each group of characters separated by one or more blank spaces as a single data block and identifies each of these data blocks as one of the following data types: value, date, time, or label.

If a data block contains an ambiguous entry—that is, data to which 1-2-2 could assign more than one data type—1-2-3 determines the data type using the following order of precedence: value, date, time, and label. For example, if a data block contains the characters 4/10, 1-2-3 identifies the data type as a value instead of a date, because value comes before date in the order of precedence.

*Data Commands* 5-1
3. If you select Format-Line Edit to edit the format line, follow the procedure for editing a format line, which follows step 5.

You need to edit the format line if any of these conditions exist:

- Any data block (including adjacent * characters) is not wide enough to accommodate any of the data that 1-2-3 will parse in the labels below it.
- Any of the block widths or data type characters is incorrect. In the example above, you would change the data type character from V (value) to D (date) if you wanted 1-2-3 to interpret 4/10 as a date.
- Any single block contains a space, because the format line treats the block as two shorter blocks.

4. If you need to create additional format lines, select Quit to return to READY mode, position the cell pointer in the next cell requiring a new format line, and select /Data Parse Format-Line Create. Edit each new format line if necessary.

You need to create additional format lines if any of these conditions exist:

- Any label below the format line contains a block whose data type does not match that indicated in the format line.
- Any label below the format line contains a block whose width should be different from that indicated in the format line.
- In addition to values, you imported data contains titles, column headings, other descriptive labels, or a row of characters separating different parts of the worksheet.

5. Select Input-Column.

6. Specify the entire single column range that contains the format lines and labels you want to parse. (The first cell in the input column range must contain a format line. 1-2-3 ignores any cells that do not contain labels.)

7. Select Output-Range.

8. Specify the address or range name of the first cell in a block range large enough to hold your rows and columns of parsed data.

9. Select Go.

Follow these steps to edit a format line:

1. Position the cell pointer in the cell that contains the format line you want to edit.

5-10 Data Commands
2. Select /Data Pave Format-Line Edit. 1-2-3 highlights the format line, places the cursor under the first character in the line, and enters OVR (overstrike) mode.

3. Edit the format line.

Several keys have special functions when you use them to edit a format line:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Scrolls the unspaced labels below the format line up one row at a time so you can compare each label with the format line.</td>
</tr>
<tr>
<td>B</td>
<td>Scrolls the unspaced labels below the format line down one row at a time so you can compare each label with the format line.</td>
</tr>
<tr>
<td>CTRL + PREAM</td>
<td>Cancels edit you made to the format line and returns 1-2-3 to READY mode.</td>
</tr>
<tr>
<td>ESC</td>
<td>Erases the format line; or, if pressed repeatedly, returns the format line to its previous state.</td>
</tr>
<tr>
<td>HOME</td>
<td>Returns the cursor to its initial position in the format line and, if you scrolled the unspaced labels below the format line, displays the unspaced labels that were visible before you began scrolling.</td>
</tr>
<tr>
<td>PGDN</td>
<td>Scrolls the unspaced labels below the format line down by the number of rows on the screen so you can compare each label with the format line.</td>
</tr>
<tr>
<td>PGUP</td>
<td>Scrolls the unspaced labels below the format line up by the number of rows on the screen so you can compare each label with the format line.</td>
</tr>
</tbody>
</table>

4. Press [CTRL] when you finish editing the format line to return to the /Data Pave menu.
/Data Parse Format-Line

Use /Data Parse Format-Line to create or edit the format line that controls the way 1-2-3 divides a long label into blocks of data. The long label will become individual entries, one per column.

1. When creating a format line, position the cell pointer in the cell that contains the first long label you want to parsed. When editing a format line, position the cell pointer in the cell that contains the format line.
3. Select one of the following options:
   Create 1-2-3 analyzes the long label, inserts an appropriate format line at the cell pointer, and moves the data below down one row.
   Edit 1-2-3 displays the format line and allows you to edit it.

/Data Parse Go

Use /Data Parse Go to parse the labels in the input columns and place them in the output range.

1. Specify an input column, format line, and output range.
2. Select /Data Parse Go.

/Data Parse Input-Column

Use /Data Parse Input-Column to specify the single column range that contains both the format line and the data you want to parse.

1. Specify the format line.
2. Select /Data Parse Input-Column.
3. Specify the entire column containing the long labels you want to parse, including the format line at the top.

/Data Parse Output-Range

Use /Data Parse Output-Range to specify the range in which you want 1-2-3 to place the parsed data. If you specify one cell, 1-2-3 uses that cell as the upper left cell in the output range.

1. Move the cell pointer to an empty part of the worksheet.
2. Select /Data Parse Output-Range.

1-12 Data Commands
3. Specify an output range. You need only specify one cell. 1:2:3 will use that cell as the upper left corner of the output range and will create a range large enough to hold the output data.

/Data Parse Quit
Use /Data Parse Quit to return 1-2-3 to READY mode.

/Data Parse Reset
Use /Data Parse Reset to clear the range address settings for the input column and the output range.

/Data Query
The Data Query command lets you locate and edit selected records in a database. You can also use QUERY (F2) to repeat your last query operation.

Before You Use /Data Query
Before you use /Data Query, you need to create three ranges: an input range, a criteria range, and an output range. (If you want to highlight or delete matching records with /Data Query Find or /Data Query Delete, an output range is not required.)
Our illustration shows an example of a 1-2-3 database with an input range, criteria range and output range after using /Data Query Extract. (Cell P8 is formatted with /Range Format Text so you can see the formula in the cell.)

The /Data Query Settings Sheet

When you select /Data Query, 1-2-3 displays a settings sheet listing the location of the input range, the criteria range, and the output range. Enter the ranges in the settings sheet by selecting /Data Query Input, /Data Query Criteria, and /Data Query Output.

Required /Data Query Ranges

Before you can use /Data Query to locate records in a database, you need to create the following three ranges.

The Input Range. Use /Data Query Input to specify the range that contains the database records you want 1-2-3 to search when you select a Data Query command.

Use the following guidelines when you create an input range:

- The first row of the range must include the field names. Subsequent rows contain all of the records in the database than you want to query.
- Do not use any separator, such as a dashed line or blank row, between the first row containing the field names and the second row containing the first record in the database.

The Criteria Range. Use /Data Query Criteria to specify which records 1-2-3 will search for in the input range. The first row of the criteria range contains copies of the field names from the input range you are searching. The remaining rows contain the criteria you want 1-2-3 to use.

Use the following guidelines when you create a criteria range:

- Choose an area of the worksheet that does not overlap the input range (for example, several rows below it). To add records to the database, use /Worksheet Insert Row.
- In the first row of the criteria range, copy the field names from the input range exactly as they appear. Use /Copy to ensure a correct first row of the criteria range. Although you need to copy only the names of the fields you want 1-2-3 to search, copying all the field
names makes it easier to change criteria (using any field) whenever you want. 1-2-3 only uses fields that contain entries in the criteria range. You can include up to 32 field names in the criteria range.

- In the second (and subsequent) rows of the criteria range, enter your criteria below the appropriate field names. You can enter labels, values, or formulas in the cells. 1-2-3 will search for the records that match your criteria.

The Output Range. Use /Data Query Output to specify the area to which 1-2-3 copies the results of /Data Query Extract or /Data Query Unique.

Like the criteria range, the first row of the output range must contain copies of the field names from the input range you want 1-2-3 to search. Use /Copy to create the first row of the output range from the first row of the input range to ensure an accurate copy of the field names. 1-2-3 uses the remaining rows of the output range to copy the selected records.

Use the following guidelines when you create an output range:

- Choose an area in the worksheet that does not overlap your input or criteria ranges.
- If you specify a single row output range consisting of just the row containing the field names, 1-2-3 will erase all data in the columns below the field names to the bottom row of the worksheet. Then 1-2-3 will use as many rows as it needs to copy data below the field names.
- If you specify a multiple row output range consisting of the field names in the first row and a number of blank rows below it, 1-2-3 will use only the range you have specified to copy data below the field names, even if there are more records that match the criteria than will fit into the specified range.
- /Copy field names from the input range to the first row of the output range. Include each of the fields that you want listed when 1-2-3 copies records that match your criteria. Each field name must be identical to the corresponding field name in the input and criteria ranges, but you can arrange the fields in the output range in any order.
Writing Criteria

Criteria are cell entries that 1-2-3 interprets as tests for the records in a database. The criteria determine whether or not a /Data Query command affects a particular record. You can write criteria that match label or value entries in the database and you can use more than one criterion.

Searching for Labels. To search for exact matches, enter labels exactly as they appear in the input range. (If you selected the ASCII collating sequence in the Setup utility, 1-2-3 distinguishes between uppercase and lowercase letters when searching for labels.)

- The ? matches any single character. For example, h?r matches hat, but not match. The ? does not match hitch; h?r matches head and hood, but not heal.
- The * matches all characters to the end of a label. For example, cat* matches cat an category, but not cart.
- Preceding a label with a tilde (~) searches for all labels except that one. For example, ~Smith matches all records with an entry in that field other than Smith.

Combine the label-matching symbols to create label criteria. For example, "S*" matches all records with an entry in that field that do not begin with s. 1-2-3 never matches a label criterion with blank cells in the input range.

Searching for Values. To search for exact value matches, enter the value as the criterion. The format does not need to match the format of the value in the database. For example, 233 matches 23, 23.000, and 2.30E+01.

You can enter one or more formulas linked by logical operators to search for values that meet a condition you set, such as all entries greater than 1500. Enter the condition as a logical expression in the criteria range, using the cell address of the corresponding field of the first record in the database. Use any of the operators listed below in your formulas to compare a cell entry to some value.

5-16 Data Commands
<table>
<thead>
<tr>
<th>Operator</th>
<th>Operation</th>
<th>Operator</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Exponentiation</td>
<td>&lt;</td>
<td>Less-than test</td>
</tr>
<tr>
<td>-</td>
<td>Identification of value as negative</td>
<td>&gt;</td>
<td>Greater-than test</td>
</tr>
<tr>
<td>+</td>
<td>Identification of value as positive</td>
<td>&lt;=</td>
<td>Less-than-or-equal-to test</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication</td>
<td>&gt;=</td>
<td>Greater-than-or-equal-to test</td>
</tr>
<tr>
<td>/</td>
<td>Division</td>
<td>#NOT#</td>
<td>Logical-NOT test</td>
</tr>
<tr>
<td>+</td>
<td>Addition</td>
<td>#AND#</td>
<td>Logical-AND test</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction</td>
<td>#OR#</td>
<td>Logical-OR test</td>
</tr>
<tr>
<td>=</td>
<td>Equal-to test</td>
<td>$&lt;$</td>
<td>String comparison</td>
</tr>
<tr>
<td>&lt;&gt;</td>
<td>Not-equal-to test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use relative cell addresses in formulas that refer to database fields in the input range. Use absolute cell addresses to refer to values outside the input range. For example, use the criterion A2<=C2 to search for records whose entry in the B field is not equal to its entry in the C field. Use A2<>B2 to search for records whose entry in the B field is not equal to the value in B2 outside the database.

**Note**

When you use a database diffusion in a formula in a criteria range, make sure the database diffusion does not refer to that criteria range. Such a database diffusion results in a circular reference, causing 1-2-3 to display an error message.

**Entering Multiple Field Criteria.** Enter criteria for different fields in a single row of the criteria range to search for only those records that match all the criteria at once. 1-2-3 treats criteria in the same row as if they were linked by the logical operator #AND#.

- A blank cell in the criteria range tells 1-2-3 to include any records in the input range, as long as the records match the other criteria.
- Enter criteria for different fields in separate rows of the criteria range to search for records that match any of the criteria. 1-2-3

Data Commands 5-17
treat criteria in separate rows as if they were linked by the logical operator #OR#.

- Do not include a blank row in a multiple row criteria range. 1-2-3 will select all the records.

- Use the logical operators #AND#, #NOT#, or #OR# in formulas to create criteria that match more than one condition in the same field. Using the example on page 5-14, the formula 
  =C2>15000#AND#C2<25000 would search for all records with
  SALARY entries greater than 15000 but less than 25000. For
  further information on logical operators and formulas, see "Working
  with Formulas" in Chapter 2.

/Data Query Criteria

Use /Data Query Criteria to specify the criteria range, which contains the selection criteria for records in the database. You must use /Data Query Criteria before you can complete any data query operation.

2. Specify the criteria range and press (Enter) (The criteria range must include a top row containing the field names of the fields you
   want to query, and one or more rows below containing the criteria.)

/Data Query Delete

/Data Query Delete lets you delete the records in the input range that match your criteria and shrink the input range to remove the blank rows. As a safety precaution, 1-2-3 prompts you for confirmation before it deletes the records.

1. Before you use /Data Query Delete, you must specify an input range and a criteria range.
2. Select /Data Query Delete.
3. Select one of the following options:
   - Cancel Returns you to the /Data Query menu without deleting any records.
   - Delete Deletes all records in the input range that match the criteria, in the criteria range.

Use /Data Query Find to preview the records that 1-2-3 will delete before 1-2-3 deletes the records. If you make a mistake and the UNDO feature is on, press UNDO (Ctrl+Z) immediately to restore the deleted records.

5-18 Data Commands
/Data Query Extract
Use /Data Query Extract to copy to the output range the records in the input range that match your criteria.

- Before you use /Data Query Extract, you must specify an input range, a criteria range, and an output range.
- Select /Data Query Extract.

Note
If you specify a single row output range, 1-2-3 will erase all data in the columns below the field names to the bottom row of the worksheet. Then 1-2-3 creates an output range that contains as many rows as needed to contain the data. If you make a mistake when extracting records and the undo feature is on, press UNDO (Alt-PC) immediately to restore the worksheet to its original state.

/Data Query Find
Use /Data Query Find to locate the records in the input range that match the criteria you specified or to locate records that you want to edit.

1. Before you use /Data Query Find, you must specify an input range and a criteria range.
2. Select /Data Query Find. 1-2-3 highlights the first record in the input range that matches the criteria. (If there are no matching records, 1-2-3 returns to the /Data Query menu.)
3. Use the following keys to move among the matching records in the input range.
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ]</td>
<td>Moves the cell pointer up to other records in the input range that match the criteria. If there are no more matching records in that direction, 1-2-3 backs.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Moves the cell pointer down to other records in the input range that match the criteria. If there are no more matching records in that direction, 1-2-3 backs.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Moves the cursor left one field within a highlighted record.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Moves the cursor right one field within a highlighted record.</td>
</tr>
<tr>
<td>[ESC]</td>
<td>ESC or ENTER</td>
</tr>
<tr>
<td>END</td>
<td>Ends /Data Query Find, moves the cell pointer to the last record in the input range.</td>
</tr>
</tbody>
</table>

4. Press [ENTER] and select Quit to return 1-2-3 to READY mode. (1-2-3 moves the cell pointer to the cell it was in when you selected /Data Query Find.)

/Data Query Input

Use /Data Query Input to specify the range that contains the records you want 1-2-3 to search. You must use /Data Query Input before you can complete any data query operation.

1. Select /Data Query Input.

5:20  Data Commands
2. Specify an input range containing all data you want to query and press ENTER. (Be sure to include the field names in the first row.)

/Data Query Output

Use /Data Query Output to specify the range in which you want 1-2-3 to place the results of /Data Query Extract or /Data Query Unique. You must use /Data Query Output before you can use either of these commands.

1. Select /Data Query Output.
2. Specify the output range as either a single row or a multiple row range and press ENTER. (Remember to include the field names as the first row.)
3. Specify a single row output range containing just the field names if you have a lot of empty space below the field names and are not concerned about any existing entries being written over. 1-2-3 will use as many rows below the field names as it needs.
4. Specify a multiple row output range with the field names as the first row if you want to be certain that 1-2-3 does not write over existing entries. 1-2-3 will write only to the multiple row range you specify. If the range is not large enough to accommodate all the records that match your selection criteria, 1-2-3 will fill as many as will fit and then display an error message.

/Data Query Quit

Use /Data Query Quit to return 1-2-3 to READY mode.

/Data Query Reset

Use /Data Query Reset to clear the range address settings for the input, criteria, and output ranges you specified.

/Data Query Unique

Use /Data Query Unique to perform the same operation as /Data Query Extract except you can eliminate any duplicate records in the output range.
1. Before you use /Data Query Unique, you must specify an input range, a criteria range, and an output range.
2. Select /Data Query Unique.
1-2-3 copies to the output range the records in the input range that match your criteria, eliminating any duplicate records in the output range.

1-2-3 displays an error message if you specified a multiple row output range and there are more matching records than can fit in the range. Press [ESC] to return 1-2-2 to READY mode. Use /Data Query Output to specify an output range with more rows, or if you have a lot of empty space below the output range, specify just the row that contains the field names as the output range.

/Data Regression

Use /Data Regression to perform a regression analysis on existing data. A regression analysis is a statistical application used for predicting future data based on current data. Use the following commands to perform a data regression:

<table>
<thead>
<tr>
<th>Command</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go</td>
<td>Calculates a data regression for the selected X range, Y range, and output range.</td>
</tr>
<tr>
<td>Intercept</td>
<td>Determines whether 1-2-3 calculates the y-axis intercept automatically (default) or uses zero as the intercept. (The y-axis intercept appears in the results as the constant.)</td>
</tr>
<tr>
<td>Output Range</td>
<td>Specifies the range in which 1-2-3 places the results of the regression analysis.</td>
</tr>
<tr>
<td>Quit</td>
<td>Returns 1-2-3 to READY mode.</td>
</tr>
<tr>
<td>Reset</td>
<td>Clears the X range, Y range, and output range; resets the intercept to Compute.</td>
</tr>
<tr>
<td>X-Range</td>
<td>Specifies the independent variables.</td>
</tr>
<tr>
<td>Y-Range</td>
<td>Specifies the dependent variable.</td>
</tr>
</tbody>
</table>

Use /Data Regression to predict a value for a dependent variable based on the values for one or more independent variables. /Data Regression also indicates the statistical accuracy of these values.

5-22 Data Commands
You can also use /Data Regression when you have several sets of values and you want to see how and whether one set is dependent on the others, and also to determine the slope and the y-axis intercept of the best-fitting line for a set of data points.

**Terms to Know**
- **An independent variable** is a value used to determine a prediction.
- **A dependent variable** is the data for which you have current information, but which you want to predict.
- **The intercept** is the point at which the Y-axis is crossed by the predicted line.

/Data Regression Settings Sheet
When you select /Data Regression, 1-2-3 displays a settings sheet listing by cell address the location of the X range, Y range, output range, and y-axis intercept. These are the settings 1-2-3 will use when you are ready to perform the regression with /Data Regression Co.

**Examples:** Performing Regression Analysis. You are the proprietor of an ice cream stand at a tourist location, and you want to predict how many quarts of ice cream you will sell the next day. You believe that your sales are influenced by three key factors: the number of hours of sunshine, the midday temperature, and the number of buses in a nearby parking lot.

You created a database that contains the available information for a six day period. (In practice, you would probably collect data for a much longer period to get greater accuracy.)
Before you can predict sales, you need to perform a regression analysis on the existing data, as described in the steps below.

1. Select /Data Regression X-range. The X range contains the independent variables in the database (the variables you can estimate with some degree of accuracy already). For the ice cream stand, the independent variables are the number of hours of sunshine, the midday temperature, and the number of buses in the parking lot (the range C4:E5).

2. Select /Data Regression Y-Range. The Y range contains the dependent variable in the database (the variable you want to predict). For the ice cream stand, the dependent variable is the amount of ice cream sold (the range B4, B5).

3. Select /Data Regression Output-Range to indicate the area of the worksheet in which you want 1-2-3 to place the results of the regression analysis. You need to specify only the first cell of the range (the cell A12).
Select [Data Regression Go]. 1-2-3 automatically enters the following calculated results (including labels) in the output range, as illustrated in the figure below:

Now you can use the regression data you have generated for a prediction. Suppose the weather forecast tells you that tomorrow will be cloudy, with only two hours of sunshine and a midday temperature of 89°F. You guess that no more than five bees will visit. These are the predicted X values.

To predict the ice cream sales (Y value) for tomorrow, complete the following steps:

1. Enter the predicted values (2, 84, 5) in the database. (If you want to continue our example, enter the predictions in C10..E10.)
2. Enter the following formula in the cell where you want to see the prediction. (Enter the formula in cell F10 so that the prediction is in sequence with actual sales, but in a different column so that it is not confused with actual sales.)

\[ y = \text{C10} \times x^2 + \text{D10} \times x + \text{E10} \]

The formula may look complicated, but it is really only the sum of the following four items:
- The first predicted x value multiplied by the first x coefficient.
- The second predicted x value multiplied by the second x coefficient.
- The third predicted x value multiplied by the third x coefficient.
- The constant.

Data Commands 5-95
Use absolute references for the X coefficients and the constant because you may want to copy the formulas to other cells, and you do not want any adjustment made in references to the coefficients or the constant.

The prediction indicates that you should expect to sell approximately 270 units of ice cream tomorrow.

**Using Data Regression**

1. Select Data Regression.
2. Select X-Range to specify the independent variables. (Select Range at any time to clear the regression settings.) You can specify up to 16 independent variables.
3. Specify the X range and press ENTER.
4. Select Y-Range to specify the dependent variable.
5. Specify the Y range and press ENTER. (The X range and Y range must have the same number of rows.)
6. If you select Intercept, select one of the following options:
   - **Compute** Calculates the y-axis intercept automatically.
   - **Zero** Uses zero as the y-axis intercept. (Do not select this option when all of your independent variables equal zero, the dependent variable must equal zero also.)
7. Select Output-Range.
8. Specify the output range in a blank area of the worksheet and press ENTER. If you select a range that is too small to contain the regression calculations, 1-2-3 cannot perform the regression and displays an error message when you select Go.
9. Select Go to calculate the regression or select Quit to return 1-2-3 to READY mode without calculating the regression.

5-26 Data Commands
When you select Go, 1-2-3 extracts the following information in the output range:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>The y-axis intercept.</td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>The number of observations minus the number of independent variables minus 1. (If you use a zero intercept, the degrees of freedom equal the number of observations minus the number of independent variables.)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>The number of rows of data in the X and Y ranges.</td>
</tr>
<tr>
<td>R-squared</td>
<td>The reliability of the regression (a value from 0 to 1, inclusive).</td>
</tr>
<tr>
<td>Std Err of Conf.</td>
<td>The standard error of each of the x coefficients.</td>
</tr>
<tr>
<td>Std Err of Y Est.</td>
<td>The standard error of the estimated y values.</td>
</tr>
<tr>
<td>X coefficients</td>
<td>The slope for each independent variable.</td>
</tr>
</tbody>
</table>

/Data Regression Go

Use /Data Regression Go to calculate a data regression for the selected X range, Y range, and output range.

1. Before you use /Data Regression Go, you must specify the X range, Y range, and output range.
2. Select /Data Regression Go
/Data Regression Intercept

Use /Data Regression intercept to determine whether 1-2-3 calculates the y-axis intercept automatically or uses zero as the intercept. The y-axis intercept appears as the constant in the results.

1. Select /Data Regression Intercept.
2. Select one of the following options:
   Compute: Calculates the y-axis intercept automatically.
   Zero: Uses zero as the y-axis intercept. (Do not select Zero unless all of your independent variables equal zero, the dependent variable must equal zero also.)

/Data Regression Output-Range

Use /Data Regression Output-Range to specify the range in which 1-2-3 places the results of the regression analysis.

1. Select /Data Regression Output-Range.
2. Specify an output range in a blank area of the worksheet and press ENTER.
   - If you specify just one cell, 1-2-3 will use that cell as the upper left cell of the output range, and determine how big a range it needs.
   - If you specify a larger range but one which is not big enough to contain the regression calculations, 1-2-3 will display an error message when you select Go.

/Data Regression Reset

Use /Data Regression Reset to clear range address settings for the X range, the Y range, and the output range, and to reset the intercept to Compute.

/Data Regression X-Range

Use /Data Regression X-Range to specify the independent variables.

1. Select /Data Regression X-Range.
2. Specify the independent variables and press ENTER. You can specify up to 16 independent variables.
/Data Regression Y-Range
Use /Data Regression Y-Range to specify the dependent variable
1. Select /Data Regression Y-Range,
2. Specify the dependent variable and press [Enter]. (The X range 
and the Y range must have the same number of rows.)

/Data Sort
Use /Data Sort to arrange the data in a range in the order you 
specify. The range can be records in a database or rows in the 
worksheet.
Before you use /Data Sort, make sure that the data you want to 
sort is in a range, and that you have similar data in the columns of 
the range. For example, if you want to sort numbers in column A in 
descending order, it may not be useful if column A contains labels. (If 
the data is in a database, it will already be organized properly.)

The /Data Sort Settings Sheet
When you select /Data Sort, 1-2-3 displays a settings sheet. The 
settings sheet lists by cell address the location of the data range, 
primary sort key, and secondary sort key. These are the settings 1-2-3 
will use when you are ready to perform a sort.

Sort Order
Ascending sort order arranges data by listing numbers first, unless you 
change the initial setting for the sort order (also called the collating 
sequence) using the Setup utility. The following table shows the 
available collating sequences. (Descending sort order reverses the 
order.)
<table>
<thead>
<tr>
<th>Collection Sequence</th>
<th>Sort Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers first</td>
<td>1. Blank cells</td>
</tr>
<tr>
<td></td>
<td>2. Labels beginning with numbers in numerical order</td>
</tr>
<tr>
<td></td>
<td>3. Labels beginning with letters in alphabetical order</td>
</tr>
<tr>
<td></td>
<td>4. Labels beginning with other characters</td>
</tr>
<tr>
<td></td>
<td>5. Values</td>
</tr>
<tr>
<td></td>
<td>1-2-3 ignore capitalization.</td>
</tr>
<tr>
<td>Numbers last</td>
<td>1. Blank cells</td>
</tr>
<tr>
<td></td>
<td>2. Labels beginning with letters in alphabetical order</td>
</tr>
<tr>
<td></td>
<td>3. Labels beginning with numbers in numerical order</td>
</tr>
<tr>
<td></td>
<td>4. Labels beginning with other characters</td>
</tr>
<tr>
<td></td>
<td>5. Values</td>
</tr>
<tr>
<td></td>
<td>1-2-3 ignore capitalization.</td>
</tr>
<tr>
<td>ASCII</td>
<td>1. Blank cells</td>
</tr>
<tr>
<td></td>
<td>2. All labels, using their ASCII values</td>
</tr>
<tr>
<td></td>
<td>3. Values</td>
</tr>
<tr>
<td></td>
<td>Uppercase letters provide lowercase letters.</td>
</tr>
</tbody>
</table>

How to Use /Data Sort

1. Select /Data Sort /Data-Range.
2. Specify the range you want to sort and press ENTER.
   The data range must contain all the records or rows you want to sort. If you are sorting a database, do not include the field names (the first row of the database).
3. Select Primary-Key.
4. Specify the primary sort key by entering the cell address of any cell in the field you want 1-2-3 to use to determine the new order for your records.
5. Enter the primary sort order (A for ascending or D for descending).
6. If some records have the same entries in the primary sort key field and you want those records arranged in a specific order, then select Secondary-Key.
7. Specify the secondary sort key by entering the address of the cell you want 1-2-3 to use to break ties in the primary sort key field and press ENTER.
8. Enter the secondary sort order (A for ascending or D for descending).
9. Select Go to sort the database or range.

5-30 Data Commands
The illustration above shows a database with four fields (NAME, MONTH, ACCOUNT, and SALES) and 10 records (rows 2 through 11). Once you select the database (not including the field names) as the data range, you can sort the records in many different ways, depending on the information you need to gather.

For example, if you want to review each person's sales, you would sort the database using the NAME field as the primary sort key (with A1). The illustration above shows the database sorted by NAME in ascending order.
You can also sort by two sort keys at once. For example, you can sort the database by NAME and ACCOUNT. The illustration above shows the database sorted by two keys. The primary sort key is NAME (cell A1) in ascending order; the secondary sort key is ACCOUNT (cell C1) in ascending order.

Be careful when you sort ranges that contain formulas. If a cell that contains a formula moves when you select /Data Sort Go, 1-2-3 adjusts relative cell addresses in the formulas to reflect the new position of the cell. This can cause problems if the formula refers to information outside the database.

Use /Data Fill to enter a field of record numbers in a database before you use /Data Sort, and include the record numbers in the Data Range. You can then use the field that contains these numbers as the primary sort key if you want to re-sort the records back to their original order.

/Data Sort Data-Range

Use /Data Sort Data-Range to specify the range you want to sort—either records in a database or rows in the worksheet.

1. Select /Data Sort Data-Range.
2. Specify the range of data you want to sort and press ENTER.

Include all the rows and columns you want to sort, but not the field names.

5-32 Data Commands
Data Sort Go
Use Data Sort Go to sort the data in the data range according to the primary and secondary key settings.
1. Before you use /Data Sort Go, you must specify a data range and a primary sort key. The secondary sort key is optional.
2. Select /Data Sort Go.

/Data Sort Primary-Key
Use /Data Sort Primary-Key to determine the primary field 1-2-3 will use to sort the data in the data range. You must specify a primary key and sort order before you can perform a sort.
1. Select /Data Sort Primary-Key.
2. Specify the cell in the field or column you want 1-2-3 to use to sort the data and press ENTER.
3. Specify a sort order:
   - A: Sorts numbers and letters in ascending order.
   - D: Sorts numbers and letters in descending order.

/Data Sort Quit
Use /Data Sort Quit to return 1-2-3 to READY mode without sorting the records or rows.

/Data Sort Reset
Use /Data Sort Reset to clear the data range and primary and secondary sort key settings.

/Data Sort Secondary-Key
Use /Data Sort Secondary-Key as an optional setting to determine the secondary field 1-2-3 will use to sort data. This is used as a tie-breaker for records in a database or rows in the worksheet that have identical primary sort key entries. After sorting the data according to the primary field, 1-2-3 will sort the data according to the secondary field. For example, if you select the field NAME as the primary sort key and the field SALES as the secondary sort key, 1-2-3 sorts any records with the same NAME by SALES.
Follow these steps when using /Data Sort Secondary-Key:

1. Select /Data Sort Secondary-Key.
2. Specify any cell in the field or column you want 1-2-3 to use as a tie-breaker and press ENTER.
3. Specify a sort order:
   A       Sorts numbers and letters in ascending order.
   D       Sorts numbers and letters in descending order.

/Data Table

The Data Table command lets you calculate a table of results when you provide different numbers for the same formulas. You can use the Data Table command to perform "what-if" or "sensitivity" analyses, and cross-tabulate the information in a 1-2-3 database.

Terms to Know

A data table is an area of a worksheet that contains the input values, formula, and results of the calculations.

A variable is the part of a formula for which input values can be substituted. For example, the formula A1*B2 contains one variable, B1.

An input cell is an unprotected cell in which 1-2-3 places values when it performs calculations. Each variable is a formula has a separate input cell.

An input value is a value 1-2-3 substitutes for a variable when it performs calculations. You must include input values in the data table.

The results area is an unprotected area of a data table in which 1-2-3 enters the results of the calculations.

Before You Use /Data Table

Before using /Data Table you must have a formula containing a variable, plus the input values you want 1-2-3 to substitute for the variable. For example, you have a formula that multiplies an hourly wage by the number of hours to calculate the payment due. The variable is the number of hours; the input values are the range of hours you specify. 1-2-3 will then calculate the range of payments due.

5-34 Data Commands
1-2-3 can create two types of data tables: data table 1 and data table 2. The type of data table you create depends on the number of variables you want to use in your formulas. Use /Data Table 1 if you have one or more formulas with one variable for which you want to substitute a range of numbers; use /Data Table 2 if you have one formula with two variables for which you want to substitute a range of numbers.

Formulas in data tables can contain values, strings, or cell addresses. Do not use logical formulas in data tables because logical formulas always produce the value 0 or 1, and all the resulting values will equal 0 or 1.

You can use /TABLE to repeat the last Data Table command you selected. This key is helpful if you are using a Data Table command such as /Data Table 2 to perform a what-if analysis, because you can change values and then instantly repeat the command without using the menu.

Example: Performing a What-If Analysis. The illustration shows how you can use /Data Table 2 to calculate a variety of weekly payments depending on the number of hours per week and the hourly wage. The values in B6:BI1 represent a range of hours per week, and the values in C5:ES represent a range of hourly wages. The dollar amounts in C6:ES1 represent the results of substituting the two sets of variables into the formula in B6. (Cells B3 and B5 are formatted with /Range.
Format Text so you can see the formula in the cell; cells C5..E11 are formatted with /Range Format Currency.

If you have a database that shows company sales broker days by salesman, month of sale, account, and dollar amount for each sale, with the Data Table command, you can cross-tabulate the information in the database to show the total sales for each person for each month.

/Data Table 1

/Data Table 1 produces a table that shows the effect of changing one variable in one or more formulas.

1-2-3 places the results of each formula in the columns below the formula. For example, the data table illustrated shows the salaries resulting from a range of hours in 1 week (column C), 10 weeks (column D) and 20 weeks (column E). The formula is written in cell B3 with the variable in B1. This makes it easy to identify the input cell. Cells C5..E5 and B3 are formatted with /Range Format Text so you can see the formulas in the cells.

Before you use /Data Table 1, you must set up the data table range. The following procedure uses the data table in the previous illustration as an example for setting up a data table range:

1. Decide on a location for the data table range. You must use the following structure when setting up a data table range:

5.36 Data Commands
- The left column contains the variables.
- The upper left cell is empty.
- The formula is located in the top cell of the second column.
- Additional formulas are located in adjacent cells to the right of the first formula.

In our example, the data table range is B5..E11; the input values (hours per week) are in B6..B11, the formula (salary for one, 10, and 20 weeks, based on hours per week) in C5..E5, and the results area in C6..E11.

2. Decide on the location for the input cell

The initial formula (salary times hours per week) is in B3; the variable (hours per week) is in B11, which is also the input cell. You can document the location of the input cell by entering a label such as “Input 1” next to the input cell.

The input cell can be empty. However, you can write the formula so the input cell contains a variable used in the formula. This helps to clarify where 1-2-3 places the input values to calculate the results.

3. Enter the formula in the first row at the top of the second column of the data table range. Make sure the formula refers to the input cell, directly or indirectly. The previous illustration is an example of an indirect reference. The formula in the next illustration uses a direct reference.

Only one formula is required.

In our example, the initial formula is in B3. C5 uses the formula in B3. The other formulas in E5 (10 weeks) and E6 (20 weeks) both use the formula in B3, which contains a reference to B1, the input cell.

**Note**

Unless the input cell contains data, the formula will evaluate to 0 or ERR. This will not, however, affect the results of the /DEA Table command.

4. In the first column of the data table range, starting with the second cell, enter the input values you want to use in each of the formulas.

**Data Commands** 5-37
If you are using array formulas in the data table, enter labels instead of values in the first column of the data table range.

In the previous illustration, the input values (the hours per week) are in B5..B11.

5. Select /Data Table 1.
6. Specify the data table range and press ENTER.
7. Specify the input cell and press ENTER.

In our example, this is B1. 1-2-3 calculates each of the formulas in B5..E5, using each of the input values in B6..B11. The result of each calculation appears in the cell at the intersection of the row and column containing the input value and formula respectively. In our example, the results area is C6..E11.

Using /Data Table 1 with a Database

/Data Table 1 lets you analyze or cross-tabulate the data in a 1-2-3 database. You can use database functions in the formulas in the data table. This allows you to perform calculations using data from selected records in the database.

Before using /Data Table 1 with a database, you need to be familiar with the following:
- The structure of databases. See "1-2-3 Databases" at the beginning of this chapter.
- Database functions. For detailed information on the database functions, see "Data Protection Descriptions" in Chapter 3.

Before using /Data Table 1, you must set up the data table range.
1. Decide on a location for the data table range and input cell.
2. Enter the formulas. Be sure to include a reference to the input cell.
3. Enter the input values. You must enter these values or labels exactly as they appear in the database.
4. Position the cell pointer in the blank cell in the upper left corner of the data table.
5. Select /Data Table 1.
6. Specify the data table range and press Enter.
7. Specify the input cell and press Enter.

1-2-3 calculates each of the formulas, using each of the input values. The result of each calculation appears in the cell at the intersection of the row and column containing the input value and formula, respectively.

You can use an XY graph to graph information from a data table. The X range is the range of values in the first column, and the other ranges are selected columns in the results area of the table.

/Data Table 2
/Data Table 2 produces a table that shows the effect of changing two variables in one formula. For example, the data table in the figure below shows the effect of varying the interest rate and the principal in an @PMT formula.

![Data Table 2 Example](image)

Before using /Data Table 2, you must set up the data table range. (The following procedure uses the data table in the illustration as an example.)
1. Decide on a location for the data table and input cells 1 and 2.
Input cell 1 always refers to the values in the first column of the data table. Input cell 2 always refers to the values in the first row of the data table.

In our example, the data table range is B4:D9, the first set of input values (interest rate) is in B3,B6, the second set (principal) in C4,D4, the formula in B4, and the results area in C5,D5. The two input cells are in B1 and B2. Because the input values for the interest rate are in the first column, cell B1 (which represents the interest rate in the PMT formula) must be input cell 1. Because the input values for the principal are in the first row, cell B2 (which represents the principal in the PMT formula) must be input cell 2. You can document the location of each input cell by entering a label such as "Input 1" or "Input 2" next to each input cell.

2. Enter the formulas in the upper left cell of the data table range.

Make sure the formula refers to both input cells.

In our example, the PMT formula is in B4 (the entire formula is visible in the control panel). The formula contains references to B1, the first input cell, and B2, the second input cell.

Note: Unless the input cells contain data, the formulas will evaluate to 0 or ERR. This will not, however, affect the results of the Data Table command.

3. Enter the input values for the variable associated with input cell 1.

In the example, the input values for the interest rate are in the first column of the data table (D5:B9) because the variable that represents the interest rate (B1) is associated with input cell 1. (The input values are formatted with Range Format Percent.)

Note: If you are using string formulas in the data table, enter labels instead of values in the first column of the data table range.

4. Enter the input values for the variable associated with input cell 2.

In the example, the input values for the principal are in the first row of the data table (C4:D4) because the variable that represents the principal (B2) is associated with input cell 2.

5. Select Data Table 2.
6. Specify the data table range and press Enter.
7. Specify input cell 1 and press Enter.
8. Specify input cell 2 and press Enter.

1-2-3 pairs each input value in the top row of the data table range with each input value in the first column of the data table range and calculates the formulas using each pair of values. The result of each calculation appears in the cell at the intersection of the row and column containing the two input values. In our example, the results are in C5, D5.

Using /Data Table 2 with a Database

/Data Table 2 lets you analyze or cross-tabulate the data in a 1-2-3 database. You can use a database function in the formula in the first cell of the data table range, letting you perform calculations using data from selected records in the database.

Before you use /Data Table 2 with a database, you need to be familiar with the following:
- The structure of databases. See "1-2-3 Database" at the beginning of this chapter.
- Database functions. For detailed information on the database functions, see "Function Descriptions" in chapter 14.

Before using /Data Table 2, you must set up the data table range.

1. Decide on a location for the data table range, input cell 1, and input cell 2.
2. Enter the formula, making sure it refers to both input cells.
3. Enter the input values for input cell 1. You must enter these values or labels exactly as they appear in the database.
4. Enter the input values for input cell 2. You must enter these values or labels exactly as they appear in the database.
5. Select /Data Table 2.
6. Specify the data table range and press Enter.
7. Specify input cell 1 and press Enter.
8. Specify input cell 2 and press Enter.

1-2-3 pairs each input value in the top row of the data table range with each input value in the first column of the data table range and calculates the formulas using each pair of values. The result of each calculation appears in the cell at the intersection of the row and column containing the two input values.

Data Commands 541
You can use an XY graph to graph information from a data table.
1. Use the values in either the first column or the top row as the X range; use other columns in the rectangle area of the table as data ranges A - F. Do not include the formula in the top left cell of the table range in any of the graph ranges.

/Data Table Reset

/Data Table Reset clears all the table range and input cell settings you specified in the worksheet.
1. Make sure the cell pointer is in the file containing the table ranges and input cell settings you want to clean.
2. Select /Data Table Reset.
3. 1-3-3 clears all the table range and input cell settings.

5-42  Data Commands
The File commands organize and maintain the information you store in files. File commands also manipulate data between files. Use File commands to do any of the following:

■ Name, save, retrieve or erase a file.
■ Import, extract, or combine files.
■ Change the file directory for the current session.
■ Obtain a list of files by file type.
File Names

When you save a file on disk, 1-2-3 prompts you for a file name. Use the following general guidelines for assigning a file name:

- File names can contain up to eight characters. Letters, numbers, underscores (_), and hyphens (-) are acceptable. Spaces are not allowed.
- Upper and lowercase letters are equivalent in file names.
- Some of the file names to avoid are AUX, CON, COM1, COM2, LPT1, NUL, and PRN (see appendix B for a complete list of MS-DOS reserved names).

File Extensions

A file extension is an optional extension that you can add to a file name. It consists of a period followed by one to three characters. File extensions allow you to group files into categories. If you do not provide an extension, 1-2-3 will automatically add an extension, depending on the file type:

<table>
<thead>
<tr>
<th>File Type</th>
<th>Extension</th>
<th>File Type</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backup worksheet</td>
<td>BACK</td>
<td>Getch file</td>
<td>PIC</td>
</tr>
<tr>
<td>file</td>
<td>PRN</td>
<td>Worksheet 3</td>
<td>WK1</td>
</tr>
<tr>
<td>Print or text file</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

File Command Descriptions

The following section describes the File commands.

Remember that you can press HELP (F1) to get information about the command you are using.

6.1 File Commands
/File Admin

Use /File Admin to recalculate formulas, get and release a file reservation, or create a table of information about disk files.

/File Admin Link-Refresh

Use /File Admin Link-Refresh to recalculate formulas in the current worksheet that refer to worksheet files on disk.

/File Admin Reservation

This command is not available on Lotus 1-2-3 or the HP 95LX.

/File Admin Table

Use /File Admin Table to create a table of information about files and directories on disk.

1. Decide where on your worksheet you want to place the file table. Because 1-2-3 writes over existing data when it creates the table, make sure that the worksheet location you choose is either blank or contains unimportant information.

2. Select /File Admin Table.

3. Select one of the following options:
   - **Worksheet** Creates a table of worksheet files (*.WKS, *.WK1, and *.WK3).
   - **Print** Creates a table of print files (*.PRN).
   - **Graph** Creates a table of graph files (*.PIC).
   - **Other** Creates a table of all files (*.*).
   - **Linked** Creates a table of all files linked to the current worksheet by formula references.

4. To list files in the displayed directory, press (RETURN) to list files in a different drive and/or directory, edit the displayed drive/directory and press (RETURN).

5. Specify the range determined in step 1 and press (RETURN).
File Combine

Use /File Combine to add to, copy to, or subtract incoming data from your current worksheet. 1-2-3 changes cell formats in the current worksheet to reflect those of the incoming data, but it doesn’t change range names or other settings, such as column widths. (You cannot combine 1-2-3 Release 3 files, saved in the WK3 worksheet file format, with the current worksheet.)

File Combine Add

Use /File Combine Add to add numbers and the results of numeric formulas in a worksheet file on disk to numbers and blank cells in the current worksheet. The incoming data has no effect on labels or formulas in the current worksheet.

Because /File Combine Add changes numbers in the current worksheet beginning at the cell pointer position, verify that the pointer is in the correct position. To avoid possible data loss from incorrectly importing files, save your current worksheet before using /File Combine Add. If you have combined files incorrectly and the UNDO feature is on, use UNDO (CUT COPY) immediately to restore the original worksheet.

Follow these steps to add files:

1. Move the cell pointer to where you want 1-2-3 to start adding the data.
2. Select /File Combine Add.
3. Select one of the following options:
   - Entire-File: Adds all numeric data in a file to the current worksheet.
   - Named-Range or Specified-Range: Add numeric data in a file range to the current worksheet. Specify the range and press ENTER. (You cannot specify a range if a file saved is the WK3 worksheet file format.)
4. Specify the file you want to add to the current worksheet and press ENTER. (If the file is password-protected, type the password exactly as it was created and press ENTER.)

(Do not use this feature to add date or time numbers because the results will not be meaningful.)

64 File Commands
Use /File Combine Copy to copy data (labels and values) from a worksheet file to the current worksheet, beginning at the cell pointer location.

Because /File Combine Copy enters data in the current worksheet beginning at the cell pointer position, verify that the position is in the correct position. To avoid possible data loss from incorrectly importing files, save your current worksheet before using /File Combine Copy. If you have combined files incorrectly and the UNDO feature is on, press UNDO (ALT F4) immediately to restore the original worksheet.

Follow these steps to combine files:
1. Move the cell pointer to where you want 1-2-3 to start copying the data.
2. Select /File Combine Copy.
3. Select one of the following options:
   - Entire-File Copies all data in a file to the current worksheet
   - Named-Range Copies data in a named range to the current worksheet Specify the range and press ENTER.
   - Specified-Range (You cannot specify a range in a file saved in the .WK3 worksheet file format.)

4. Specify the file you want to copy to the current worksheet and press ENTER. (If the file is password-protected, type the password exactly as it was created and press ENTER.)

File Combine Subtract

Use /File Combine Subtract to subtract numeric data (and the results of numeric formulas) in a file from the current worksheet. It works the same way as the Add feature, except that it subtracts instead of adding. And, as with Add, the incoming data has no effect on labels or formulas in the current worksheet.

Because /File Combine Subtract changes numbers in the current worksheet beginning at the cell pointer position, verify that the position is in the correct position. To avoid possible data loss from incorrectly importing files, save your current worksheet before using /File Combine Subtract. If you have combined files incorrectly and the UNDO feature is on, press UNDO (ALT F4) immediately to restore the original worksheet.
Follow these steps to subtract files:

1. Move the cell pointer to where you want 1-2-3 to begin subtracting the data.
2. Select /File Combine Subtract.
3. Select one of the following options:
   - Entire-File  Subtracts all numeric data in a file from the current worksheet.
   - Named-Range  Subtracts numeric data in a file range from the current worksheet. Specify the range and press Enter. (You cannot specify a range in a file saved in the WK2 worksheet file format.)
   - Specified-Range  Enter. (If the file is password-protected, type the password exactly as it was created and press Enter.)
4. Specify the file you want to subtract from the current worksheet and press Enter. (If the file is password-protected, type the password exactly as it was created and press Enter.)

Don't use this feature to subtract date or time numbers because the results will not be meaningful.

/File Directory

Use /File Directory to override the default directory for the current 1-2-3 session. (The directory consists of a drive name (such as A: or C:) followed by a \ (backslash), and possibly a subdirectory.)

For example, suppose your default directory is C:\\12, but the files you want to use during the current session are in C:\\EXPENSES. You can use /File Directory to make C:\\EXPENSES the current directory (1-2-3 automatically uses that directory during the current session). Or, if you are using data files on a RAM disk in drive A:, you can use /File Directory to make A:\ the current directory. 1-2-3 will use the specified directory until you use /File Directory again, use /Worksheet Global Default Directory, or end the 1-2-3 session.

Follow these steps to change the current directory:

2. Choose one of the following:
   - Press Enter to accept the displayed directory.
   - Type the name of the new directory and press Enter.

If the current worksheet contains linking formulas that do not include paths as part of their references, and you use /File Directory to change the default directory, 1-2-3 will no longer be able to locate.

6-6  File Commands
the source files to which the formulas refer. The linking formulas will evaluate to ERR.

/ File Erase

Use /File Erase to erase a file on disk. Once you erase the file, you cannot retrieve the data or use UNDO to recover the file, so before using this feature, make sure that you no longer need the data you are erasing. You cannot erase the current file if anyone has the reservation for it.

Note these differences between /File Erase and /Worksheet Erase:

- /File Erase erases a file on disk.
- /Worksheet Erase removes the current worksheet from memory (leaving a blank worksheet), but it does not erase the corresponding file on disk.

Follow these steps to erase a file:

1. Select /File Erase.
2. Select one of the following options:
   - Worksheets: Displays worksheet files in the current directory (*.WKS, *.WK1, and *.WK3.)
   - Print: Displays print files in the current directory (*.PRT).
   - Graph: Displays graph files in the current directory (*.GPH).
   - Other: Displays all files in the current directory (*.).
3. If 1-2-3 cannot find specified files, it enters EDIT mode:
   - To display files with a different extension, type "." followed by the extension and press ENTER.
   - To display all files in the current directory, type ".*" and press ENTER.
4. If you want to list different files, press ESC to clear the file names, type the new file name, and press ENTER.
5. Specify the name of the file to erase and press ENTER.
6. Select either of the following options:
   - No: Cancels the command without erasing the file.
   - Yes: Erases the file on disk.
/File Import

Use /File Import to copy data from a print or text file into the current worksheet beginning at the cell pointer position. There are two types of text files:

- A delimited text file contains characters (delimiters) that separate data. 1-2-3 imports both labels and numbers, entering them in different cells. To import this file type correctly, labels must be enclosed in quotation marks, and all labels and numbers must be separated by commas, spaces, colons, or semicolons. (Don't format numbers with commas because the comma will act as delimiters.) Use /File Import Numbers to import data from a delimited text file.

- A non-delimited text file does not separate data. To import this file type correctly, each line in the file must end with a carriage return or a line feed and must not exceed 240 characters. Use /File Import Text to import both labels and numbers. 1-2-3 treats each line of data in the text file as a long label, entering it in a separate cell. (To create a non-delimited text file with 1-2-3, use /Print File.)

To avoid possible data loss from incorrectly importing files, save your current worksheet before using /File Import. If you make a mistake and the UNDO feature is on, press UNDO (Ctrl-Z) immediately to restore the worksheet to its original state.

Follow these steps to import data:

1. Move the cell pointer to an area of the worksheet large enough to accommodate the imported data.
2. Select /File Import.
3. Select one of the following options:

   Text Imports labels and numbers from a non-delimited text file beginning at the cell pointer position in the current worksheet. (You can view or print data imported with /File Import Text, but you cannot use the numbers in calculations unless you use /Data Page to place the labels and numbers in separate cells in the worksheet.)

   Numbers Imports only numbers from a non-delimited text file; imports numbers and labels from a delimited text file. 1-2-3 places each entry in a separate cell.
beginning at the cell pointer location in the current worksheet.

4. To display files in a different drive or directory, press ESC to clear the displayed file name, enter the drive and/or directory, and press ENTER.

5. Specify the name of the text file to import and press ENTER.

/FILE LIST

Use /FILE List to display a temporary list of files that override the current worksheet. When you highlight a file name, 1-2-3 displays specific information about that file.

1. Select /FILE List.
2. Select one option:
   - **Worksheet**: Lists worksheet files (*WKS, *.WKS), and
     *WKS) in the current directory.
   - **Print**: Lists print files (*PRN) in the current directory.
   - **Graph**: Lists graphic files (*.PIC) in the current directory.
   - **Other**: Lists all files (*.*) in the current directory.
   - **Linked**: Lists all files linked to the current worksheet by formula references.

3. If 1-2-3 can't find the specified files, it enters EDIT mode:
   - To list files with a different extension, type *. followed by the new extension and press ENTER.
   - To list all files in the current directory, type *. and press ENTER.

4. To display files in a different drive or directory, press ESC to clear the displayed file name, enter the drive and/or directory, and press ENTER.

5. Use the pointer-movement keys to highlight a file name and display information:
   - If you select Worksheet, Print, Graph, or Other, 1-2-3 displays the name, the date and time the file was last saved, and the size of the file in bytes.
   - If you select Linked, 1-2-3 displays the names of all files on disk that are linked to the current worksheet.

6. Press ENTER to return to the current 1-2-3 worksheet.
**File Retrieve**

Use /File Retrieve to read a file from disk. The retrieved worksheet file will replace the current worksheet. (Use /File Save to save the current worksheet before you select /File Retrieve. If the UNDO feature is on, you can press UNDO ([Alt]+[F]) immediately to restore the worksheet that was in memory when you selected /File Retrieve.)

Follow these steps to retrieve a file:

1. Select /File Retrieve. (You cannot retrieve files saved in .WK3 format.)
2. If you want to display other files, press [ESC] to clear the file names, then enter the desired drive and/or directory, and press [ENTER].
3. Specify the name of the file you want to retrieve and press [ENTER].
4. If you are trying to retrieve a file shared on a network that is removed by someone else, select one of these options:
   - Yes: Retrieves the file without the reservation; changes cannot be saved to the same file name.
   - No: Cancels the command without retrieving the file.
5. If the file is password protected, type the password and press [ENTER].

Normally, when you start 1-2-3, the program displays a blank worksheet. You can, however, have 1-2-3 display a particular worksheet automatically every time you start the program. Use /File Save to save the desired worksheet in a file named AUTO123.WK1 in the default directory. 1-2-3 will then retrieve that file whenever you start 1-2-3.

**File Save**

Use /File Save to create a permanent copy of your worksheet on disk. (You can create new files, update existing files, or change the name or extension when you save a file. 1-2-3 assigns a .WK1 extension to files you create with /File Save unless you enter a different extension when you name the file.)

Saving a File without a Password:

1. Select /File Save.

6-10 File Commands
2. 1-2-3 displays the current directory and the default file extension; if the file has been saved before, 1-2-3 also displays the file name. Do one of the following:

- If the current worksheet is unsaved, type a file name and press <Enter>. To save the file to a different drive or directory, press (ESC) twice, edit the drive/directory, type a file name, and press <Enter>.
- If the worksheet has been saved before, and you want to use the same file name, press <Enter>. To save the file with a different name in the same directory, type a new file name and press <Enter>.
- If the current worksheet has been saved previously and you want to save the file in a different drive or directory, press <ESC> twice, edit the drive/directory, specify a file name, and press <Enter>.
- If the file is shared on a network, you need the reservation to save it to the same file name. Use /File Admin Reservation Get to see if the reservation is available. If it isn't and you want to save your changes, you must save the file under a different file name.

3. If saving to an existing file, select one of the following options:

- Cancel. Returns 1-2-3 to ready mode without saving the worksheet.
- Replace. Writes over the saved worksheet file with a copy of the current worksheet.
- Backup. Copies the worksheet file (on disk) to a backup file with the same name, but with extension .BAK; saves the current worksheet with the existing file name and with the extension .WK1.

**Saving a File with a Password.**

(Remember, when you save a file with a password, you must enter the password exactly as it was saved before you can read the file.)

1. Select File Save.
2. 1-2-3 displays the current directory and the default file extension; if the file has been saved before, 1-2-3 also displays the file name. Do one of the following:

- If you are updating the file, press the space bar once to enter a space after the current file name or edit the file name and then press the space bar once. Do not press <Enter>.
- If the file is new, enter the file name and press the space bar once. Do not press <Enter>.

File Commands 6-11
3. Type a and then press [ENTER].
4. Type a password and press [ENTER]. (1-2-3 displays blanks as you enter the password.) Passwords can contain any combination of uppercase and lowercase letters.
5. Type the same password again at the Verify password prompt and press [ENTER].
6. If you are updating the file, select Replace to save the file with the password.

Changing a Password
Follow these steps to change your password:
1. Select /File Save.
2. Press [Esc] once to clear the PASSWORD PROTECTED prompt.
3. Press the space bar once.
4. Follow steps 2 through 5 in the preceding procedure.

Deleting a Password
Follow these steps to delete your password:
1. Select /File Save.
2. Press [Esc] once to clear the PASSWORD PROTECTED prompt and press [Enter].
3. Select Replace to update the file without a password.

/FILE Xtract
Use /File Xtract to save a range of data from the current worksheet to a new worksheet file on disk. /File Xtract also saves all settings associated with the worksheet in the extracted file. (This command does not change the current worksheet.)

Before you use /File Xtract, note the following:
- If you extract a formula, make sure that you extract all data referred to by the formula, or the formula may not produce the expected results.
- If you extract data in a named range, make sure you extract the entire named range, or the range name in the extracted file may not refer to the correct range of data.

6-15 File Commands
Follow these steps to extract a file:

1. Select /File Xtract.
2. Select one of the following options:
   - **Formulas**: Copies a range of data in the current worksheet to a file on disk, including labels, numbers, formulas, and worksheet settings.
   - **Values**: Copies a range of data in the current worksheet to a file on disk, including labels, numbers, values of formulas, and worksheet settings.

3. If you want to save the extracted data in a different drive or directory, press the drive/directory, press [ENTER] to clear the file names, edit the drive/directory, and then press [ENTER].

4. Specify a file name for the extracted data and press [ENTER].

5. Specify the range of data you want to extract and press [ENTER].

(1-2-3 enters the extracted range in the new file beginning in cell A1. If you extracted formulas, 1-2-3 adjusts the cell references to reflect their new locations.)

6. If you specified a file name that already exists, select one of the following options:
   - **Cancel**: Returns 1-2-3 to READY mode without extracting the range.
   - **Replace**: Writes over the file on disk with the extracted range.
   - **Backup**: Replaces the previously extracted file on disk with the extension .BAK and saves the extracted range with the existing file same and the extension .WKL.

---

File Commands 8-13
Extracting a File with a Password. You can limit access to a worksheet by extracting it with a password. No one can read that file without knowing and specifying the password.

Follow these steps to extract a file with a password:

1. Follow steps 1 through 3 in the preceding procedure.
2. Specify a file name for the extracted data, press the space bar, type p, and then press ENTER.
3. Type a password and press ENTER.
4. Type the same password again at the Verify password prompt and press ENTER.
5. Specify the range of data you want to extract and press ENTER. (1-2-3 enters the extracted range in the new file beginning in cell A1. If you extracted formulas, 1-2-3 adjusts the cell references to reflect their new locations.)
6. If you specified a file name that does not already exist, 1-2-3 saves the extracted file in a password-protected file. If you specified a file name that already exists, select one of the following:
   - Cancel: Returns 1-2-3 to READY mode without extracting the range.
   - Replace: Writes over the file on disk with the extracted range.
   - Backup: Renames the previously extracted file on disk with the extension .BAK and saves the extracted range with the existing file name and the extension .WK1.

1-14 File Commands
The Graph Commands

Worksheet Range Copy Move File Print Graph Data System Again Quit
Type X A B C D E F Reset View Date Options Name Group Quit
Line Bar XY Block Pen Cancel Replace
Graph X A B C D E F Options Quit
Chart Create Delete Menu Table
Legend Format View Grid Scale Copy Edit Data Labels Quit

The Graph Commands: 7-1
Graphs are tools for illustrating the relationships between numbers. Because of their visual nature, graphs often convey messages about numbers more quickly and dramatically than the numbers themselves. Use the Graph commands to perform these tasks:

<table>
<thead>
<tr>
<th>Command</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>/Graph A - F</td>
<td>Specifies the ranges that contain the numeric data you want to graph.</td>
</tr>
<tr>
<td>/Graph Group</td>
<td>Specifies multiple graph data ranges as areas when the ranges are located in consecutive columns or rows.</td>
</tr>
<tr>
<td>/Graph Name</td>
<td>Creates, modifies, and deletes named graphs in the current worksheet and creates tables of named graphs.</td>
</tr>
<tr>
<td>/Graph Options</td>
<td>Adds subelements such as titles, legends, rulers, and grid lines to a graph and determines the scaling method for the graph's axes.</td>
</tr>
<tr>
<td>/Graph Quit</td>
<td>Returns 1-2-3 to READY mode.</td>
</tr>
<tr>
<td>/Graph Reset</td>
<td>Resets some or all of the current graph settings to the default graph settings.</td>
</tr>
<tr>
<td>/Graph Save</td>
<td>Saves the current graph to a graph (.GRF) file.</td>
</tr>
<tr>
<td>/Graph Type</td>
<td>Specifies the kind of graph to create: line graph, bar graph, XY graph, stacked bar graph, or pie chart.</td>
</tr>
<tr>
<td>/Graph View</td>
<td>Displays the current graph on your screen.</td>
</tr>
<tr>
<td>/Graph X</td>
<td>Specifies the range that contains the x-axis labels, x-axis values for an XY graph, or the pie slice labels.</td>
</tr>
</tbody>
</table>

When you're viewing a graph, you can use the Zoom and Pan capabilities. If you wish to view an area more closely, each press of \( \text{F2} \) increases the magnification by 0.5 (up to 4 times the original scale). Then, the \( \text{F3} \) \( \text{F4} \) \( \text{F5} \) \( \text{F6} \) and \( \text{F7} \) \( \text{F8} \) \( \text{F9} \) \( \text{F10} \) keys allow you to move around the graph. (Pressing \( \text{F1} \) ultimately returns the graph to its original size.)

Remember that you can press HELP (F3) to get information about the command you are using.

7.4 The Graph Commands
The /Graph Settings Sheet

When you select /Graph or any of the graph subcommands, 1-2-3 displays special screens called /Graph settings sheets. On these screens, 1-2-3 lists the names of graph settings and the settings for the current graph (if any). 1-2-3 will use these settings the next time you display a graph with /Graph View or GRAPH (F2).

The /Graph settings sheets allow you to see the settings for the current graph at a glance. You can change any of the settings with the Graph commands displayed in the menu above the settings sheet.

1-2-3 Graph Types

With 1-2-3, you can create five basic graph types:

- Bar
- Line
- Pie
- Stacked bar
- XY (scatter)

These graph types are explained and illustrated on the following pages.
Bar Graphs

Bar graphs consist of a series of bars, each bar representing a value. You can use bar graphs to compare related data at a given point in time. In our example, the bar graph shows three categories of products sold by Dawes Manufacturing and compares the sales for one week.

Use the following guidelines to determine the appropriate graph data ranges for a bar graph:

- For a single range bar graph, use /Graph A to indicate the range of values you want each bar to represent.
- For a multiple range bar graph, use /Graph A - P to indicate the ranges of values you want to represent simultaneously.
- Use /Graph X to indicate labels for the x-axis.

7-4 The Graph Commands
Line Graphs

Line graphs are generally used to plot changes in one or more data values over time. Each line in a line graph represents a category of data, and each point along the line represents the data's value at a particular time. The line graph in our example compares the weekly sales of the three products from Dave's Manufacturing for one month. Because line graphs stress continuity of data over time, they are particularly useful for identifying trends and making projections.

Use the following guidelines to determine the appropriate graph data ranges for a line graph:

- Use /Graph A to indicate the set of values you want to represent with your first line, or with one single line.
- Use /Graph B - F to indicate the sets of values you want to represent with each additional line.
- Use /Graph X to indicate labels for the x-axis.
Pie Charts

Pie charts (graphs) are used to relate two or more values to one another by representing the values as slices of a pie. They are useful for comparing parts to the whole. You can emphasize one or more values in a pie chart by exploding (separating slightly) the slices that represent those values. The pie chart in our example shows the weekly sales of the three Dawes Manufacturing products, with tire sales exploded.

Use the following guidelines to determine the appropriate graph data ranges for a pie chart:

- Use /Graph A to indicate the set of values you want to represent as slices of pie.
- Use /Graph B to indicate the range where you entered values for controlling the hatch patterns or colors for slices of pie, or for exploding slices of pie. (For instructions, see /Graph A - F later in this chapter.)
- Use /Graph X to indicate labels for the slices of pie.

7-6 The Graph Commands
Stacked Bar Graphs

Stacked bar graphs compare values by stacking them one on top of the next in a single bar and using different colors or hatch patterns to differentiate the parts of the bar. The stacked bar graph in our example compares product sales in yet another way.

Use the following guidelines to determine the appropriate graph data ranges for a stacked bar graph:

1. Use /Graph A - F to indicate each set of values you want to represent as portions of bars. Positive values are stacked by range in ascending alphabetical order: the portion that represents the A data range appears below the portion that represents the B data range; the portion that represents the C data range appears below the portion that represents the B data range, and so on. Negative values are stacked by range in descending alphabetical order. Mixed values appear above and below zero, still in alphabetical order.
2. Use /Graph X to indicate labels for the x-axis.
XY Graphs

XY graphs (also called scatter charts) are used to show correlation between two types of numeric data. XY graphs resemble line graphs in the sense that values are plotted as points in the graph. Unlike line graphs, however, XY graphs use a numeric scale along the x-axis.

![XY Graph Example](image)

Use the following guidelines to determine the appropriate graph data ranges for an XY graph:

- Use /Graph X to identify the set of values you want to plot on the x-axis.
- Use /Graph A to indicate the set of values you want to plot on the y-axis in your first line, or in one single line.
- Use /Graph B - F to indicate the sets of values you want to plot in each additional line.

Creating a Graph with the /Graph Menu

1. Select /Graph Type.
2. Select one of the following options: line, bar, XY, stack-bar, or pie.
3. Use /Graph X to specify the graph's x data range.
4. Use /Graph A - F to specify the graph's numeric data ranges (the worksheet ranges that contain the numbers to be graphed).

1-2-3 uses the data in the B range differently in a pie chart—see /Graph A - F.

1.6 The Graph Commands
If the X and A - F data ranges are in consecutive columns or rows of a range, you can use /Graph Group instead of /Graph X and A - F to specify the graph data ranges (see /Graph Group).

3. To view the graph, do one of the following:
   • Select View from the /Graph menu,
   • Press GRAPh (G) when 1-2-3 is in READY mode.
   The screen goes blank if 1-2-3 cannot display the graph for any reason (for example, you have not specified enough data for 1-2-3 to draw the graph).

6. To redisplay the worksheet, press GRAPh (G), ENTER, or (Esc).  

7. If you want to add explanatory text, colors, grid lines, and other enhancements to the basic graph, use /Graph Options.

8. If you want to save the graph so you can view it at another time, you must name the graph with /Graph Name Create (see “Saving the Graphs You Create” in the next section).

9. If you want to print the graph using a graph print utility, you must save the graph as a graph or picture (.PIC) file with /Graph Save (see “Saving the Graphs You Create” in the next section).

10. When you have completed the graph and want to return 1-2-3 to READY mode, select /Graph Quit.

Saving the Graphs You Create

Whenever you select /Graph View or press GRAPh (G), 1-2-3 displays a graph based on whatever graph settings are currently specified; this graph is called the current graph. As you use the Graph commands to specify new graph settings, the current graph changes. The current graph can be preserved in its present form for worksheet use, printing, or both.

Saving a Graph for Worksheet Use

• Use /Graph Name Create to store the current graph so you can display it at another time. You can continue to change the graph settings and create and store new graphs, and will be able to display and work with each of them. /Graph Name Create creates a named graph by assigning a name to whatever graph settings exist when you use the command, and stores the named graph in the worksheet.

The Graph Commands 7-9
Use /File Save to save the worksheet that contains the named graphs. This saves all the named graphs you created for use in future 1-2-3 sessions.

If you want to display and work with a named graph, select /Graph Name Use, which retrieves a named graph in a worksheet to make it once again the current graph.

**Saving a Graph for Printing**

Use /Graph Save to save the current graph so you can print it using a graph print utility. /Graph Save creates a graph (.PIC) file, which cannot be revised or modified in 1-2-3.

**Printing the Graphs You Create**

You can also print graphs you create in 1-2-3 with any program that prints graph (.PIC) files. Use /Graph Save to save the graph in a picture file, then import the file into the program you are using.

**/Graph A - F**

/G Graph A - F specifies the A - F data ranges, the ranges that contain the numeric data you want to graph.

The way 1-2-3 uses the A - F data range depends on the type of graph you create:

- **In a bar graph**, 1-2-3 uses the A - F data ranges as the sets of bars in the graph. 1-2-3 creates one set of bars for each data range, with each bar representing one value in the range.

- **In a line graph**, 1-2-3 uses the A - F data ranges as the lines in the graph. 1-2-3 creates one line for each data range, with each point along the line representing one value in the range.

- **In a pie chart**, 1-2-3 uses the A data range as the set of pie slices, the B data range to determine the color or hatch pattern of each pie slice (depending on whether graph display is set to color or black and white) and whether the slice explodes from the rest of the pie, and the A data range as labels for each pie slice.

To assign either colors or hatch patterns to the slices in a pie chart, create a B data range the same size as the A data range and enter a value from 1 to 8 in each cell in the B data range. When graph display is set to color, the B data range values determine the colors.
of the pie slices, the color each value represents depends on your monitor. When graph display is set to black and white, the B data range values determine the hatch patterns, which are the same for all monitors.

To explode one or more slices in a pie chart, add 100 to the B data range values that correspond to the slices you want to explode. For example, to explode the slice with cube or hatch pattern 6, enter 106 in the corresponding B data range cell.

- In a stacked bar graph, 1-2-3 uses the A - F data ranges as positions of the bars. Positive values are stacked by range in ascending alphabetical order; negative values are stacked by range in descending alphabetical order. Mixed values appear above and below zero, still in alphabetical order.

- In an XY graph, 1-2-3 uses the A - F data ranges as points plotted against the X data range. 1-2-3 creates one set of points for each data range you set.

Follow these steps when using /Graph A - F:

1. Select /Graph A, B, C, D, E, or F.
2. Specify the range you want to use as the A, B, C, D, E, or F data range and press ENTER.

The range should include only numeric data (numbers and/or numeric formulas). Cells containing labels will be interpreted by 1-2-3 as zero. The range must include at least two cells, and can include any number of columns and rows.
/Graph Group

Use /Graph Group to specify all graph data ranges (X and A-F) at once, when the X and A-F data ranges are in consecutive columns or rows of a range.

1. Select /Graph Group.
2. Specify the group range you want to divide into graph data ranges and press ENTER.
3. Select one of the following options:
   - Columnwise: Divides the group range into data ranges by columns.
   - Rowwise: Divides the group range into data ranges by rows.

1-2-3 uses the first column or row of the group range as the X data range and subsequent columns or rows as the A-F data ranges. If the range includes more than seven columns or rows, 1-2-3 stops assigning data ranges after the seventh column or row.

7.15 The Graph Commands
Example: The bar graph in our illustration shows /Graph Group being used to specify the X, A, B, and C data ranges, which are in consecutive rows of the range B5:E7. The group range is specified as B5:E7, Rowwise.

/Graph Name

/Graph Name lets you create, delete, and retrieve named graphs, and create a table of named graphs in the worksheet.

/Graph Name Create

Use /Graph Name Create to create or redefine a named graph by storing the current graph settings with the name you specify.
1. Display the current graph using \texttt{Graph View} or \texttt{GRAPH [F2]} to verify that the graph looks the way you want it to look.

2. Select \texttt{Graph Name Create}.

3. Specify an existing graph name or a new graph name of up to 15 characters and press \texttt{ENTER}. (1-2-3 does not distinguish between upper- and lower-case letters in graph names.)

   Follow these guidelines when you create graph names:
   - Do not include spaces, commas, semicolons, or the characters \texttt{+}, \texttt{-} \& \texttt{<} \texttt{>} \texttt{?} \texttt{#} in graph names because they may appear to be formulas to 1-2-3.
   - Do not use a name that already exists; if you do, you will overwrite the graph that was previously stored with that name.
   - Do not use names that look like cell addresses, such as P12 or EX10.
   - Do not use function names, advanced macro command keywords, or 1-2-3 key names as graph names.

\textbf{/Graph Name Delete}

Use \texttt{/Graph Name Delete} to delete a named graph.

1. Select \texttt{/Graph Name Delete}.

2. Specify the named graph you want to delete and press \texttt{ENTER}.

   If you did not mean to select Delete and the undo feature is on, select \texttt{UNDO} to return to the worksheet, then press \texttt{UNDO [F3]} immediately to restore the named graph.

\textbf{/Graph Name Reset}

Use \texttt{/Graph Name Reset} to delete all named graphs in the worksheet.

\textbf{/Graph Name Table}

Use \texttt{/Graph Name Table} to create a three-column table that alphabetically lists all named graphs in the worksheet, as well as graph types and titles.

1. Decide on a location for the graph name table. The table can be placed in any unprotected area of the worksheet.

2. Select \texttt{/Graph Name Table}.

3. Specify the location you decided on in step 1 and press \texttt{ENTER}.

   (You need to specify only the first cell of the table’s location.)
Note

/Graph Name Table will create a table that occupies three columns and as many rows as there are named graphs plus one blank row. To avoid possible data loss from writing over existing data, save the worksheet before using /Graph Name Table. After you are /Graph Name Table, select Quit to return to the worksheet and check the location of the table. If you make a mistake when placing the table and the undo feature is on, press UNDO (F2) (F3) immediately to restore the worksheet to its original state.

/Graph Name Use

Use /Graph Name Use to retrieve a named graph (making it the current graph).

Note

When you retrieve a named graph, you lose all of the previous graph settings. To preserve those settings for later use, assign them a name with /Graph Name Create before you use /Graph Name Use.

Follow these steps when using /Graph Name Use:
1. Select /Graph Name Use.
2. Specify a named graph and press ENTER.

/Graph Options

/Graph Options lets you select format options for your graph.

/Graph Options B&W

/Graph Options B&W (the default setting) sets the graph display to black and white. 1-2-3 displays bars and pie slices (if you specified a B data range for the pie chart) in contrasting hatch patterns.
1. Select /Graph Options B&W.
2. Select Quit to return to the /Graph Options menu.

The Graph Commands 7-15
/Graph Options Color

Because the HP 9845X does not display colors, if you select /Graph Options Color, 1-2-3 displays clear (no hatch pattern) bars and pie slices; and graph lines and symbols that are identical to those with B&W setting.

1. Select /Graph Options Color.
2. Select Quit to return to the /Graph Options menu.

If you have a color printer or plotter, you can see /Graph Options Color with /Graph Save even if your monitor does not display colors.

If you have a black and white printer, do not use /Graph Options Color with /Graph Save, because your printer will print all the ranges in solid blocks of black.

/Graph options Data-Labels

Use /Graph Options Data-Labels to label the contents of a range as labels for the points or bars in a graph. The labels come from the ranges you specify as the A - F data label ranges.

1. Select /Graph Options Data-Labels.
2. Select one of the following options:
   - A - F: Assigns the data label range you specify in step 3 to the selected data range.
   - Group: Assigns the data label range you specify in step 3 to all data ranges at once and clears any settings you previously established with /Graph Options Data-labels A, B, C, D, E, or F.
   - Quit: Returns you to the /Graph Options menu.

3. To specify the data label range, do one of the following:
   - If you selected A, B, C, D, E, or F, specify a data label range of the same size as the selected data range and press [ENTER].
   - If you selected Group, specify a data label range of the same size as all the data ranges combined and press [ENTER].

4. If you selected Group and then specified a range, select one of the following options:
   - Columnwise, to divide the data label range into individual ranges by columns.
   - Rowwise, to divide the data label range into individual ranges by rows.

7-16 The Graph Commands
5. Select one of the following options:
   Center  Places data labels on top of the points in a line.
   Left    Places data labels to the left of the points in a line.
   Above   Places data labels above the points in a line.
   Right   Places data labels to the right of the points in a line.
   Below   Places data labels below the points in a line.

   If you are creating data labels for a bar or stacked bar graph,
   1-2-3 places data labels above the corresponding bars if the values
   are positive and below if the values are negative regardless of the
   placement you specify.

6. Select Quit to return to the /Graph Options menu.

To label the slices in a pie chart, use /Graph X, not /Graph Options
Data-Labels.

To label only some of the values in a data range, leave blank the cells
in the data label range that correspond to the values you don’t want to label.

To include descriptive text in a line or XY graph, use /Graph A = F

   to create a line that positions the descriptive text correctly and create
   a corresponding data label range that contains the descriptive text.

   Then use /Graph Options format A = f Symbols or Neither to hide
   the line that positions the text.

   If the format of the cells containing the data label entries is Hidden,
   1-2-3 will not display them. 1-2-3 will, however, display data label
   entries stored in hidden columns

/Graph Options Format

Use /Graph Options Format to set the way 1-2-3 displays each line in
a line or XY graph. 1-2-3 can use symbols to mark the points along a
line, connect the points with lines, use both symbols and lines, or use
neither symbols nor lines.

1. Select /Graph Options Format.
2. Select one of the following options:
   ■ Graph, to format all lines in the graph at once.
   ■ A = F, to format the line defined by the specified data range.
   ■ Quit, to return to the /Graph Options menu.

The Graph Commands 7-17
3. Select one of the following options:
   - Lines, to connect the points along the line.
   - Symbols, to display a symbol at each data point.
   - Both, to display a symbol at each point and connect the points with lines. (This is the default display.)
   - Neither, to display neither symbols nor connecting lines.
4. Select Quit to return to the /Graph Options menu.

/Graph Options Grid
Use /Graph Options Grid to add or remove grid lines in a graph. (Pie charts do not include grid lines.)

1. Select /Graph Options Grid.
2. Select one of the following options:
   - Horizontal. Draws grid lines across the graph, originating from the left border.
   - Vertical. Draws grid lines up the graph, originating from the bottom border.
   - Both. Draws horizontal and vertical grid lines.
   - Clear. Cuts all grid lines from the graph, returning the graph to the 1-2-3 default display.

/Graph Options Legend
Use /Graph Options Legend to create legends for the graph's data ranges.

1. Select /Graph Options Legend.
2. Select one of the following options:
   - A - F, to assign a legend to an individual data range.
   - Range, to assign legends to all data ranges at once.
3. If you selected Range, specify the legend range and press ENTER. The legend range is the range that contains the legend for each graph data range.
4. If you selected A, B, C, D, E, or F, specify the legend for the data range by doing one of the following:
   - Type the actual legend (up to 10 characters) and press ENTER.
   - Press backslash (\), specify the cell that contains the legend, and then press ENTER.

If the format of the cells containing the legend entries is Hidden, 1-2-3 will not display them. 1-2-3 will, however, display legend entries stored in hidden columns when the graph is viewed.

7-11 The Graph Commands
To ensure that your legends will be displayed fully and print out completely, keep them each under 19 characters. (Legends over 19 characters will overlap and run off the 19 character screen.)

To assign legends to the slices of a pie chart, use the X data range.

/Graph Options Quit

/Graph Options Quit returns you to the /Graph menu

/Graph Options Scale

/Graph Options Scale determines the scaling method for the y-axis and (for XY graphs) x-axis scaling and the format of the numbers that appear along each axis. /Graph Options Scale also sets which entries in the X data range appear along the x-axis in line, bar, and stacked bar graphs.

1. Select /Graph Options Scale.
2. Select one of the following options:
   - Y-Scale, to set the scaling for the y-axis.
   - X-Scale, to set the scaling for the x-axis.
   - Skips, to set a skip factor for the x-axis labels.

   The skip factor determines which entries in the X data range 1-2-3 displays along the x-axis. For example, if you set a skip factor of 3, 1-2-3 displays along the x-axis only the first, fourth, seventh, tenth (and so on) entries in the X data range. The skip factor setting does not affect pie charts or XY graphs.

3. If you select Skips, specify a skip factor and press ENTER.
4. If you selected Y-Stage or X-Stage, select one of the following options:

<table>
<thead>
<tr>
<th>Command</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>Sets the scaling method for the selected axis to automatic (the default), to 1-2-3 automatically creates a scale that shows all the graph data.</td>
</tr>
<tr>
<td>Manual</td>
<td>Sets the scaling method for the selected axis to manual, so 1-2-3 creates a scale using the upper and lower limits you specify (or as near to those limits as possible if rounding is necessary). When 1-2-3 draws the graph, it displays only the data that falls within those limits.</td>
</tr>
<tr>
<td>Lower</td>
<td>Used only when you select /Graph Options Y-Stage or X-Stage Manual. Sets the lower scale limit (the default is 0 for the selected axis). In some instances, 1-2-3 rounds down the limit you specify. The lower limit with bar graphs is always 0.</td>
</tr>
<tr>
<td>Upper</td>
<td>Used only when you select /Graph Options Y-Stage or X-Stage Manual. Sets the upper scale limit (the default is 0 for the selected axis). In some instances, 1-2-3 rounds up the limit you specify.</td>
</tr>
<tr>
<td>Format</td>
<td>Sets the format in which 1-2-3 displays the numbers along a scale. You can select (Common), Currency, Date, Fixed, General (the default), Hidden, Percent, %, /%, Sci (Scientific), Text, or True format.</td>
</tr>
<tr>
<td>Indicator</td>
<td>Determines whether or not the scale indicator is displayed. When 1-2-3 uses an order of magnitude other than 6 for the numbers along a scale, it creates a scale indicator, such as (thousands) or (trillions 1015), to identify the order of magnitude. The scale indicator appears between the scale and the axis side. When you select Indicator, 1-2-3 displays a Yes/No menu. Select Yes (the default) to display the scale indicator; select No to suppress display of the scale indicator entirely.</td>
</tr>
<tr>
<td>Quit</td>
<td>Returns you to the /Graph Options menu.</td>
</tr>
</tbody>
</table>
/Graph Options Titles
/Graph Options Titles adds graph titles and axis titles to a graph.

1. Select /Graph Options Titles.
2. Select one of the following options:
   - First, to set the first line of the graph title.
   - Second, to set the second line of the graph title.
   - X-Axis, to set the title for the x-axis.
   - Y-Axis, to set the title for the y-axis.
3. Specify a title by doing one of the following:
   - Type the title (up to 39 characters) and press [ENTER].
   - Press backslash (\), specify the cell that contains the title, and then press [ENTER].
   - If the format of the cells containing the title entries is hidden, \-2-3 will not display them. 1-2-3 will, however, display title entries stored in hidden columns when the graph is viewed.
4. Repeat steps 2 and 3 to specify another title.
5. Select Quit to return to the /Graph Options menu.

/Graph Quit
Use /Graph Quit to remove the /Graph menu and return 1-2-3 to READY mode.

/Graph Reset
Use /Graph Reset to reset some or all of the current graph settings to the default settings.

1. Select /Graph Reset.
2. Select one of the following options:
   - Graph: Resets all graph settings; returns you to the /Graph menu.
   - X: Resets the X data range setting.
   - A-F: Resets the A-F data range settings and the corresponding data label settings, if any.
   - Ranges: Resets all data range settings (X and A-F data ranges) and data label settings.
   - Options: Resets all current /Graph Options settings.
   - Quit: Returns you to the /Graph menu.
3. Select Quit to return to the /Graph menu.

The Graph Commands 7-21
/Graph Save

Use /Graph Save to save the current graph in a '.PGC' file. /Graph Save saves the graph only for use outside 1-2-3. You cannot retrieve a '.PGC' file with 1-2-3. (To save the current graph for future worksheet use within 1-2-3, use /Graph Name Create and /File Save.)

1. Select /Graph Save.
2. 1-2-3 displays the default directory and extension. Do one of the following:
   - Specify a graph file name and press ENTER.
   - To save the graph in another directory, press ESC, edit the directory, type a file name, and press ENTER.
3. If you enter an existing graph file name, select one of the following options:
   - Cancel, to end the /Graph Save command without saving the current graph.
   - Replace, to complete the /Graph Save command, replacing the stored graph file with the current graph.

/Graph Type

Use /Graph Type to set the basic type of graph you are creating: bar, line, pie, stacked bar, or XY.

1. Select /Graph Type.
2. To set a basic graph type, select one of the following options:
<table>
<thead>
<tr>
<th>Command</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td>Graphs one or more data ranges (A - F). 1-2-3 displays-line graphs in one of four ways set with /Graph Options Format: Lines, Symbols, Both, or Neither.</td>
</tr>
<tr>
<td>Bar</td>
<td>Graphs one or more data ranges (A - F) as bars. The different ranges are distinguished by either hatch patterns or colors.</td>
</tr>
<tr>
<td>XY</td>
<td>Graphs the X data range and one or more other data ranges (A - F). You must specify the X data range and at least one other data range. The X data range determines the numeric scale of the X-axis. 1-2-3 plots the other data ranges with the X data range values, and plots them at coordinates along the X and Y axes. They are displayed in one of four ways set with /Graph Options Format: Lines, Symbols, Both, or Neither.</td>
</tr>
<tr>
<td>Stack-Bar</td>
<td>Graphs one or more data ranges (A - F) as stacked bars. The ranges are distinguished by either hatch patterns or colors.</td>
</tr>
<tr>
<td>Pie</td>
<td>Graphs the X data range as slices of a pie. 1-2-3 labels each slice of the pie with the percentage it represents of the whole pie. (These numbers are rounded off, so they may not exactly total 100.) Entries in the X data range appear as labels next to each slice. Values in the Y data range specify exploded or unexploded slices, as well as the type of hatch patterns or colors.</td>
</tr>
</tbody>
</table>

/Graph View

See /Graph View to temporarily display the current graph.

1. Select /Graph View.
2. When you finish viewing the graph, press GRAPH [F10], ENTER ESC or (Esc) to redisplay the worksheet.

When you’re viewing a graph, you can use the Zoom and Pan capabilities. If you wish to view an area more closely, each press of [+] increases the magnification by 0.5 (up to 4 times the original scale). Then, the (A) (B) (F) (T) and (A) (B) keys allow you to move around the graph. (Pressing (A) ultimately returns the graph to its original size.)

The Graph Commands 7-23
Graph X

Use /Graph X to specify the X data range for a graph. The way 1-2-3 uses the contents of this range depends on the type of graph you create:

- In line, bar or stacked bar graphs, 1-2-3 uses the contents of the X data range as the x-axis labels. The X data range can contain either values or labels.
- In pie charts, 1-2-3 uses the contents of the X data range as the pie slice labels. These labels appear with the percentage labels 1-2-3 automatically creates. The X data range can contain either values or labels.
- In XY graphs, 1-2-3 uses the contents of the X data range to determine the x-axis scale and where along the x-axis scale to plot the data in the A-F data ranges. The X data range must contain numeric values.

Follow these steps when using /Graph X:

1. Select /Graph X.
2. Specify the range that contains the entries you want to use as the graph's X data range and press Enter.
The Move Command

Use /Move to reorganize data. /Move lets you transfer a range of data, range names, and cell formats to another range in the worksheet.

Remember that you can press HELP (?) to get information about the command you are using.

Before You Use /Move

- If you move data that a formula refers to, the cell references in the formula change to reflect the new location of that data. For example, the formula @SUM(A1..A3) adds the numbers entered in the range A1..A3. If you move the data from A1..A3 to C1..C3, the formula will change to @SUM(C1..C3).
- If you move data into the cells that define a range in a formula, the range changes to ERR and formulas that refer to that range evaluate to ERR.
- If you move data out of the cells that define a range in a formula, 1-2-3 changes the range definition. For example, if you refer to the range A3..D8 in the formula @SUM(A3..D8), and then move the contents of cell B8 to F8, 1-2-3 changes the formula to @SUM(A3..F8) and includes any data in the expanded range.
/Move

1. Select /Move.
2. Specify the range you want to move FROM and press ENTER.
3. Specify the range you want to move TO and press ENTER. You need to specify only the upper left cell in the TO range.

Note

The TO range can be any unprotected area of the worksheet. To avoid possible data loss from writing over existing data, save the worksheet before using /Move. If you make a mistake when moving data and the undo feature is on, press UNDO (CUT-ED) immediately to restore the worksheet to its original state.

8-2 The Move Command
The Print commands create printed copies of your work and let you control basic printing operations such as specifying a range to print or advancing the paper in the printer by a line or a page. They also let you enhance printed worksheets by adding headers, footers, and borders, for example.

Before you can use the Print commands, however, you must select the destination for your worksheet print output. 1-2-7 offers you two choices.

You can select Printer to print your worksheet data directly on a printer. (Refer to appendix C for information on connecting a printer to your 1-2-7.) You can select File to print your worksheet data to a standard ASCII text file (a file with a .PRN extension). You can print...
the text file later with an operating system command or a print utility program, or use the text file in another program (for example, a word processing program). When you select File, 1-2-3 will prompt you to enter a name for the text file.

Once you select Printer or select File and specify a file name, 1-2-3 displays the same menu. You can use all of the Print commands whether you select [Printer or File] as the print destination.

Terms to Know

A print job consists of one or more printed items. A printed item can be a file, a range of data, or blank lines. The print job begins when you start sending data to a printer or a file. You can select Go, Line, or Page from the /Print [Printer or File] menu to begin the print job. The print job ends when the PRINT mode indicator at the top right of the screen stops flashing, or when you press [CTRL] BREAK.

Print settings are the options you specify for your print job. Margins, page headers, and page footers are a few examples of print settings.

A print destination is where 1-2-3 prints your data. In 1-2-3, the print destination can be a text file on disk or a printer.

A text or print file is a standard ASCII file that contains data, including text, borders, headers, footers, margins, and page breaks; but no graphs or special printer codes. When you use /Print File to create a text file from a worksheet range, 1-2-3 assigns the file the default extension .PRN.

The default printer is the printer listed in the /Worksheet Global Default settings sheet and configured in the Setup utility (see appendix C for additional information).

A settings sheet is a special status screen that displays all the settings associated with a particular task. When you select /Print Printer or /Print File, 1-2-3 displays the /Print settings sheet, which allows you to see the settings that will affect the current print job.

9-2 The Print Commands
Basic Steps for Printing in 1-2-3

This section describes the steps for printing a worksheet range on a printer (/Print Printer) or to a print file (/Print File).

Printing a Range on a Printer (/Print Printer)

(1-2-3 uses the printer configured in the Setup utility. For additional information, see appendix C.)

1. Select /Print Printer.

2. Select Range. You must always specify a print range (see /Print Printer or File Range later in this chapter).

3. Specify the range you want to print and press ENTER.

4. If you want to change any of the current print settings, select Options.

For a description of available print options, see /Print Printer or File Options later in this chapter. If you do not change the margins or page length, 1-2-3 uses the following default settings when it prints the range:

- Left margin: 7 characters from left edge of the paper
- Right margin: 76 characters from left edge of the paper
- Top margin: 2 lines from the top of the paper
- Bottom margin: 2 lines from the bottom of the paper
- Page length: 65 lines
5. When you have specified the print options, select Quit as many times as necessary to return 1-2-3 to the /Print [Printer or File] menu.

6. Select Align to tell 1-2-3 the paper in the printer is correctly positioned at the top of a page and ready for printing.

7. Select Go to print the range or the printer.

8. Select Page to advance the paper to the top of the next page and include the footer (if you have specified one) on the last line of the page.

9. Select Quit to complete the print job and return 1-2-3 to READY mode.

Printing a Range to a Text File (/Print File)

This section describes the steps for printing a worksheet range to a text (.PRN) file on either the internal disk or an installed ram disk.

1. Select /Print File. 1-2-3 displays files with a .PRN extension in the current directory.

2. If you want to display files in a different drive and/or directory or with a different extension, do one of the following:
   - To display files with a different extension, type *. followed by another extension and press [ENTER] (for example, *.txt).
   - To display all files in the current directory, type ** and press [ENTER].

   To display files in a different drive and/or directory, press [ESC] to clear the file names, edit the drive and/or directory, and then press [ENTER].

3. Specify the name of the text file you want 1-2-3 to create and press [ENTER]. 1-2-3 automatically uses the extension .PRN for text files, unless you specify a different extension.

4. If you specify the name of a text file that already exists, select one of the following options:
   - Cancel: Returns 1-2-3 to READY mode without specifying a text file as the print destination.
   - Replace: Writes over the existing text file on disk when you select /Print File Go.

1-2-3 displays the Print commands and the /Print settings sheet after you specify the file name. These commands offer a number of options that control the appearance and format of the
print output. The only option that must be specified is the range
to be printed.
5. Select Range.
6. Specify the range you want to print and press ENTER.
7. If you want to change any of the current print settings, select
Options. If you are creating a text file or disk so you can use
1-2-3 data with another program, you may want to change the
following print options:
- To eliminate headers, footers, and page breaks from the text file
1-2-3 will create, select Options Other Unformatted.
- To set the left margin to 0, select Options Margins Left and
enter 0.
- To set the right margin, select Options Margins Right and
enter a number for the right margin that is appropriate for the
program in which you are going to use the text file.
8. When you have specified the print options, select Quit as many
times as necessary to return 1-2-3 to the /Print [Printer or File]
menu.
9. Select Align to set the internal line count 1-2-3 maintains to zero,
which represents the top of a page.
10. Select Go to print the range to a text file.
11. If you want to include other worksheet ranges in the same text
file, repeat steps 5, 7, and 10. (1-2-3 appends the new range to the
end of the previous range in the text file.)
12. If you specified a footer and you want it to appear on the last line
of the page, select Page.
13. Select Quit to complete the print job and return 1-2-3 to READY
mode.

Command Definitions

The following section describes the Print commands available in 1-2-3
and lists them in alphabetical order.

Remember that you can press HELP (F1) to get information about the
command you are using.

The Print Commands 9-1
/Print [Printer or File] Align

Use /Print [Printer or File] Align to tell 1-2-3 that the paper in the printer is correctly positioned, at the top of a page and to reset the page number to 1. This ensures that headers, footers, and page breaks will be in the correct spot when you print.

/Print [Printer or File] Align also lets you tell 1-2-3 to reset the program's internal line count to 0 (top of a page). 1-2-3 maintains an internal line count to determine how many lines of text it can fit on a page in the print output and when to begin a new page. You should use /Print [Printer or File] Align even when the print destination is a text file on disk. And, if you select /Print Printer Options Center Unformatted, which eliminates headers, footers, and page breaks from the print output, /Print [Printer or File] Align has no effect.

Follow these steps to use /Print [Printer or File] Align:
1. If you are printing on a printer, position the paper in the printer at the top of a page, with the perforation just above the print head.
2. Each time you reposition the paper in the printer at the top of a new page, you should select /Print [Printer or File] Align. If you do not, the new page will not be filled correctly because 1-2-3 will continue to use its existing line count instead of starting at 0 again.

Use 1-2-3 commands to advance paper in the printer by line or page instead of the printer controls.

/Print [Printer or File] Clear

Use /Print [Printer or File] Clear to reset some or all of your current print settings to the default settings.

1. Select /Print [Printer or File] Clear.
2. Select one of the following options:
   - **All**: Clears the current print range, clears all borders, headers, and footers, resets all formats and options to their default settings.
   - **Range**: Clears the current print range.
   - **Borders**: Clears all borders (column and row ranges).
   - **Format**: Resets margins, page length, and setup strings to their default settings.

9.6 The Print Commands
3. Do one of the following:
   ■ Select other settings from the /Print menu.
   ■ Select Quit to return 1-2-3 to READY mode.

/Print [Printer or File] Go

Use /Print [Printer or File] Go to start the print job, sending your worksheet data to a printer or to a file on disk.

1. Make sure you specified a print range using /Print [Printer or File] Range.
2. If you are printing on a printer, make sure the printer you want to use is turned on, properly connected, and ready to print (on-line), and that the paper in the printer is aligned at the top of a new page.
4. Select Go.
5. If you want to print additional ranges with different options as part of the same print job, change your options, select the new ranges, and select Go again.
6. Select Quit.

Quit closes the print job and returns 1-2-3 to READY mode. If you do not select Quit, you may notice the following effects:
   ■ If you are printing to a text file on disk, 1-2-3 does not complete saving the file on disk until you select Quit.
   ■ If you are using a print spooler, the spooler may not send data to the printer until you select Quit.
   ■ If your printer is attached to a network, the printer will not print your data until you select Quit.

1-2-3 also closes your print job when you press ALT+BREAK or press ESC enough times to return 1-2-3 to the /Print menu.

/Print [Printer or File] Line

Use /Print [Printer or File] Line to force a line feed on a printer or in a file. It also adds one line to the internal line count 1-2-3 maintains.

This ensures that headers, footers, and page breaks will be in the correct spot when you print.
Use /Print [Printer or File] line to insert blank lines between print ranges if you are printing several different ranges in the same print job.

Each time you select line, 1-2-3 advances the paper in the printer one line or inserts a new line in the text file.

If you use your printer’s line feed control to advance the paper in the printer up by one line, 1-2-3 does not adjust its internal line count. This causes the positioning of headers, footers, and page breaks on subsequent pages to be incorrect. Use /Print [Printer or File] line to keep the line count synchronized with the paper.

/Print [Printer or File] Options

Use /Print [Printer or File] Options to control the appearance of your print output.

/Print [Printer or File] Options Borders

/Print [Printer or File] Options Borders lets you print descriptive information from specified columns and rows in your worksheets to the left and top edges of every page of print output. (This is useful when you are printing a large range that will be split up on several pages and you want to keep track of related data more easily.)

1. Select /Print [Printer or File] Options Borders.

2. Select one of the following options:

Columns: Creates vertical headings that are repeated on the left side of each page of print output. Use this option when the print range contains more columns of data than will fit across one page and you have labels or other information in a column or columns that will help identify data printed on subsequent pages.

Rows: Creates horizontal headings that are repeated on the top of each page of print output. Use this option when the print range contains more rows of data than will fit down one page and you have labels or other information in a row or rows that will help identify data printed on subsequent pages.

If you have previously specified borders, 1-2-3 highlights this range.
3. Specify the range you want to print in boxes and press ENTER.

/Print [Printer or File] Options Footer

Use /Print [Printer or File] Options Footer to create a page footer, which is a line of text printed just above the bottom margin of every page of print output.

Use the following guidelines when creating footers:

- A footer can contain up to 260 characters (including spaces), which is the widest page you can print in 1-2-3.
- Although a footer is limited to a single line, 1-2-3 allows you to divide the footer into separate segments for the right, left, and center portions of each line. This means you can include more than one piece of information in a footer. Use the split vertical bar (|) to separate the information you are entering into each section of the footer. 1-2-3 left-aligns text you type before a split vertical bar, centers text you type after a split vertical bar, and right-aligns text you type after a second split vertical bar. If you do not use any split vertical bars, 1-2-3 left-aligns the entire footer.
- A footer can include any text as well as the special character @ and the # symbol.

Use the # symbol anywhere in a footer to include a page number on every page of print output. It can be combined with text for additional description, such as Page #.

Use @ anywhere in a footer to include the current date on every page of print output. 1-2-3 uses the date supplied by your computer's internal clock. Like the # symbol, the @ can be combined with text for additional description, such as Today's Date: @. (1-2-3 uses the date format set with /Worksheet Global Default Other Clock.)

Use backslash (\) followed by a cell address or range name to use the contents of a single cell as the footer. For example, entering `\B1` uses the contents of cell B1 as the footer. If a split vertical bar is the first character in a cell, you must precede it with another split vertical bar as a label prefix for the footer to work.

The following table shows some examples of footers.

The Print Commands 3-9
Follow these steps to create a footer:

1. Select /Print [Printer or File] Options Footer. (1-2-3 displays the current footer, if any.)
2. If 1-2-3 displays a footer, edit the displayed text and press ENTER when you finish. Otherwise, specify the footer by doing one of the following:
   - Type the text for the footer and press ENTER.
   - Type a backslash (\) followed by the address or range name of the cell that contains the text for the footer, and then press ENTER.

The program prints the footer on the line above the bottom margin and leaves two blank lines between printed data and the footer.

1-2-3 will not print the footer on the last page of the print job unless you select /Print [Printer or File] Page after printing the print job.

/Print [Printer or File] Options Header

Use /Print [Printer or File] Options Header to create a page header—a line of text printed just below the top margin of every page of print output. When creating headers, you may want to refer to the guidelines described in the previous section, /Print [Printer or File] Options Footer.

Follow these steps to create a header:

1. Select /Print [Printer or File] Options Header. (1-2-3 displays the current header, if any.)
2. If 1-2-3 displays a header, edit the displayed text and press ENTER when you finish. Otherwise, specify the header by doing one of the following:

9-10 The Print Commands
Type the text for the header and press **ENTER**.
Type a backslash followed by the address or range name of the cell that contains the text for the header, and then press **ENTER**.

The program prints the header on the line below the top margin, and leaves two blank lines between printed data and the header.

**Print [Printer or File] Options Margins**

Use **/Print [Printer or File] Options Margins** commands to override the default print margins (see chapter 13, *Workbook: Global Default Printer*).

**Print [Printer or File] Options Margins Bottom.** Use **/Print [Printer or File] Options Margins Bottom** to set the bottom margin for printed pages. It is the number of lines (from 0 to 32) from the bottom edge of the paper.

1. Select **/Print [Printer or File] Options Margins Bottom** (1-2.3 displays the current bottom margin setting.)
2. Do one of the following:
   - Press **ENTER** to accept the current bottom margin setting.
   - Change the setting by typing the number of lines (0 to 32) for the bottom margin and pressing **ENTER**.

**Print [Printer or File] Options Margins Left.** Use **/Print [Printer or File] Options Margins Left** to set the left margin for printed pages. It is the number of characters from the left edge of the paper. You can specify any number from 0 to 240, but the number should be smaller than the right margin setting.

1. Select **/Print [Printer or File] Options Margins Left** (1-2.3 displays the current left margin setting.)
2. Do one of the following:
   - Press **ENTER** to accept the current left margin setting.
   - Change the setting by typing the number of characters (0 to 240) for the left margin and pressing **ENTER**.

**Print [Printer or File] Options Margins None.** Use **/Print [Printer or File] Options Margins None** to clear the current margins and reset the top, left, and bottom margins to 0 and the right margin to 240.

---

The Print Commands 9-11
/Print [Printer or File] Options Margins Right. Use /Print [Printer or File] Options Margins Right to set the right margin for printed pages in number of characters from the left edge of the paper. You can specify any number from 1 to 240, but the number should be greater than the left margin setting.

1. Select /Print [Printer or File] Options Margins Right. (1-2-3 displays the current right margin setting.)
2. Do one of the following:
   - Press ENTER to accept the current right margin setting.
   - Change the setting by typing the number of characters (0 to 240) for the right margin and pressing ENTER.

/Print [Printer or File] Options Margins Top. Use /Print [Printer or File] Options Margins Top to set the top margin for printed pages in number of lines (from 0 to 32) from the top edge of the paper.

1. Select /Print [Printer or File] Options Margins Top. (1-2-3 displays the current top margin setting.)
2. Do one of the following:
   - Press ENTER to accept the current top margin setting.
   - Change the setting by typing the number of lines (0 to 32) for the top margin and pressing ENTER.

/Print [Printer or File] Options Other

Use /Print [Printer or File] Options Other to specify whether 1-2-3 prints the data in the worksheet or the formulas underlying the data, and whether 1-2-3 prints headers and footers and inserts page breaks.

1. Select /Print [Printer or File] Options Other.
2. Select one of the following options:
   - As-Displayed Prints the data as it appears on your screen (the default setting). Results of formulas are printed as they are displayed on the screen using current cell formats and column widths.
   - Cell-Formulas Prints the contents of each nonblank cell in the print range, one cell per line. Each line contains exactly what appears in the first line of the cell. When the cell pointer is on the cell:
     - cell address, cell format, the protection status (P' or U), and the cell contents (number, formula, or label). 1-2-3 does not print borders, even if you specify them.

9-12 The Print Commands
3. If you want to select a combination of options, such as Cell Formulas and Unformatted, select Other again and then select another option.

/Print [Printer or File] Options Pg-Length

Use /Print [Printer or File] Options Pg-Length to override the default page length set with /Worksheet Global Default Printer Pg-Length (see chapter 19).

Page length is measured in lines. The default page length is 96 lines. When you print with the default page length, 1-2-3 uses the 66 lines as follows:

<table>
<thead>
<tr>
<th>Lines</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>Default top margin.</td>
</tr>
<tr>
<td>3</td>
<td>Header or blank line.</td>
</tr>
<tr>
<td>4 and 5</td>
<td>Blank lines.</td>
</tr>
<tr>
<td>6 through 61</td>
<td>Worksheet data (total of 56 lines)</td>
</tr>
<tr>
<td>62 and 63</td>
<td>Blank lines.</td>
</tr>
<tr>
<td>64</td>
<td>Footer or blank line.</td>
</tr>
<tr>
<td>65 and 66</td>
<td>Default bottom margin.</td>
</tr>
</tbody>
</table>

Follow these steps to set the page length:

1. Select /Print [Printer or File] Options Pg-Length. (1-2-3 displays the current page length setting.)
2. Do one of the following:
   - Press \( \text{ENTER} \) to accept the current setting.
   - Type the number of desired lines (1 to 100) and pressing \( \text{ENTER} \).

(Laser printers often have special rules for determining the length of a page. See appendix C or your printer manual for assistance.)
The Print Commands

Follow these steps to create or change the setup string:

1. Select /Print [Printer or File] Options Setup. (1-2-3 displays the current setup string, if any.)
2. Do one of the following:
   - Type a setup string (up to 39 characters) and press ENTER.
   - Press ENTER to accept the previously specified setup string (if any).
   - Press Ctrl or Esc to edit the previously specified setup string (if any), and then press ENTER.

Note: To avoid complications when printing, do not use setup strings to control print settings that you can control through 1-2-3 commands. For example, do not use setup strings to control page length and margins.
Use /Print [Printer or File] Page to advance the paper in the printer to the top of the next page or insert blank lines in a text file on disk.

/Print [Printer or File] Quit

Use /Print [Printer or File] Quit to close the current print job and return 1-2-3 to READY mode.

/Print [Printer or File] Range

Use /Print [Printer or File] Range to specify the print range—the data 1-2-3 prints when you select /Print [Printer or File] Go. Whether you are printing on a printer or to a file on disk, you must specify the cells you want 1-2-3 to print.

Consider the following information when specifying the print range:

• If the data in the print range is wider than the paper you are printing on, 1-2-3 automatically prints the data that extends beyond the right margin on a separate page.

• When you print long labels on a printer using proportionally spaced fonts, the number of characters your printer prints may differ from the number of characters you specified in your 1-2-3 print range.

• When a print range includes hidden columns, 1-2-3 does not print the hidden columns. Likewise, when a cell's format is Hidden, 1-2-3 does not print the contents of that cell.

• 1-2-3 remembers the last print range you specified. To print the same range again, select /Print [Printer or File] Go without specifying a range.

Follow these two steps to specify a print range:

1. Select /Print [Printer or File] Range.
2. Specify the range you want to print and press ENTER.

Note

If the print range includes long labels, the print range must include the cells the long label overlaps as well as the cell in which you entered the long label. For example, to print a long label entered in A1 that overlaps B1 and C1, be sure cells A1, B1, and C1 are included in the print range.
Use /Quit to end the 1-2-3 session.

1. Select /Quit.
2. Select one of the following options:
   - No: Returns 1-2-3 to READY mode.
   - Yes: Ends 1-2-3 session.
3. If you selected Yes and have changed data in the worksheet but not saved it, 1-2-3 displays another No/Yes menu. Select one of the following:
   - No: Returns to READY mode so you can use /File Save to save the worksheet.
   - Yes: Ends 1-2-3 session without saving changes to the worksheet (all changes to the current worksheet will be lost).

Remember to press HELP (F1) to get information about the command you are using.
The Range Commands

Worksheet Range Copy More File Plot Graph Data System Apps Quit

Formulas Label Range Name Justify Find Insert Highlight Value Time Search

Credits Dealer Title Help Tel Fax

Left Right Center Right Down Left Up Find Replace

Next Quit Replace As Next Quit

Fixed 4th Currency - General of Percent Date Time Hidden Reset


The Range commands let you work with ranges. A range is any rectangular block of cells—a single cell, a row or column, part of several rows and columns, or an entire worksheet. The next illustration shows several examples of ranges.
Command Descriptions

The Range commands are described in the following sections.

*Remember to press HELP (F1) to get information about the command you are using.*

_/Range Erase_

Use /Range Erase to erase the data in a range (does not change the format or protection status of cells in the range).

1. Select /Range Erase.
2. Specify the range you want to erase and press ENTER.

1-2 The Range Commands
Note
You cannot erase data in protected cells unless you
turn off worksheet protection using /Worksheet
Global Protection Disable (see chapter 13) or
unprotect the cells whose contents you want to erase
with /Range Unprotect.

/Range Format

Use /Range Format to specify the cell format (the way 1-2-3 displays
data) for each cell in a range, overriding the global cell format (set
with /Worksheet Global Format).

Before using /Range Format, note the following:

- Most cell formats only affect the way 1-2-3 displays numeric data.
  Hidden and Text formats, however, also affect the display of labels
  and formulas.
- Changing a cell’s format changes the way 1-2-3 displays data in
  the cell but not the data itself. You can choose a cell format that
  displays $45.125 as $45, but 1-2-3 still stores the value as $45.125
  and uses that value when calculating.
- Whenever the cell pointer is on a cell in the formatted range,
  1-2-3 displays in the control panel the first character of the cell
  format name and (if applicable) the number of decimal places. For
  example, (P2) means Percent format with 2 decimal places.

Follow these steps to specify the range format:

1. Select /Range Format.
2. Select the cell format you want from the series of menus and
   prompts 1-2-3 displays. (The table that follows this procedure
   explains each cell format.)
3. Specify the range you want to format and press Enter.

If 1-2-3 displays a cell filled with asterisks, it usually means the
column is not wide enough to display the entire number. The
columns must be one character wider than the width of the number.
To widen the column, use either /Worksheet Column Set-Width or
/Worksheet Global Column-Width.

The Range Commands 11-3
The following table describes the `/Range Format` menu and includes examples of data in each cell format. The third column of the table shows the data as you would enter it and the fourth column shows the way 1-2-3 displays the data (preceded by the control panel notation for that format).

<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Data entered</th>
<th>Data displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Comma)</td>
<td>Displays numbers with thousands separators and a comma for decimal</td>
<td>8969</td>
<td>(.3) 8,999.00</td>
</tr>
<tr>
<td></td>
<td>values. Negative numbers are displayed with either a minus sign,</td>
<td>-15000</td>
<td>(0) (15,000)</td>
</tr>
<tr>
<td></td>
<td>or a zero depending on the <code>/Worksheet Global Default Other</code> setting.</td>
<td>-5532750</td>
<td>(.1) 0.6</td>
</tr>
<tr>
<td></td>
<td>Currency format is the same as <code>Currency format without the currency</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currency</td>
<td>Displays numbers with a currency symbol, thousands</td>
<td>12</td>
<td>(C2) $12.00</td>
</tr>
<tr>
<td></td>
<td>separators, and a leading zero for decimal values. Negative numbers</td>
<td>-256</td>
<td>(C1) ($0.3)</td>
</tr>
<tr>
<td></td>
<td>are displayed with either a plus or a minus sign, depending on the</td>
<td>1125.99</td>
<td>(C3) $1,126</td>
</tr>
<tr>
<td></td>
<td><code>/Worksheet Global Default Other International Negative</code> setting. The</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>currency symbol 1-2-3 uses depends on the</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>current <code>/Worksheet Global Default Other International Negative</code></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Currency setting</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11.4 The Range Commands
<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Date entered</th>
<th>Displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Displays numbers from 1 to 32,767.</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td>display number for 1 January 2001 to 31 December 2009</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td>as dates, in the Date Format</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td>(21 - 35) for month 1-2-3 means only the 1st date of the month</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td>years are shown in the past date only if the current year is greater than 1990.</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td>For example, a date 1 or</td>
<td>-2</td>
<td>32,769.11</td>
</tr>
<tr>
<td></td>
<td>more than 73000 displays</td>
<td>32,769.11</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>73000</td>
<td>14-Mar-01</td>
</tr>
<tr>
<td>Time</td>
<td>Displays numbers as times, in</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>the Time Format (25 - 36)</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>in 1-2-3 Display the</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>numerical part of a number to</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>determine the time the</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>number represents. For</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>positive numbers, 1-2-3</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>calculate the time by</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>adding the decimal part</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>of the number to 0.</td>
<td>00:00:00</td>
<td>00:00:00</td>
</tr>
<tr>
<td>Fixed</td>
<td>Displays numbers with up to</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>31 decimal places, a minus</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>sign for negatives, and a</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>leading zero for decimal</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>values.</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td>General</td>
<td>Displays numbers with</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>minus sign for negatives, no</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>thousands separators, and no</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>leading zero to the right of</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
<tr>
<td></td>
<td>the decimal point.</td>
<td>12,345.67</td>
<td>00:00:00</td>
</tr>
</tbody>
</table>

When the number of digits to the left of the decimal point exceeds the column width, round and/or scientific notation. When the number of digits to the right of the decimal point exceeds the column width, 1-2-3 displays as many digits as it can.
<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Data entered</th>
<th>Data displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hidden</td>
<td>Makes data in the range invisible, though the data still exists. The data appears in the control panel unless the cells are protected and global protection is on.</td>
<td>-4.27/4.2*E0</td>
<td>(H)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(G)</td>
</tr>
<tr>
<td>Percent</td>
<td>Displays numbers as percentages, with up to 4 decimal places and a percent sign.</td>
<td>-12.43/38</td>
<td>(P1) 1242.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.25</td>
<td>(P2) -4.25%</td>
</tr>
<tr>
<td>+/-</td>
<td>Displays a bar of plus or minus sign or a period. The number of plus or minus signs in the bar equals the whole number value of the entry (rounded to the largest integer). Plus signs indicate a positive value, minus signs indicate a negative value, and a period indicates a number between -1 and 1. If the whole-number value of the entry is wider than the column width, 1-2-3 displays asterisks.</td>
<td>1.3</td>
<td>(+) +++++</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.04</td>
<td>(v) --</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(+)</td>
</tr>
<tr>
<td>Reset</td>
<td>Selects the range to be the global cell format (specified with /Worksheet Global Format).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>Displays numbers in scientific notation, with up to 15 decimal places in the mantissa and an exponent from -99 to +99.</td>
<td>-4.3</td>
<td>(S0) 4E+00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21.245</td>
<td>(S1) 1.2E+01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12900000000</td>
<td>(S2) 1.2E+11</td>
</tr>
<tr>
<td>Text</td>
<td>Displays numbers as entered rather than their computed value. Displays numbers in General format.</td>
<td>+4.23/4.2*B2</td>
<td>(/RANGE) +C7/4.2*B2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FIRST&amp;LAST</td>
<td>(+) FIRST&amp;LAST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100.00</td>
<td>(T) 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100.03</td>
<td>(T) 100.03</td>
</tr>
</tbody>
</table>

Using /Range format requires additional memory. If you are concerned about the amount of memory a worksheet is using, format only ranges that require it or use /Worksheet Global Format, which does not require additional memory.

11.6 The Range Commands
/Range Input

Use /Range input to limit cell pointer movement and data entry to unprotected cells in a range so you can enter or edit data in those cells but not in others. The command works with /Range Unprot.

Use /Range Input for data entry in a fill-in-the-blanks entry form, with the unprotected cells acting as the blanks in the form.

1. If you want a fill-in-the-blanks entry form, set up the form.
   The entry form should include prompts for the information you want entered in the blanks and any pertinent instructions.

2. Select /Range Unprot.
   Specify the cell or cells in which you want to enter or edit data and press [ENTER].


4. Specify the data input range and press [ENTER].
   The data input range is any range that includes the cells you unprotected in step 2. If you set up an entry form, be sure to include the entire entry form—not just the blank cells—in the data input range.

5. Enter or edit data in the unprotected cells. You can move the cell pointer only to the unprotected cells in the data input range.

6. To end /Range Input, press either [ENTER] or [ESC] when 1-2-3 is in READY mode. (1-2-3 returns the cell pointer to the cell it was in before you selected /Range Input, and restores unrestricted cell pointer movement.)

/Range Input is also commonly used in interactive macros. When 1-2-3 gets to a Range Input command in a macro, 1-2-3 suspends the macro until you press [ENTER] or [ESC] to end the Range Input command. At that point 1-2-3 continues executing the macro.

The Range Commands 11-7
Range Justify

/Range Justify lets you treat a column of labels as a paragraph and center ranges (justified) the labels to fit within your specified width. Use /Range Justify to make labels equal lengths in a range, fit text into a specific width for viewing or printing, treat a paragraph in a worksheet, or rejustify an edited paragraph. To use this command, global worksheet protection must be off.

Note

Do not use /Range Justify as a column whose contents are used in macros or string formulas; otherwise, each cell that gets moved up to the previous line will have a space inserted in front of it, thus changing the formula.

Follow these steps when using /Range Justify:

1. Move the cell pointer to the first cell in the column of labels you want to justify. This positions the cell pointer correctly for specifying the justify range in step 3.
2. Select /Range Justify.
3. Specify the justify range and press Enter.

If you specify a single row justify range, 1-2-3 justifies the entire column of labels to fill the width of the justify range using as many rows as necessary. If the justified labels occupy more rows than the original labels, 1-2-3 moves down any subsequent data in the column (data below the justified labels). If the justified labels occupy fewer rows than the original labels, 1-2-3 moves up any subsequent data. Use a single row justify range only if all cells below the labels you are justifying are blank or if movement of data below the labels is acceptable.

If you specify a multiple row justify range, 1-2-3 limits the justification to the specified range and does not move data below the justify range. If you use a multiple row justify range, be sure the range is wide and deep enough to hold the entire series of justified labels.
InRange Label

Use /Range Label to change the alignment of labels in a range by changing their label prefix: " (left-aligned), " (right-aligned), or " (centered). Labels that exceed the width of a column appear left-aligned no matter what label prefix they have. (Right-aligned labels leave a blank space to the right if there is enough room.)

1. Select /Range Label.
2. Select one of the following options:
   - Left: Aligns labels with left edge of cells.
   - Right: Aligns labels with right edge of cells.
   - Center: Centers labels in cells.
3. Specify the range of labels whose alignment you want to change and press ENTER.

InRange Name

Range names are names of up to 15 characters that you use in commands and formulas instead of cell or range addresses. For example, if you assign the same SALES to A5..D5, you can move the cell pointer to A5 by pressing GOTO (F5), typing sales, and pressing ENTER; total the numbers in A5..D9 with the formula (SUM(SALES)), and print the data in A6..E9 by specifying SALES as the print range. Range names are generally easier to remember and
can be selected more quickly than the range addresses to which they correspond.

/*Range Name Create*/

Use /Range Name Create to assign a name to a range or redefine which cells an existing range name refers to. Use /Range Name Create to edit a range name by selecting an existing name, pressing EDIT (F2), and editing it.

To prevent confusion when using range names in formulas and advanced macro commands, follow these guidelines:

- Do not include spaces, commas, semicolons, or the characters + - * / \ & < > ( [ ] @ # $) in range names because they may appear to be formulas to 1-2-3.
- Do not create names that look like cell addresses, such as Q2 or SX100.
- Do not use function names, advanced macro command keywords, or >2-3 key names as range names.
- Do not create range names that begin with a number, such as 2DEC, or consist entirely of numbers, such as 1989. You cannot include such range names in a formula.

Caution: If you enter a range name identical to an existing range name, 1-2-3 reassigns the range name to the new range.

Follow these steps to create or edit a range name:

1. Select /Range Name Create.
2. Specify a range name of up to 15 characters and press ENTER. (1-2-3 does not distinguish between uppercase and lowercase letters in range names.)
3. Specify the range to name and press ENTER.

If, when using /Move, you move data into the upper left or lower right cell of a named range, the range name becomes undefined. Formulas that used that range evaluate to ERR.

Use NAME (F2) to specify a named range when completing a command or writing a formula.

11-10 The Range Commands
/Range Name Delete

Use /Range Name Delete to delete a range name but leave the data in the range unchanged.
1. Select /Range Name Delete.
2. Specify the range name you want to delete and press ENTER.

/Range Name Labels

Use /Range Name Labels to assign range names to single-cell ranges, using existing adjacent labels as the range names.

To prevent confusion when using range names in formulas and advanced macro commands, make sure that the labels you are going to use to create range names meet these guidelines:
- Do not include spaces, commas, semicolons, or the characters + - / & > < \ @ and $ because they may appear to be formulas to 1-2-3.
- Do not look like cell addresses, such as A2 or Z100.
- Do not use function names, advanced macro command keywords, or 1-2-3 key names.
- Do not begin with a number, such as 2DEG, or consist entirely of numbers, such as 1989.

Note

If a label you use as a range name (or the first 15 characters of the label) duplicates an existing range name, 1-2-3 renames the range name to the new range. Formulas that refer to the named range as it was previously defined now refer to the new range.

Follow these steps to assign a range name:
1. Select /Range Name Labels.
2. Select one of the following options:
   - Right: Cell to name is to the right of the label.
   - Down: Cell to name is below the label.
   - Left: Cell to name is to the left of the label.
   - Up: Cell to name is above the label.
3. Specify the range that contains the labels you want to use as range names and press \( \text{ENTER} \).

1-2-3 uses only the labels in the range as range names; it ignores any numbers or formulas in the range. If any of the labels exceed 15 characters, 1-2-3 uses only the first 15 characters.

/Range Name Reset

Use /Range Name Reset to delete all range names in the current worksheet that have the data in the ranges unchanged. (Named macros are disabled with /Range Name Reset.)

/Range Name Table

Use /Range Name Table to create a two column table that alphabetically lists range names in the worksheet and their corresponding addresses.

1. Decide on a location for the range name table.

2. Select /Range Name Table.

3. Specify the location you decided on in step 1 and press \( \text{ENTER} \).

(You need to specify only the first cell of the table's location.)

If you use /Range Name Table frequently, assign a range name to a worksheet area you designate as the table location. Whenever you select /Range Name Table, type the range name. This technique saves time and helps avoid the possibility of writing over data when you create a range name table.

11-12 The Range Commands
/Range Prt
Use /Range Prt to protect cells in a range (that have been unprotected with /Range Unprot) when global worksheet protection is on. (See /Worksheet Global Protection in chapter 18.)

1. Select /Range Prt.
2. Specify the range containing the unprotected cells you want to protect again and press ENTER.

/Range Search
Use /Range Search to locate character strings consisting of letters or numbers in labels and/or formulas within a specified range. /Range Search does not locate numbers that are not in formulas.

Use Find to locate the string you specify by highlighting it with the cell pointer, or Replace to locate the specified string and replace it with another string. The search string is not case sensitive, however the replacement string is.

Searching for a String
1. Select /Range Search.
2. Specify the range you want 1:2-3 to search and press ENTER.
3. Do one of the following:
   • Type the string you want 1:2-3 to search for and press ENTER.
   • Press ENTER to accept the previously specified string (if any).
   • Press 2 or ENTER to edit the previously specified string (if any), and then press ENTER.
4. Select one of the following options:
   • Formulas: Looks only in formulas for the search string.
   • Labels: Looks only in labels for the search string.
   • Both: Looks in both formulas and labels for the search string.
5. Select Find to highlight the first occurrence of the search string.
6. Select one of the following options:
   • Next: Highlights the next occurrence of the search string.
   • Quit: Stops the search and returns 1:2-3 to READY mode.

The Range Commands 15-13
7. When 1-2-3 cannot find any more occurrences of the search string in the search range, it displays an error message. Press ESC or ENTER to return 1-2-3 to READY mode.

/(Range Search does not search hidden columns. It does, however, search cells formatted with /Range Format Hidden.)

Replacing a String

1-2-3 does a search and replace with the strings you specify. 1-2-3 will replace numeric strings in formulas, but will not replace numbers entered directly in cells.

Note

1-2-3 searches and replaces left to right by column, starting with column A, then B, and so on. When you replace range names in formulas, you may get unexpected results depending on the location of the range name references.

Follow these steps to replace a string:

1. Select /Range Search.
2. Specify the range you want 1-2-3 to search and press ENTER.
3. Do one of the following:
   - Type the string you want 1-2-3 to search for and press ENTER.
   - Press ENTER to accept the previously specified string (if any).
   - Press A or UAC to edit the previously specified string (if any), and then press ENTER.
4. Select one of the following options:
   - Formulas: Looks only in formulas for the search string.
   - Labels: Looks only in labels for the search string.
   - Both: Looks in both formulas and labels for the search string.
5. Select Replace to replace occurrences of the search string with a different (replacement) string.
6. Do one of the following:
   - Type the replacement string and press ENTER.
   - Press ENTER to accept the previously specified string (if any).
   - Press A or UAC to edit the previously specified string (if any), and then press ENTER.

11-14 The Range Commands
7. 1-2-3 highlights the cell containing the first occurrence of the search string. Select one of the following options:
   Replace  Replaces the current string with the replacement string and highlights the next cell containing the search string.
   All     Replaces all remaining occurrences of the search string with the replacement string.
   Next    Finds the next occurrence of the search string without replacing the current string.
   Quit    Stops the search and returns 1-2-3 to READY mode without replacing the current string.

8. If you selected Replace or Next, 1-2-3 displays an error message when it cannot find any more occurrences of the search string in the search range. Press ESC or ENTER to return 1-2-3 to READY mode.

Although /Range Search does not search hidden columns, it does search cells formatted with /Range Format Hidden.

/Range Trns
Use /Range Trns to copy a range of data, transposing the copied data and replacing any copied formulas with their current values.
1-2-3 transposes the data from a horizontal arrangement to a vertical arrangement, or vice versa.

Note
If the CALC indicator appears at the bottom of the screen, press CALC (F9) to update formulas before you use /Range Trns. If any of the formulas whose values you will be transposing refer to cells in files on disk, you also need to use /File Admin Link-Refresh to make sure those formulas’ values are up-to-date.

Follow these steps when using /Range Trns:
1. Select /Range Trns.
2. Specify the FROM range (the range whose data you want to transpose) and press ENTER.

The Range Commands 11-15
3. Specify the YO range (the location for the transposed data) and press ENTER. You need to specify only the first cell of the YO range.

Caution
If the FROM and TO ranges overlap, you may get unexpected results. To avoid possible data loss from writing over existing data, save the worksheet before using /Range Trans. If you do not get the results you want and the undo feature is on, press UNDO (ALT+H) immediately; to restore the worksheet to its original state.

Range Unprot

Use /Range Unprot to unprotect cells. This allows changes to cells in a range when global worksheet protection is on. (See /Worksheet Global Protection in chapter 13.) When the cell pointer is on an unprotected cell, 1-2-3 displays a U in the control panel.

1. Select /Range Unprot.
2. Specify the range you want to unprotect and allow changes to and press ENTER.
/Range Value

Use /Range Value to copy a range of data, replacing any copied formulas with their current values. For example, if a cell in the specified range contains the formula =A3*B3, which currently results in the value 34, /Range Value copies 34.

Note

If the *Calc* indicator appears at the bottom of the screen, press CALC [E2] to update formulas before you use /Range Value. If any of the formulas whose values you will be copying refer to cells in a file on disk, use /File Admin Link. Refresh to make sure those formulas' values are up to date.

Follow these steps when using /Range Value:

1. Select /Range Value.
2. Specify the FROM range (the range whose current values you want to copy) and press [E2].
3. Specify the TO range (the location for the copied values) and press ENTER. (You need to specify only the first cell of the TO range.)

Caution

If you specify a TO range that already contains data, 1-2-3 writes over the existing data. Formulas that acted on the previous contents of the TO range now act on the new data. To avoid possible data loss from writing over existing data, save the worksheet before using /Range Value. If you make a mistake when using /Range Value and the undo feature is on, press UNDO [E2] immediately to restore the worksheet to its original state.

To convert a formula to its current value without using /Range Value, move the cell pointer to the cell containing the formula, press EDIT [E2], press CALC [E2], then press ENTER.
The System Command

The /System command is not available in Lotus 1-2-3 on the HP 904X. To exit to the operating system, use the system command in the Filer.

Note
If your macros include either */ or {SYSTEM} macro commands, the macros will not work.
The Worksheet commands let you control the display and organization of your work. They also let you control global settings, which are 1-2-3 settings that affect the entire worksheet and 1-2-3 as a whole.

A default setting is one that 1-2-3 uses unless you specify a different setting.

A configuration setting is one that 1-2-3 uses each time you begin a session, such as open screen, Help access method, printer instructions, and many others. Configuration settings are stored in a file named 123.CNF, and displayed in a settings sheet when you select /Worksheet Global Default.

The /Worksheet commands are defined in the following sections.

Remember to press HELP (F1) to get information about the command you are using.

/Worksheet Column

Use /Worksheet Column to change the width of one or more columns, reset columns to the global column width, and hide and redisplay columns.

If you split the screen into two windows with /Worksheet Window Horizontal or Vertical, the /Worksheet Column affects only the window the cell pointer is in. When you clear the windows with /Worksheet Window Clear, 1-2-3 uses the top or left window's column settings.

/Worksheet Column Column-Range

Use /Worksheet Column Column-Range to change the width of a range of adjacent columns.

After you set the width of columns, with /Worksheet Column Column-Range Set-Width, the column's width appears in brackets in the control panel when the cell pointer is anywhere in that column.

13-2 The Worksheet Commands
Follow these steps to adjust a column width:

1. Select /Worksheet Column Column-Range.
2. Select one of the following options:
   - Set-Width  Changes the width of a range of columns.
   - Reset-Width Resizes a range of columns to the global default column width (the default is 9 characters).
3. Specify the range of columns whose widths you want to set or reset and press ENTER.
4. If you selected Set-Width, in step 2, specify the new width by doing one of the following:
   - Type a number from 1 to 240 and press ENTER.
   - Press  or  to decrease or increase the width and press ENTER.

/Worksheet Column Display

Use /Worksheet Column Display to redisplay hidden columns.

1. Select /Worksheet Column Display.
   1-2-3 temporarily redisplays all hidden columns with asterisks next to their column letters.
2. Specify the range of columns you want to redisplay and press ENTER.

/Worksheet Column Hide

Use /Worksheet Column Hide to hide one or more columns without permanently erasing the data in those columns. Formulas in hidden columns and formulas that refer to cells in hidden columns continue to work correctly.

1-2-3 temporarily redisplays hidden columns whenever it changes to POINT mode, using asterisks next to the column letters to identify them as hidden columns. Follow these steps to hide columns:

1. Select /Worksheet Column Hide.
2. Specify the range of columns you want to hide and press ENTER.
/Worksheet Column Reset-Width
Use /Worksheet Column Reset-Width to restore the global default column width (9 characters) for the column that contains the cell pointer.

/Worksheet Column Set-Width
Use /Worksheet Column Set-Width to change the width of the column that contains the cell pointer.

After you set the width of a column with /Worksheet Column Set-Width, the column's width appears in brackets in the control panel when the cell pointer is in that column.

Follow these steps to change the width of a cell:
1. Select /Worksheet Column Set-Width.
2. Specify a width for the current column by doing one of the following:
   - Type a number from 1 to 249.

/Worksheet Delete
Use /Worksheet Delete to remove columns or rows from the worksheet. 1-2-3 closes up the space left by the deletion. (You cannot delete columns or rows if /Worksheet Global Protection is enabled.)

1. Select /Worksheet Delete.
2. Select one of the following options:
   - Columns: Deletes one or more columns
   - Row: Deletes one or more rows.
3. Specify the range of columns or rows you want to delete and press [ENTER].

13-4 The Worksheet Commands
When a column or row deletion moves a cell used in a formula, 1-2-3 adjusts the cell address in the formula. For example, suppose you enter the formula =SUM(A1:B10) and then delete column A and B. 1-2-3 changes the formula to =SUM(C1:O10).

When a column or row deletion moves the upper left or lower right cell of a range used in a formula, 1-2-3 adjusts the range address in the formula. For example, suppose you enter the formula =SUM(B8..E3) and then delete columns C and D. 1-2-3 changes the formula to =SUM(B8..C3).

If you delete the upper left or lower right cell of a named range, the range loses its definition and formulas that refer to that range evaluate to ERR. For example, suppose you assign the range name TOTALS to R2..M15. If you then delete row 2 or column B, the range name loses its definition.

/Worksheet Erase

Use /Worksheet Erase to remove the worksheet from memory and replace it with a blank worksheet. /Worksheet Erase restores the default Global settings.

1. Select /Worksheet Erase.
2. Select one of the following options:
   - No: Returns 1-2-3 to READY mode without erasing the worksheet.
   - Yes: Erases the worksheet.

The Worksheet Commands 13-5
Note

\textit{Worksheet Erase} removes the current worksheet from memory, but it does not affect the worksheet file stored on disk. To avoid data loss, use \textit{File Save} to save the worksheet before using \textit{Worksheet Erase}. If you make a mistake when erasing a worksheet and the undo feature is on, press UNDO (82 83) immediately to restore the worksheet to its original state.

\textbf{Worksheet Global}

The \textit{Worksheet Global} command allows you to change settings that affect the current worksheet as well as configuration settings that 1-2-3 uses every time you start a 1-2-3 session.

\textbf{Global and Default Settings Sheets}

When you select \textit{Worksheet Global} or \textit{Worksheet Global Default}, 1-2-3 displays a special status screen called \textit{settings sheet}. The \textit{Worksheet Global settings sheet} displays the current global settings, such as the recalculation method and column width. When you change settings by making selections from the \textit{Worksheet Global} menu, the settings sheet reflects the changes. Conventional memory, Expanded memory and Math coprocessor are indicators and are not affected by menu selections.

The \textit{Worksheet Global Default settings sheet} displays the current default settings, such as the default directory and printer. When you change these settings by making selections from the \textit{Worksheet Global Default menu}, the settings sheet reflects the changes.

\textbf{Saving Global and Default Settings}

You may want to vary the settings you use with different worksheets. For example, you might want to set the recalculation method to Manual, and save the worksheet. The next time you retrieve it, recalculation will still be set to Manual, even if you started the 1-2-3 session with recalculation set to Automatic. Or you may set some settings, and then decide that you want to reset the Global settings for a new worksheet with \textit{Worksheet Erase}.
Default settings are saved in the 1-2-3 configuration file. These settings are in effect for every 1-2-3 session until you change them, or they are not saved with the worksheet.

/Worksheet Global Column-Width

Use /Worksheet Global Column-Width to change the width of all columns in the worksheet except those columns whose width you set individually with /Worksheet Column Set-Width or /Worksheet Column Column-Range Set-Width. The minimum column width is 1; the maximum is 240. The default global column width setting is 9 characters.

1. Select /Worksheet Global Column-Width.
2. Specify a column width by doing one of the following:
   - Type a number from 1 to 240.
   - Press [4] or [2] to decrease or increase the width; press [ENTER].

/Worksheet Global Default

The Worksheet Global Default commands let you control default settings for the 1-2-3 session. With these commands you can specify many global worksheet settings, such as printer instructions, the current directory, international and clock display formats, autotext, macros, and auto-attach add-ins.

Although the settings you establish with /Worksheet Global Default apply globally during the current 1-2-3 session, you can override some of them with other commands. (For example, you can override print margins set with /Worksheet Global Default Printer by using /Print Printer Option Margins.)

The settings you specify with /Worksheet Global Default are stored in a file called 122.CNF. This file is read by 1-2-3 each time you start a session, and the settings take effect automatically. If you have changed some settings and want to save them for future sessions, you must select /Worksheet Global Default Save, which will save the changes to the 122.CNF file. To view your current settings, select /Worksheet Global Default Status and check the status screen; or select /Worksheet Global Default and check the settings sheet.
Use /Worksheet Global Default Autoexec to tell 1-2-3 whether to run autoexec macro, macro named 123 (macro), when it retrieves a file that contains one. For more information on macros, see chapter 15.

1. Select /Worksheet Global Default Autoexec.
2. Select one of the following options:
   - Yes Automatically executes macro named 123 (macro).
   - No Does not automatically execute macro named 123 (macro).
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new Autoexec setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Directory

Use /Worksheet Global Default Directory to set the path (drive and directory names) that 1-2-3 automatically searches when you save, read, or list files. Initially, the default directory is the directory that contains the 1-2-3 program files. If the files you most frequently work with are in another directory, you will probably want to use this command to change the directory.

2. Specify the new directory and press ENTER.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new Directory setting in future sessions, select Update from the /Worksheet Global Default menu.

To override the default directory and change the current directory for the current session only, use /File Directory rather than /Worksheet Global Default Directory.

/Worksheet Global Default Other

The /Worksheet Global Default Other commands let you specify the international and clock display formats, the Help access method, the computer's beep, and auto-attach add-ins. This command also turns the undo feature on and off.

/Worksheet Global Default Other Add-In

Use /Worksheet Global Default Other Add-In to configure 1-2-3 so it automatically attaches an add-in program whenever you start 1-2-3. You can specify up to

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right auto-attach add-ins. You can also specify whether you want 1-2-3 to automatically invoke one of the auto-attach add-ins as well.

1. Select /Worksheet Global Default Other Add-in.
2. Select one of the following options:
   - **Set**: Sets an auto-attach add-in, and attaches the add-in.
   - **Cancel**: Cancels an auto-attach add-in, and detaches the add-in.
   - **Quit**: Returns you to the /Worksheet Global Default menu.

3. Select the number (1 through 8) of the auto-attach add-in to set or cancel.

   If you selected Set, 1-2-3 displays a menu of files with an ADN extension in the directory from which you started 1-2-3.

4. Specify the file name of the add-in you want to attach automatically and press ENTER.

   You can specify a different directory from the start up directory, if necessary, by pressing ESC to erase the path and then entering a new drive and/or directory.

   **Steps 5 and 6 do not apply to add-in functions.**

5. Select the key you want to use to invoke the add-in:
   - **7**: Assigns the add-in to RFP1 (ALT 10).
   - **8**: Assigns the add-in to RFP2 (ALT 10).
   - **9**: Assigns the add-in to RFP3 (ALT 10).
   - **10**: Assigns the add-in to RFP4 (ALT 10).
   - **no key**: Does not assign the add-in to a key.

   Once you assign an add-in to a key, that key will no longer appear in the menu during the current session unless you cancel the auto-attach add-in setting.

6. 1-2-3 asks if you want the add-in to be invoked automatically at the start of each session. Select one of the following options:
   - **Yes**: Invokes the auto-attach add-in whenever you start 1-2-3.
   - **No**: Attaches the add-in but does not automatically invoke it.
7. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new Add-In settings in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Other Beep. Lets you control whether 1-2-3 sounds the computer bell when errors occur and when executing (BEEP) commands in a macro.

1. Select /Worksheet Global Default Other Beep.
2. Select one of the following options:
   Yes 1-2-3 will sound the bell.
   No 1-2-3 will not sound the bell.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new Beep setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Other Help. Use /Worksheet Global Default Other Help to specify the method 1-2-3 uses to access the Help system. The Help file (123.HLP) either remains open during the 1-2-3 session (Instant), or closes each time you return to the worksheet (Removable).

1. Select /Worksheet Global Default Other Help.
2. Select one of the following options:
   Instant 1-2-3 opens the Help file the first time you press HELP (F1) in a 1-2-3 session and keeps the file open for the rest of the session.
   Removable 1-2-3 opens the Help file each time you press HELP (F1) and closes the file again when you press ESC to leave Help.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new Help setting in future sessions, select Update from the /Worksheet Global Default menu.

13-10 The Worksheet Commands
1-2-3 looks to the internal ROM (C:) for Instant Help and looks to a plug-in card (A:) for Removable Help. If 1-2-3 attempts to access Removable Help when the card is not inserted, 1-2-3 beeps and displays the error message No Help available. Press ESC to exit.

/Worksheet Global Default Other International. Use /Worksheet Global Default Other International to set a variety of display formats, including the punctuation for numbers, the argument separator for functions and advanced macro commands, the currency symbol, the international date and time formats, and the negative number display in Comma and Currency formats.

1. Select /Worksheet Global Default Other International.
2. Select one of the following options:
   - Punctuation: Sets the characters 1-2-3 uses as the decimal point, argument separator for functions and advanced macro commands, and thousands separator for numbers. You can choose from eight combinations of three, listed in order of decimal point, argument separator, and thousands separator: A (.), B (.), C (.), D (.), E (.), F (.), G (.) and H (.)
   - Currency: Sets the currency symbol 1-2-3 uses in cells formatted as Currency and whether the currency symbol precedes or follows numbers. (The default is $ Prefix.)
   - Date: Sets the international Date format 1-2-3 uses for cells formatted as DD (MM/DD/YY, Long Intl) or D5 (MM/DD, Short Intl). The options are: A (MM/DD/YY), B (DD/MM/YY), C (DD.MM.YY), and Y (YY-MM-DD).
Time

Sets the international Time format 1-2-3 uses for cells formatted as D8 (HH:MM:SS, 24 hour, long date) or D9 (HH/MM/SS, 24 hour, short date). The two options are A (HH:MM:SS), B (HH:MM:SS), C (HH:MM:SS), and D (HH:MM/YYYY).

Negative

Sets whether 1-2-3 uses parentheses (the default setting) or a minus sign for negative values in cells formatted as Currency or Currency.

Quit

Returns you to the /Worksheet Global Default menu.

3. Do one of the following, depending on the option you selected in step 2:
   - If you selected Punctuation, select A, B, C, D, E, F, G, or H.
   - If you selected Currency, enter the currency symbol and then select Prefix or Suffix. The currency symbol can consist of up to 15 characters and can include any of the characters in the standard International Character Set (ICS).
   - If you selected Date or Time, select A, B, C, or D.
   - If you selected Negative, select Parentheses or Sign.

4. To update the 1-2-3 configuration file (122.CFF) or 1-2-3 uses the new international settings in future sessions, select Update from the /Worksheet Global Default menu.

To use a character that is not on the keyboard as part of the default currency symbol, use COMPOSE ([ALT][ f]). For example, to specify the £ (British pound) as the default currency symbol, press COMPOSE ([ALT][ f]), type £, and press ENTER. For a list of ICS characters and composition sequences, see Appendix F.

/Worksheet Global Default Other Undo

Use /Worksheet Global Default Other Undo to turn the undo feature on and off. When the undo feature is on, you can press UNDO ([CTRL][ F4]) to undo any changes made to the worksheet since 1-2-3 was last in READY mode.

1. Select /Worksheet Global Default Other Undo.

2. Select one of the following options:
   - Enable: Turns on the undo feature.
   - Disable: Turns off the undo feature.

3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new undo setting in future sessions, select Update from the /Worksheet Global Default menu.

13-12 The Worksheet Commands
When undo is on, 1-2-3 reserves a portion of memory for the undo buffer, which is used to make a backup copy of the worksheet. 1-2-3 uses expanded memory for the undo buffer if possible, but uses conventional memory if there is not enough (or any) expanded memory available. Using conventional memory for the undo buffer significantly reduces the amount of memory for worksheet data and add-ins. If necessary, use /Worksheet Global Default Other Undo Disable to turn off the undo feature and increase your available memory. For other ways to increase available memory, see chapter 6.

For further information on Undo, see "Using the Undo Feature" in chapter 2.

/Worksheet Global Default Printer

The /Worksheet Global Default Printer command(s) provide 1-2-3 with information about your printer at the start of each 1-2-3 session, including the type of printer you are using, its interface with your computer, and the settings for printing pages.

(Use /Print Printer Options rather than /Worksheet Global Default Printer to specify settings for individual print sets.)

/Worksheet Global Default Printer AutoLF. Use /Worksheet Global Default Printer AutoLF to control the signal 1-2-3 sends to your printer at the end of each line of output.

To determine the correct AutoLF setting for your printer, print a range of two or more rows. Then use the following guidelines:

- If the printing is double-spaced, set AutoLF to Yes.
- If the paper in the printer does not advance, set AutoLF to No (the default setting).

Follow these steps when using /Worksheet Global Default Printer AutoLF:

1. Select /Worksheet Global Default Printer AutoLF.
2. Select one of the following options:
   - Yes: Does not send line feeds to your printer because your printer automatically advances at the end of each line of output.
   - No: Sends line feeds to your printer at the end of each line of output because your printer does not automatically advance.

The Worksheet Commands 15-13
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Printer Bot. Use /Worksheet Global Default Printer Bot to set the default bottom margin for printed pages in number of standard lines. You can specify any number from 0 to 32 (the default setting is 2).

1. Select /Worksheet Global Default Printer Bot.
2. Specify the number of standard lines (0 to 32) for the default bottom margin and press Enter.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Printer Interface. Use /Worksheet Global Default Printer Interface to specify the interface for your printer. The interface, or port, refers to the way your printer is connected to the computer. The default is 2 (Serial 1). This is the only appropriate interface for the HP-GL/2 at this time.

For the serial interface, you will need to indicate the baud for which your printer is set (the default is 9600). The baud is the rate at which 1-2-3 sends data to the printer. The baud setting must match your printer’s baud rate. The 1-2-3 printer interface and baud rate default to the printer interface and baud specified in the Setup utility.

Follow these steps when using /Worksheet Global Default Printer Interface:

1. Select /Worksheet Global Default Printer Interface.
2. Select 2 (Serial 1).
3. Select one of the following options to specify the baud:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>110 baud</td>
<td>6</td>
<td>2400 baud</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>150 baud</td>
<td>7</td>
<td>4800 baud</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>300 baud</td>
<td>8</td>
<td>9600 baud</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>600 baud</td>
<td>9</td>
<td>19200 baud</td>
<td></td>
</tr>
</tbody>
</table>

13-14 The Worksheet Commands
1. To update the 1-2-3 configuration file (123.CNF) in 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

Change the following settings on your serial printer. These are not settings you can change in 1-2-3—refer to your printer manual for instructions.

Data bits: 8
Stop bits: 2 if 110 baud; otherwise 1
Parity: None
Handshaking (XON/XOFF): Enabled

/Worksheet Global Default Printer Left. Use /Worksheet Global Default Printer Left to set the default left margin for printed pages (in number of characters from the left edge of the paper). You can specify any number from 0 to 254, but the number should be smaller than the number you specify as the right margin setting. The default left margin setting is 4.

1. Select /Worksheet Global Default Printer Left.
2. Specify the number of standard characters (6 to 244) for the default left margin and press ENTER.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Printer Name. /Worksheet Global Default Printer Name specifies which printer you want to use. The HP 96LX uses the system printer as specified in the Setup utility.
Worksheet Global Default Printer Pg-Length. Use /Worksheet Global Default Printer Pg-Length to set the length of each printed page. Page length is measured in standard lines.

The Pg-Length setting determines the number of printed lines per page and where 1-2-3 creates page breaks when printing. You can specify any number from 1 to 100; the default setting is 66.

1. Select /Worksheet Global Default Printer Pg-Length.
2. Specify the number of standard lines (1 to 100) for the page length and press ENTER.
3. To update the 1-2-3 configuration file (12C.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

Worksheet Global Default Printer Quit. Use /Worksheet Global Default Printer Quit to return to the /Worksheet Global Default menu.

Worksheet Global Default Printer Right. Use /Worksheet Global Default Printer Right to set the default right margin for printed pages, in number of characters from the left edge of the paper. You can specify any number from 0 to 260, but the number should be greater than the number you specify as the left margin setting. The default right margin setting is 78.

1. Select /Worksheet Global Default Printer Right.
2. Specify the number of standard characters (0 to 260) for the default right margin and press ENTER.
3. To update the 1-2-3 configuration file (12C.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

Worksheet Global Default Printer Setup. Use /Worksheet Global Default Printer Setup to enter a default setup string, which is a series of characters preceded by a backslash (\) that 1-2-3 sends to your printer to tell it to print a certain way. For example, you can send a setup string that causes the printer to compress type or underline text.

You create setup strings by translating the printer control codes for your printer into the appropriate format. For more information on entering printer control codes as setup strings, see appendix C. (To avoid problems when printing, do not use setup strings to control print settings that you can control through 1-2-3 commands.)

13-16 The Worksheet Commands
1. Select /Worksheet Global Default Printer Setup.
2. Specify the default setup string and press [ENTER].
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Printer Top. Use /Worksheet Global Default Printer Top to set the default top margin for printed pages (in number of standard lines). You can specify any number from 0 to 32; the default setting is 2.
1. Select /Worksheet Global Default Printer Top.
2. Specify the number of standard lines (0 to 32) for the default top margin and press [ENTER].
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Printer Wait. Use /Worksheet Global Default Printer Wait to tell 1-2-3 to pause after it prints each page so you can insert a new piece of paper. Use this command when you are printing on single sheets of paper rather than continuous-form paper. (The default setting is No.)
1. Select /Worksheet Global Default Printer Wait.
2. Select one of the following options:
   Yes
   Purses after printing each page so you can insert a new sheet of paper. (Do not select Yes if you are using a print spooler because the spooler controls single sheet paper feeding.)
   No
   Does not pause after printing a page.
3. To update the 1-2-3 configuration file (123.CNF) so 1-2-3 uses the new setting in future sessions, select Update from the /Worksheet Global Default menu.

/Worksheet Global Default Quit
Use /Worksheet Global Default Quit to return 1-2-3 to READY mode.

/Worksheet Global Default Status
Use /Worksheet Global Default Status to display current worksheet settings, such as the default directory. The status screen overlays the worksheet. You can press any key to redisplay the worksheet.

The Worksheet Commands 13-17
1. Select /Worksheets Global Default Status.
2. When you finish viewing the status screen, press any key to remove it and redisplay the worksheet.

To see information about available memory, recalculation settings, circular references, the math operators you are using, the global cell format, label prefixes, column width and zero display settings, and the protection status of the current worksheet, select either /Worksheet Status or /Worksheet Global to display the settings sheet.

/Worksheet Global Default Status is useful if you have cleared the display of the settings sheet by pressing WINDOW (C) and then want to redisplay the settings sheet.

/Worksheet Global Default Update

Use /Worksheet Global Default Update to save the current /Worksheet Global Default settings in the 1-2-3 configuration file (123.CNF). 1-2-3 reads the new /Worksheet Global Default settings each time you start the program until you change the settings and again select /Worksheet Global Default Update.

/Worksheet Global Format

Use /Worksheet Global Format to set the global cell format for the worksheets. The cell format setting determines the way 1-2-3 displays data in the worksheet.

When using /Worksheet Global Format, note the following:

---

1. Cells formatted with /Range Format override the global format set with /Worksheet Global Format.
2. Changing a cell’s format changes the way 1-2-3 displays data in the cell but not the data itself. You may, for example, choose a cell format that displays 45.123 as $45, but 1-2-3 still stores the value as 45.123 and uses the decimal places when calculating.
3. If 1-2-3 displays a cell filled with asterisks after you use /Worksheet Global Format, it usually means the column is not wide enough to display the entire number in the specified cell format. The column must be one character wider than the width of the number as formatted. To remove the asterisks and redisplay the number, widen the column with /Worksheet Column Set-Width or /Worksheet Global Column Width. Or try a cell format which uses fewer characters.

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13-16 The Worksheet Commands
- Cell formats set with /Worksheet Global Format are not displayed in the control panel, as they are with /Range Format.

Follow these steps when using /Worksheet Global Format:

1. Select /Worksheet Global Format.
2. Select the cell format you want from the series of menus and prompts 1-2-3 displays.

The following table describes the /Worksheet Global Format menu and includes examples of data in each cell format. The third column of the table shows the data as you would enter it and the fourth column shows the way 1-2-3 displays the data in the worksheet when you select the format type indicated in parentheses.

<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Data as entered</th>
<th>Data as displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comma</td>
<td>Display numbers with thousands separators, up to 11 decimal places, parentheses or a single sign (depending on the /Worksheet Global Default Other International Negative setting) for negative, and a leading zero for decimal values. Comma format is the same as Currency format without the currency symbol.</td>
<td>4500</td>
<td>(4,500.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15000</td>
<td>(15,000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.53</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The Worksheet Commands 13-19
<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Data as entered</th>
<th>Data as displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Displays numbers with a currency symbol,</td>
<td>12</td>
<td>(C$) $12:00</td>
</tr>
<tr>
<td></td>
<td>decimal places, up to 15 decimal places, or a minus sign (depending on the Worksheet Global Default Other International Negative setting) for negative, and a leading zero for decimal values. The currency symbol 1-2 #s depend on the current Worksheet Global Default Other International Currency setting.</td>
<td>-256</td>
<td>(C1) $0:03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>116.09</td>
<td>(C0) $1:35</td>
</tr>
<tr>
<td>Date</td>
<td>Displays numbers from 1 (the date number for 1 January 1900 is 252000) to 229999 (the date number for 31 December 2009 is 224ld). In other formats you select, 1-2 #s determine the date the number represents, and ignore the decimal part of the number. There are five Date formats: [1] [2] [3] [4] [5] [6]; DD-MM-YY, DD-MM-YY, DD-MM-YY, Long Month, and Short Month. For numbers less than 1 or more than 32,000, displays asterisks.</td>
<td>32734.11</td>
<td>(D1) 31-Aug-39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32734.89</td>
<td>(D2) 14-Aug</td>
</tr>
<tr>
<td></td>
<td></td>
<td>224ld</td>
<td>(D3) 31-Aug-39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32734.89</td>
<td>(D4) 08/14/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32734.89</td>
<td>(D5) 08/14/09</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32734.89</td>
<td>(D6) 08/14/09</td>
</tr>
<tr>
<td>Format</td>
<td>Result</td>
<td>Date as displayed</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><strong>D-Hh-Mm-Ss</strong> Time</td>
<td>Displays numbers as times, in the Time format you select. Leading zeros will be used to determine the time the number represents. For positive numbers, 1-2-3 calculates the time number by adding the decimal part of the number to 0. There are four Time formats (24-hour): H-HH-MM, AM/PM, HH:AM (AM/PM), long (long time in 24-hour), short (short time in 24-hour).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>58055</td>
<td>(T1) 02:03:37 PM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>58055</td>
<td>(T2) 02:03:37 PM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MM:SS</td>
<td>(T3) 14:03:37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(T4) 14:03</td>
<td>(T4) 14:03:37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(T4) 14:03</td>
<td>(T4) 14:00:00</td>
<td></td>
</tr>
<tr>
<td>Fixed</td>
<td>Displays numbers with up to 15 decimal places; a minus sign for negatives, and a leading zero for decimal values.</td>
<td>11.383</td>
<td>(F1) 17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-873.2</td>
<td>(F2) -8152.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0745</td>
<td>(F3) 0.6</td>
</tr>
<tr>
<td>General</td>
<td>Displays numbers with a minus sign for negatives, to thousands separators, and no trailing zeros to the right of the decimal point.</td>
<td>1600.00</td>
<td>(G) 1600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>=12.43700</td>
<td>(G) =12.437</td>
</tr>
<tr>
<td></td>
<td>When the number of digits to the left of the decimal point exceeds the column width minus one, use scientific notation. When the number of digits to the right of the decimal point exceeds the column width, 1-2-3 displays as many digits as it can.</td>
<td>13000000000</td>
<td>(G) 1.3000E+11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(when column width is 12)</td>
<td>(G) 1.2338766</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(when column width is 9)</td>
<td>(G) 1.2338766</td>
</tr>
</tbody>
</table>

The Worksheet Commands 10-21
<table>
<thead>
<tr>
<th>Format</th>
<th>Result</th>
<th>Data as entered</th>
<th>Data as displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hidden</td>
<td>Makes data in the range invisible, though the data still exists. The date appears in the control panel unless the cells are protected and global protection is enabled.</td>
<td>$+C2/J4.2^*H2$</td>
<td>(H1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.4278</td>
<td>(P)</td>
</tr>
<tr>
<td>Percent</td>
<td>Displays numbers as percentages (that is, multiplied by 100), with up to 15 decimal places and a percent sign.</td>
<td>12.4278%</td>
<td>(P1) 124.75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.45%</td>
<td>(P2) -4.45%</td>
</tr>
<tr>
<td>+ / -</td>
<td>Displays a bar of plus or minus signs or a period. The number of plus or minus signs in the bar equals the whole number value of the entry (rounded to the nearest integer). Plus signs indicate a positive value, minus signs indicate a negative value, and a period indicates a number between -1 and 1. If the whole number value of the entry is wider than the width of the column the entry is in, 1-2-2 displays asterisks instead of a bar.</td>
<td>5.3</td>
<td>(+) + + + + +</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-3</td>
<td>(+) - --</td>
</tr>
<tr>
<td>Sci. (Scientific)</td>
<td>Displays numbers in scientific (exponential) notation, with up to 15 decimal places in the mantissa and an exponent from -99 to +99.</td>
<td>4.3E+12</td>
<td>(S0) -4E+60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.45E00</td>
<td>(S1) 1.2E+01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1246800000000000</td>
<td>(S2) 1.2E+11</td>
</tr>
<tr>
<td>Text</td>
<td>Displays formulas as entered rather than their computed value, displays numbers in General format.</td>
<td>$+C2/J4.2^*H2$</td>
<td>(T1) +C2/J4.2*H2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>155.00</td>
<td>(T2) +FIRST&amp;LAST</td>
</tr>
<tr>
<td></td>
<td></td>
<td>165.03</td>
<td>(T) 165.03</td>
</tr>
</tbody>
</table>

13-22 The Worksheet Commands
Use /Worksheet Global Label- Prefix to set the global label alignment for the worksheet. The command affects future entries only; it does not change the alignment of labels already entered in the worksheet.

1. Select /Worksheet Global Label- Prefix.
2. Select one of the following options:
   - Left: Aligns labels at the left edge of cells.
   - Right: Aligns labels at the right edge of cells.
   - Center: Centers labels in cells.

Labels that exceed the width of a column always appear left-aligned regardless of the global label alignment setting.

You can override the global label alignment setting by using /Range Label after you enter a label, or by typing a label prefix as the first character in a label you are entering.

Label prefix Alignment
- Left: Aligns labels at the left edge of cells.
- Right: Aligns labels at the right edge of cells.
- Center: Centers labels in cells.

/Worksheet Global Protection

Use /Worksheet Global Protection to turn global protection on or off for the worksheet. It works in conjunction with /Range Prot and /Range Unprot to prevent changes being made to particular cells.

When global protection is on (1-2-3 displays #R in the control panel for protected cells), you can make changes only to cells that you explicitly unprotected with /Range Unprot.

1. Select /Worksheet Global Protection.
2. Select one of the following options:
   - Enable: Turns on worksheet protection, preventing you from entering or editing data in the worksheet except in cells you explicitly unprotected with /Range Unprot.
   - Disable: Turns off worksheet protection, letting you enter or edit data in any cell in the worksheet.

The Worksheet Commands 15-23
/Worksheet Global Recalculation

Use /Worksheet Global Recalculation to control when and in what order 1-2-3 recalculates worksheet formulas and how many recalculation passes 1-2-3 performs each time it recalculates the formulas.

The recalculation settings you specify with /Worksheet Global Recalculation remain in effect until you end the 1-2-3 session or read into memory another worksheet file with different recalculation settings. Whenever you read a file into memory with /File Retrieve, that file's recalculation settings override the current recalculation settings for the 1-2-3 session. The default setting is Automatic (recalculation method) Natural (recalculation order).

1. Select /Worksheet Global Recalculation.
2. Select from the following options to specify a new recalculation order and/or recalculation method, or change the number of recalculation passes (you can select one option from each of the following categories):

12-04 The Worksheet Commands
<table>
<thead>
<tr>
<th>Recalculation order:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
</tr>
<tr>
<td>Columnwise</td>
</tr>
<tr>
<td>Rowwise</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recalculation method:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic</td>
</tr>
<tr>
<td>Manual</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recalculation pasmes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
</tr>
</tbody>
</table>

2. If you selected Iteration, specify the number of recalculation passes (1 to 50) and press [EXE].

**Recalculation.** Whenever the recalculation order specified with /Worksheet Global Recalculation is Natural, 1-2-3 recalculates only those cells that have changed since the worksheet was last recalculated, and the cells that depend on them. Known as minimal recalculation, this feature optimizes the recalculation of cells in a worksheet and decreases recalculation time. There is no way to turn minimal recalculation on or off. If, however, you change the recalculation order to a setting other than Natural, 1-2-3 does not use minimal recalculation and will recalculate all the formulas in the worksheet when you make a change.

*The Worksheet Commandos* 13-25
There are several functions that 1-2-3 updates each time it recalculates the worksheet—even when minimal recalculation is in effect—because their values may change even if you do not modify the worksheet:

- @SAF
- @SAPP
- @STRING
- @TIMEVALUE
- @DATEVALUE
- @RAND
- Add-in functions

1-2-3 also recalculates cells that depend on the cells containing these functions.

Use Manual recalculation to speed up macro execution. When a macro is running, 1-2-3 performs Automatic recalculation not in the background but rather between macro instructions. For this reason, Automatic recalculation may slow down macro execution. If you use Manual recalculation when running a macro, you can use [CALC], [RECALC], and [RECALCCOL] to control when 1-2-3 recalculates formulas.

/Worksheet Global Zero

Use /Worksheet Global Zero to specify whether 1-2-3 displays a zero, a label, or nothing in cells that contain either the number zero or a formula that evaluates to zero.

1. Select /Worksheet Global Zero.

2. Select one of the following options:

   - No (Default) Displays zero in cells whose value is zero.
   - Yes Causes cells whose value is zero to appear blank. 1-2-3 continues to display the contents of these cells in the control panel.
   - Label Displays a label in cells whose value is zero. 1-2-3 continues to display the contents of these cells in the control panel.

3. If you selected Label, type the label to display in cells whose value is zero and then press [ENTER]. Pressing [ENTER] without typing a label will cause 1-2-3 to display zeros as blanks.

   The label can be any combination of up to 240 characters. If you want to left-align or center the label in cells, type the appropriate

13-26 The Worksheet Commands
label prefix (" or ") at the beginning of the label. Otherwise, 1-2-3 inserts the " label prefix, and right-aligns the label in cells.

If any zeros remain in the worksheet after you select /Worksheet Global Zero Yes or Label, they represent nonzero values in cells whose format makes them look like zero. For example, if you enter .05 in a cell formatted as Fixed, 0 decimal places, 1-2-3 displays 0 in the cell regardless of the worksheet's global zero setting. (To have the global zero setting affect that cell, use @ROUND to round the number to a true zero.)

If you select /Worksheet Global Zero Yes, you may want to turn on worksheet protection with /Worksheet Global Protection Enable so you do not inadvertently write over data in cells that appear empty.

/Worksheet Insert

Use /Worksheet Insert to insert one or more blank columns or rows in the worksheet.

1. Select /Worksheet Insert.
2. Select one of the following options:
   - Column: Inserts one or more blank columns to the left of the first column of the insert range.
   - Row: Inserts one or more blank rows above the first row of the insert range.
3. Specify a range that includes at least one cell in each of the columns or rows you are inserting, and press [Enter].

/Worksheet Learn

/Worksheet Learn provides an alternative method of entering macro instructions. Instead of typing the macro instructions, you can record the task that you want to automate.

Once you specify a learn range and turn on the learn feature with LEARN ([ALT][E]), 1-2-3 transcribes your keystrokes into macro instructions and records them in the learn range. 1-2-3 continues recording your keystrokes until you turn off the learn feature by pressing LEARN ([ALT][E]) again or until you fill the learn range. You then name the macro and when you run it, 1-2-3 automatically executes the instructions recorded in the learn range.

The Worksheet Commands 13:27
For more information on how to use the learn feature to write macros, read "Using the Learn Feature to Create Macros" in chapter II.

/*Worksheet Learn Cancel*/

Use /Worksheet Learn Cancel to cancel the currently specified learn range. If you want 1-2-3 to record keystrokes when you turn on the learn feature, you must specify another learn range.

/*Worksheet Learn Erase*/

Use /Worksheet Learn Erase to clear the contents of the learn range. The range is still defined and if you turn on the learn feature by pressing LEARN (ALT-ESC), 1-2-3 will record new keystrokes in the range.

1. Select /Worksheet Learn Erase.
2. Select one of the following options:
   Yes Clear the contents of the learn range.
   No Return to 1-2-3 to READY mode.

/*Worksheet Learn Range*/

Use /Worksheet Learn Range to specify the range where 1-2-3 will record keystrokes at labels. 1-2-3 begins recording keystrokes in the learn range when you turn on the learn feature by pressing LEARN (ALT-ESC). 1-2-3 continues recording keystrokes until you press LEARN again (to turn off the learn feature).

1. Select /Worksheet Learn Range.
2. Specify a long, single-column range in an empty part of the worksheet and press ENTER.

Here are some tips to remember when using /Worksheet Learn Range:

- It is necessary to specify only one’s single column as the learn range. 1-2-3 stores your keystrokes as long labels in the leftmost column of the learn range, even if you specify a multi-column range.
- If there are any nonblank cells in the learn range when you press LEARN, 1-2-3 begins recording keystrokes in the first cell of contiguous blank cells that extend all the way to the bottom of the learn range. This can significantly reduce the number of keystrokes that can be recorded in the learn range. For example, if the bottom cell of the learn range is nonblank and you turn on the learn feature, the learn range will be immediately filled—even if...

13-38 The Worksheet Commands
all the other cells in the learn range are blank. If 123 displays a Learn Range is Full error message, you can increase the size of the learn range and then continue saving keystrokes in the learn range. Press ESC to clear the error message, select /Worksheet Learn Range, specify a new learn range that is large enough to accommodate your macro, and then press ENTER. You may have to reenter the keystroke that caused the error message, and check the macro to be sure it is complete.

- Be careful not to delete the column that contains the learn range while the learn feature is on. If you do, 1-2-3 turns off the learn feature and cancels the learn range.
- If you make a mistake when the learn feature is on, you can erase the entire learn range with /Worksheet Learn Erase and start again, or you can continue to record keystrokes and edit the macro later in the same way that you edit all 1-2-3 data. For more information, see "Editing an Entry" in chapter 2. To successfully edit macros, you must be familiar with the guidelines for entering macro instructions. See "Entering a Macro" in chapter 15.

/Worksheet Page

Use /Worksheet Page to insert a row in the worksheet that contains two columns (|:). When you print the worksheet range, this symbol forces a page advance and resets the line counter in 1-2-3.

1. Position the cell pointer in the leftmost column of the range you are printing and the row where you want a new page to start.
2. Select /Worksheet Page.

Do not enter data to be printed in the same row as the page break symbol. Except for the page break symbol, 1-2-3 ignores this row when printing.

You can also enter a page break symbol manually. Move the cell pointer to the leftmost column in the range you are printing, and enter a split vertical bar followed by two colons (|:|) in the row where you want the new page to start.

The Worksheet Commands 13-29
Worksheet Status

Use /Worksheet Status to display information about available memory, recalculation, cell display format, circular references, and global protections in a status screen that overlays the worksheet.

1. Select /Worksheet Status.
2. When you finish viewing the status screen, press any key to remove it and redisplay the worksheet.

The status screen displays only one circular reference at a time. If you eliminate the displayed circular reference, select /Worksheet Status again to see whether another circular reference exists.

Worksheet Titles

Use /Worksheet Titles to freeze rows and/or columns along the top and left edges of the worksheet so they remain in view as you work through the worksheet.

1. Before freezing worksheet titles, position the cell pointer as follows:
   - For Horizontal titles, position the cell pointer one row below the rows you want to freeze.
   - For Vertical titles, position the cell pointer one column to the right of the columns you want to freeze.

2. For Both (horizontal and vertical) titles, position the cell pointer one row below and one column to the right of the rows and columns you want to freeze.

3. Select /Worksheet Titles.

4. Select one of the following options:
   - Both: Freeze rows above the cell pointer and columns to the left of the cell pointer.
   - Horizontal: Freeze rows above the cell pointer.
   - Vertical: Freeze columns to the left of the cell pointer.
   - Clear: Unfreezes all title rows and columns.

To move the cell pointer to a frozen row or column, press GOTO and then specify the address or range name of the cell you want to go to. 1-2-3 displays a second set of the frozen rows or columns immediately below or to the right of the first set and moves the cell pointer to the specified cell there. To clear the second set of frozen rows or columns, press CLEAR and then [F6] (for row) or [F7] (for column).

13-38 The Worksheet Commands
1-2-3 automatically clears worksheet titles in any situation in which the cell pointer would not be visible because of the current /Worksheet Titles setting. For example, suppose you retrieve a file in which rows 1 through 25 were set as worksheet titles but your screen displays only 20 rows. 1-2-3 automatically clears the titles when you retrieve the file because otherwise the cell pointer would not be visible on your screen.

/Worksheet Window

Use /Worksheet Window lets you view your work in several ways: It lets you split the screen horizontally or vertically into two windows, and synchronize scrolling in two windows or scroll them independently.

1. Before creating split windows, do one of the following:
   - To split the screen horizontally, move the cell pointer to the row you want to use as the top edge of the second window.
   - To split the screen vertically, move the cell pointer to the column you want to use as the left edge of the second window.

2. Select /Worksheet Window.

3. Select one of the following options:
   - **Horizontal**: Creates two windows with the screen split horizontally immediately above the row the cell pointer is in. Use WINDOW (F3) to move the cell pointer from one window to the other.
   - **Vertical**: Creates two windows with the screen split vertically immediately to the left of the column the cell pointer is in. Use WINDOW (F4) to move the cell pointer from one window to the other.
   - **Sync**: Synchronizes window scrolling (the default setting).
   - **Unsync**: Unsynchronizes window scrolling, allowing windows to scroll independently in all directions.

The Worksheet Commands 12-31
Clear

Restores a single window that occupies the whole screen, using the contexts and settings of the window that was on the left or on the top.

With horizontal or vertical windows, all commands that change the worksheet display affect both windows, except for /Worksheet Column, /Worksheet Global Column Width, and /Worksheet Titles, which affect only the current window.

When you clear horizontal or vertical windows, 1-2-3 uses the titles, global and individual column width settings, and hidden/displayed columns of the top or left window.

13-32 The Worksheet Commands
1-2-3 @Functions

The 1-2-3 @functions are built-in formulas that perform a variety of calculations. You can use @functions for financial, mathematical, statistical, string, or date-and-time calculations. You can also use @functions to create conditional formulas or perform such tasks as looking up a value in a table.

This chapter is divided into three sections:
- “Syntax of @Functions” explains the rules for writing formulas that contain @functions.
- “Types of @Functions” lists the 1-2-3 @functions by category, and provides some specific rules and tips.
- “@Function Descriptions” contains descriptions and examples of each @function, arranged alphabetically.

Syntax of @Functions

Each @function has a specific structure, or syntax. Unless you follow this syntax exactly, 1-2-3 cannot interpret the @function. The syntax for an @function is in one of two forms:
- An @ symbol followed by the function name, as in @PI and @NOW.
- An @ symbol and the function name followed by a set of parentheses enclosing arguments separated by argument separators (normally commas or semicolons). Examples of this syntax are @DB(1000,200,6,5) and @TIME(12,32,0).
Arguments

Arguments supply the information 1-2-3 needs to complete the function calculation. For example, when 1-2-3 encounters the function @SUM(B4..B25), the argument B4..B25 tells 1-2-3 to add the values in the range B4..B25.

The arguments in an @function can be any length, providing the total number of characters in the cell that contains the @function does not exceed 240.

@functions use four types of information as arguments: value, strings, locations (cells or ranges), and conditions (usually logical formulas).

• For value arguments, you can use a number, a numeric formula, or the range name or address of a cell that contains a number or numeric formula.
• For string arguments, you can use a literal string (any sequence of letters, numbers, and symbols enclosed in quotation marks), a string formula, or the range name or address of a cell that contains a label or string formula.

Note

Every literal string used as a string argument should be enclosed in quotation marks. This prevents 1-2-3 from interpreting the literal string as a number, formula, address, or range name. It also prevents 1-2-3 from interpreting commas, semicolons, or periods within the literal string as argument separators.

• For location arguments, you can use a range name or address.
• For condition arguments, you typically use a logical formula (a formula that uses one of the logical operators < > = <= >= #NOT# #AND# and #OR#) or the range name or address of a cell that contains a logical formula. However, you can also use any numeric or string formula, number, literal string, or cell reference as a condition argument.

14-2 @Functions
Basic Rules of Syntax

Use these general guidelines when you enter @functions:

- Begin every @function with the @ (at sign).
- You can type @functions in either uppercase or lowercase letters; 1-2-3 displays them in uppercase letters.
- Do not include spaces between the @function name and its arguments. For example, @AVG(B8..B2) is correct; @AVG (B8..B2) is not.
- Always enclose an @function's arguments in parentheses.
- When you use an @function as an argument, enclose the arguments for each @function in parentheses. For example, in @INT(@SUM(A5..A11)), the argument for @INT is (@SUM(A5..A11)), and the argument for @SUM is (A5..A11).
- If an @function includes two or more arguments, separate the arguments from one another with argument separators. By default, commas and semicolons are the valid argument separators for @functions, but you can use /Worksheet Global Default Other International Punctuation to set argument only or semicolons and periods as the valid argument separators.
- You can use an @function by itself as a formula, combine it with other @functions and formulas, or use it in a macro. (To learn how to write 1-2-3 macros, see "Creating a Macro" in chapter 75.) In any case, the total number of characters in the cell that contains the formula or macro instructions must not exceed 240.
- 1-2-3 assigns the value 0 to blank cells whose addresses are used as arguments in financial, logical, and mathematical @functions.

Types of @Functions

1-2-3 @functions can be grouped into nine categories.

- Add-in @functions that perform a variety of tasks are available from many third-party software developers.
- Database @functions perform statistical calculations and queries in 1-2-3 databases.
- Date and time @functions calculate values that represent dates and times.
- Financial @functions calculate loans, annuities, and cash flows.
Logical functions calculate the results of conditional (logical) formulas. For information about logical formulas, read “Working with Formulas” in chapter 2.

Mathematical functions perform a variety of calculations with values.

Special functions perform a variety of tasks, such as looking up a value in a table or providing information about a specific cell.

Statistical functions perform calculations on lists of values.

String functions calculate with strings—labels, string formulas, or literal strings (any sequence of letters, numbers, and symbols enclosed in quotation marks).

Add-In Functions

If an add-in program provides functions, they can be attached and will remain in memory until you end the 1-2-3 session. If you want to retrieve a worksheet that contains add-in functions, you should attach the appropriate add-in functions before retrieving the file.

Note

If you retrieve a worksheet that contains add-in functions without first attaching the appropriate add-in, each add-in function is displayed as #N/A in the control panel and returns the value #NA in the worksheet. To correct this, attach the add-in and then retrieve the worksheet again.

Database Functions

For a complete description of each function listed here, see the alphabetical listing later in this chapter.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@AVG</td>
<td>Averages the values in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@COUNT</td>
<td>Counts the nonblank cells in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@DNAX</td>
<td>Finds the largest value in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@DMIN</td>
<td>Finds the smallest value in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@STDEV</td>
<td>Calculates the population standard deviation of the values in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@SUM</td>
<td>Sums the values in a field of a database based on certain criteria.</td>
</tr>
<tr>
<td>@VAR</td>
<td>Calculates the population variance of the values in a field of a database based on certain criteria.</td>
</tr>
</tbody>
</table>

**Guidelines for Using Database @functions**

Database @functions scan a database, select the records that match the criteria in the criteria range, and then perform calculations on the selected values or labels in the field you specify.

All database @functions have three arguments: `input`, `field`, and `criteria`.

- **Input** is the range that contains the database. `Input` can be the address or name of a range that contains a database.
- **Field** is the field's offset number. A field's offset number corresponds to the position of the column the field occupies in the input range. The first field of the input range has an offset number of 0, the second field has an offset number of 1, and so on. If the field's offset number is a value larger than the number of columns minus 1, database @functions return the value ERR. For example, if there are 5 columns in an input range, the largest valid offset number is 4.
- **Criteria** is a range you create to specify selection requirements. Each criteria range must include field names from the input range and the criteria you want 1-2-3 to use. You must enter the criteria directly below their corresponding field names. `Criteria` can be a range address or a range name.
Date and Time @Functions

For a complete description of each @Function listed here, see the alphabetical listing later in this chapter.

### Date calculations:

<table>
<thead>
<tr>
<th>@Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@DATE</td>
<td>Calculates the date number for a set of year, month, and day values. For example, @DATE(98, 7, 28) returns 32515, the date number for January 7, 1989.</td>
</tr>
<tr>
<td>@DATEVALUE</td>
<td>Converts a string that looks like a date into its equivalent date number. For example, @DATEVALUE(&quot;7-Jan-89&quot;) returns the date number 32515.</td>
</tr>
<tr>
<td>@DAY</td>
<td>Calculates the day of the month as a date number. For example, @DAY(32515) returns the value 7 because 32515 is the date number for January 7, 1989.</td>
</tr>
<tr>
<td>@MONTH</td>
<td>Calculates the month as a date number. For example, @MONTH(32515) returns the value 1 because 32515 is the date number for January 7, 1989.</td>
</tr>
<tr>
<td>@YEAR</td>
<td>Calculates a two- or three-digit value for the year in a date number. For example, @YEAR(32515) returns the value 99 because 32515 is the date number for January 7, 1989.</td>
</tr>
</tbody>
</table>

### Time calculations:

| @HOUR | Calculates the hour in a time number (based on a 24-hour format). For example, @HOUR(0,0,0,475) returns the value 14 because 0.00475 is the time number for 2:30:50 PM. |
| @MINUTE | Calculates the minutes in a time number. For example, @MINUTE(0,0,0,475) returns the value 30 because 0.00475 is the time number for 2:30:50 PM. |
| @SECOND | Calculates the seconds in a time number. For example, @SECOND(0,0,0,475) returns the value 56 because 0.00475 is the time number for 0.0056 seconds. |
| @TIME | Calculates the time number for a set of hours, minutes, and seconds values. For example, @TIME(1,30,40) returns 0.004745, the time number for 1:30:40 PM. |
| @TIMEVALUE | Converts a string that looks like a time into its equivalent time number. For example, @TIMEVALUE("02:30:40 PM") returns the time number 0.004745. |
**Guidelines for Using Date and Time @Functions**

- **Date @functions** use date numbers, consecutive integers that correspond to dates from January 1, 1900 (the date number 1) through December 31, 2099 (the date number 20999).
- **Time @functions** use time numbers, consecutive decimal values that correspond to times from midnight (the time number 0.000000) through 11:59:59 PM (the time number 0.999999).
- To format date and time numbers so 1-2-3 displays them as actual dates and times, use /Range Format Date or /Worksheet Global Format Date. For example, @DATE(89,1,7) returns the date number 32115. You can format this number to appear on the screen as 07-Jan-89, 07-Jan-89, or in an International Date format, such as 01/07/89. The function @TIME(14,36,50) returns the time number 3.604765. You can format this number to appear on the screen as 02:30 PM, 02:30:50 PM, or in an International Time format, such as 14:30.
- If you enter a number that contains decimal places as a date number in an argument, 1-2-3 uses only the integer part of the number. For example, 1-2-3 calculates both @YE(31799.9) and @YEAR(31799) as 87.
Financial @Functions

For a complete description of an @function listed here, see the alphabetical listing later in this chapter.

<table>
<thead>
<tr>
<th>Depreciation:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@DB</td>
<td>Calculates the double-declining balance depreciation allowance of an asset for one period.</td>
</tr>
<tr>
<td>@SLN</td>
<td>Calculates the straight-line depreciation allowance of an asset for one period.</td>
</tr>
<tr>
<td>@SYD</td>
<td>Calculates the sum-of-the-years'-digits depreciation allowance of an asset for one period.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ordinary annuities:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@FV</td>
<td>Calculates the future value of a series of equal payments.</td>
</tr>
<tr>
<td>@FMT</td>
<td>Calculates the amount of the periodic payment needed to pay off a loan.</td>
</tr>
<tr>
<td>@PV</td>
<td>Calculates the present value of a series of equal payments.</td>
</tr>
<tr>
<td>@TERM</td>
<td>Calculates the number of payment periods of an investment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Single-sum compoundings:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@NTERM</td>
<td>Calculates the number of compounding periods necessary for an investment to grow to a future value.</td>
</tr>
<tr>
<td>@RATE</td>
<td>Calculates the periodic interest rate necessary for an investment to grow to a future value.</td>
</tr>
</tbody>
</table>

Guidelines for Using Financial @Functions

- Within an @function, express the term and the interest rate in the same unit of time. For example, in @FMT(1000, 0.05/12, 36) the term is 36 months, so the annual interest rate is divided by 12 to produce a monthly interest rate.
- 1-2-3 accepts interest rates as either percentages or decimal values. For example, you can enter 15.3% either as 0.153 or as 15.3%. 1-2-3 automatically converts all percentages to decimal values.
- The financial @functions assume that annuities are ordinary annuities. An annuity is a series of equal payments made at regular
intervals. An ordinary annuity is an annuity in which the payments are made at the end of each time interval.

**Logical @Functions**

For a complete description of an @function listed here, see the alphabetical listing later in this chapter.

| @FALSE | Returns the logical value 0 (false). |
| @IF | Takes one action if a condition is true; another if the condition is false. For example, @IF(SALES > COSTS, SALES - COSTS, "No profit") returns the result of SALES minus COSTS if sales are greater than costs or the string "no profit" if sales are less than or equal to costs. |
| @ISAAF | Returns 1 (true) for a defined add-in @function; 0 (false) for any other entry. |
| @ISAPP | Returns 1 (true) for a currently attached add-in; 0 (false) for any other entry. |
| @ISERR | Returns 1 (true) for the value ERR; 0 (false) for any other value. |
| @ISNA | Returns 1 (true) for the value NA; 0 (false) for any other value. |
| @ISNUMBER | Returns 1 (true) for a numeric value, NA, ERR, or a blank cell; 0 (false) for a string. |
| @ISTRING | Returns 1 (true) for a string; 0 (false) for a numeric value, NA, ERR, or a blank cell. |
| @TRUE | Returns the logical value 1 (true). |

**Guidelines for Using Logical @Functions**

- You use @ISERR and @ISNA to test for the values ERR (error) and NA (not available). These values cause a ripple-through effect. A ripple-through effect exists when a formula evaluator encounters ERR or NA and other formulas refer to the cell that contains the formula. A formula that refers to a cell that contains the values ERR or NA also evaluates to ERR or NA. You can use @ISERR and @ISNA to stop the ripple-through effect. For example, you want to divide the value in G12 by the value in K12. The value in C12 is the result of a complex formula and you want to be sure the formula has not evaluated to ERR before you use G12 in other calculations. @IF(@ISERR(G12),G12/K12) returns 0 if G12 contains the value ERR; this prevents 1/0 from evaluating.
the G12/K12 formula if G12 contains the value ERR. If G12 does not contain the value ERR, the @IF formula returns the result of G12/K12.

You can use @ISNUMBER and @ISSTRING to prevent errors that would occur if a cell used in a formula contained the wrong type of data. For example, @IF(@ISNUMBER(G12),@AVG(A12..K12),"Label") returns @AVG(A12..K12) if G12 contains a value. If G12 contains a label, the @IF formula returns the word Label.

**Mathematical @Functions**

For a complete description of an @function listed here, see the alphabetical listing later in this chapter.

<table>
<thead>
<tr>
<th>General</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ABS</td>
<td>Calculates the absolute (positive) value of a value.</td>
</tr>
<tr>
<td>@EXP</td>
<td>Calculates the number e raised to a specified power.</td>
</tr>
<tr>
<td>@INT</td>
<td>Returns the integer portion of a value.</td>
</tr>
<tr>
<td>@LN</td>
<td>Calculates the natural logarithm (base e) of a value.</td>
</tr>
<tr>
<td>@LOG</td>
<td>Calculates the common logarithm (base 10) of a value.</td>
</tr>
<tr>
<td>@MOD</td>
<td>Calculates the remainder (modulo) of two values.</td>
</tr>
<tr>
<td>@RAND</td>
<td>Generates a random value between 0 and 1.</td>
</tr>
<tr>
<td>@ROUND</td>
<td>Rounds a value to a specified number of decimal places.</td>
</tr>
<tr>
<td>@SQRT</td>
<td>Calculates the positive square root of a value.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trigonometric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ACOS</td>
<td>Calculates the arc cosine of a value.</td>
</tr>
<tr>
<td>@ASIN</td>
<td>Calculates the arc sine of a value.</td>
</tr>
<tr>
<td>@ATAN</td>
<td>Calculates the arc tangent of a value.</td>
</tr>
<tr>
<td>@ATAN2</td>
<td>Calculates the four-quadrant arc tangent of two values.</td>
</tr>
<tr>
<td>@COS</td>
<td>Calculates the cosine of an angle.</td>
</tr>
<tr>
<td>@PI</td>
<td>Returns the value π (calculated at 3.1415926536).</td>
</tr>
<tr>
<td>@SIN</td>
<td>Calculates the sine of an angle.</td>
</tr>
<tr>
<td>@TAN</td>
<td>Calculates the tangent of an angle.</td>
</tr>
</tbody>
</table>
Guidelines for Using Mathematical @Functions

- You must express angles you enter as arguments for @COS, @SIN, and @TAN in radians. To convert degrees to radians, multiply the number of degrees by @π/180.
- @COS, @SIN, @TAN, and @TAN2 produce range values in radians. To convert radians to degrees, multiply the number of radians by 180/π.

Special @Functions

For a complete description of an @Function listed here, see the alphabetical listing later in this chapter.

<table>
<thead>
<tr>
<th>Cell and range information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ABS</td>
</tr>
<tr>
<td>@CELL</td>
</tr>
<tr>
<td>@CELL_POINTER</td>
</tr>
<tr>
<td>@COLS</td>
</tr>
<tr>
<td>@ROWS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error trapping:</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ERR</td>
</tr>
<tr>
<td>@NA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lookup calculations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>@CHOOSE</td>
</tr>
<tr>
<td>@HLOOKUP</td>
</tr>
<tr>
<td>@INDEX</td>
</tr>
<tr>
<td>@VLOOKUP</td>
</tr>
</tbody>
</table>
Guidelines for Using Special @Functions

@ERR and @NA mean cells that contain formulas with errors (@ERR) or unavailable values (@NA). They assign the same value to every cell that depends on formulas that contain @ERR or NA, creating a ripple-through effect. For example, you want to use the formula @SUM(Q.1,Q.3,Q.3,Q.4) to calculate annual travel expenses but do not have figures for the fourth quarter. Enter @NA in the cell named Q.4 to show that the value is not yet available. The @SUM formula will also evaluate to NA until you replace @NA with a value for fourth-quarter expenses.

Statistical @Functions

For a complete description of an @function listed here, see the alphabetical listing later in this chapter.

| @AVERAGE | Averages a list of values. |
| @COUNT | Counts the nonblank cells in a list of values. |
| @MAX | Finds the maximum value in a list of values. |
| @MIN | Finds the minimum value in a list of values. |
| @STDEV | Calculates the population standard deviation of a list of values. |
| @SUM | Sums a list of values. |
| @VAR | Calculates the population variance of a list of values. |

Guidelines for Using Statistical @Functions

All statistical @functions perform calculations on lists of values, which are represented by the argument named list. The values in list can be entered as one or more numbers, numeric formulas, references to ranges that contain values, or any combination of numbers, formulas, and references to ranges.
1-2-3 assigns the value 0 to any strings used as arguments in statistical functions. Therefore, labels within ranges in list will not cause statistical functions to evaluate to ERR. 1-2-3 assigns the value 0 to all labels in a range and includes them in calculations. For example, if you use @AVG to calculate the average of the values in a range and the range contains a label, 1-2-3 considers the label to have the value 0 when it calculates the average.

**Note**
You should always check for labels in the ranges you use in a list to guard against unexpected results.

The statistical functions ignore blank cells in ranges in list. For example, if you use @AVG to average the values in a range that spans eight cells, and the range contains a blank cell, 1-2-3 divides the sum by seven to find the correct average.

Each of the statistical functions has an equivalent database function. For example, you use @AVG to average values in a range; you use @DAVG to average values in a field of a database that meet certain criteria.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ASCHAR</td>
<td>Returns the character that a Lotus International Character Set (LICS) code represents.</td>
</tr>
<tr>
<td>@CLEAN</td>
<td>Removes control characters from a string.</td>
</tr>
<tr>
<td>@CODE</td>
<td>Returns the LICS code that corresponds to the first character in a string.</td>
</tr>
<tr>
<td>@EXACT</td>
<td>Returns 1 (true) if two strings are the same; 0 (false) if the strings are different.</td>
</tr>
<tr>
<td>@FIND</td>
<td>Calculates the position of the first character of one string within another string.</td>
</tr>
<tr>
<td>@LEFT</td>
<td>Returns the first n characters in a string.</td>
</tr>
<tr>
<td>@LENGTH</td>
<td>Counts the characters in a string.</td>
</tr>
<tr>
<td>@LOWER</td>
<td>Converts all the letters in a string to lowercase.</td>
</tr>
<tr>
<td>@MID</td>
<td>Returns a number of characters in a string, starting at a specified character.</td>
</tr>
<tr>
<td>@N</td>
<td>Returns the value in the first cell in a range or 0 if the cell contains a label.</td>
</tr>
<tr>
<td>@PROPER</td>
<td>Converts the first letter in each word in a string to uppercase and the rest of the letters in each word to lowercase.</td>
</tr>
<tr>
<td>@REPEAT</td>
<td>Duplicates a string a specified number of times.</td>
</tr>
<tr>
<td>@RPLACE</td>
<td>Replaces characters in one string with characters from a different string.</td>
</tr>
<tr>
<td>@RIGHT</td>
<td>Returns the last n characters in a string.</td>
</tr>
<tr>
<td>@S</td>
<td>Returns the label in the first cell in a range or a blank cell if the cell contains a value.</td>
</tr>
<tr>
<td>@STRING</td>
<td>Converts a value into a label with a specified number of decimal places. For example, @STRING(34.875, 2) returns the label (not the value) 34.87.</td>
</tr>
<tr>
<td>@TRIM</td>
<td>Removes leading, trailing, and consecutive spaces from a string.</td>
</tr>
<tr>
<td>@UPPER</td>
<td>Converts all the letters in a string to uppercase.</td>
</tr>
<tr>
<td>@VALUE</td>
<td>Converts a string that looks like a number into a value. For example, @VALUE(&quot;34.87&quot;) returns the value 34.87.</td>
</tr>
</tbody>
</table>

14:14 @Functions
Guidelines for Using String Functions

- Always enclose literal strings used as arguments in quotation marks. For example, @LENGTH("EXPENSES") returns the number of characters in the string "EXPENSES" while @LENGTH( EXPENSES ) returns the number of characters in the label located in the single cell range named EXPENSES.

- Some string functions use offset numbers, which locate the position of a character in a string. The first offset number is always 0. For example, the string "Red Shoes" contains 9 characters. The R is at position 0 the first e is at position 1, and so on. The last offset number is always one less than the length of the string.

- Uppercase and lowercase letters have different LCS codes. For example, @CODE("A") returns the code 65, but @CODE("a") returns the code 97. For information on LCS, see Appendix F.

- If you use blank cells as arguments in string functions, 1-2-3 returns the value ERR. For example, @LENGTH(B1) returns the value ERR if B1 is a blank cell.

- If a cell contains one of the label prefixes " " or ", but contains no text, 1-2-3 treats it as an empty string, a string with a length of 0. The cell looks blank, but 1-2-3 will not return the value ERR when you use it as an argument in a string function.

@Function Descriptions

This section contains descriptions of the 1-2-3 @functions. As you use it, keep in mind the following conventions:

- Each function is listed alphabetically.
- @Functions, advanced macro command keywords, cell addresses, and range names appear in uppercase letters, but they can be entered in uppercase and/or lowercase letters.
- Argument names appear in italics, but actual arguments used in examples are not italicized.
@@(location) returns the contents of the cell whose name or address is specified in location. Location must be the name or address of a single cell or range that contains a valid cell reference. If you specify a multiple cell range for location, @@ evaluates to ERR.

Example. The following figure shows a simple sales commission chart. The @@(A11) formula entered in D4 returns the contents of C2, which is the cell specified in A11. Cell A11 contains an IF formula that enters one of two cell addresses, depending on which product code you enter in D3. If you enter anything in D3 other than one of the two product codes, both the IF and @@ functions will evaluate to ERR.

[@ABS](x) calculates the absolute (positive) value of x.

Example. In the following example, the formula @ABS(A4 - B4) copied down column C calculates the differences between the starting and ending temperatures. (@ABS calculates each difference as a positive value.)

14-16 @Functions
@ACOS

@ACOS(x) calculates the arc cosine in radians of a value.
(Multiplying the result by 180/@PI converts the radians to degrees.)
Example. @ACOS(0.5)*180/@PI = 60 (degrees).

@ASIN

@ASIN(x) calculates the arc sine in radians of a value.
(Multiplying the result by 180/@PI converts the radians to degrees.)
Example. @ASIN(1)*180/@PI = 90 (degrees).

@ATAN

@ATAN(x) calculates the arc tangent in radians of a value.
(Multiplying the result by 180/@PI converts the radians to degrees.)
Example. @iTAN(1) = 0.785398 (radians).
@ATAN2

\@ATAN2(x,y) \text{ calculates the four-quadrant arc tangent of } y/x. \text{ The four-quadrant arc (or inverse) tangent is the angle, measured in radians, whose tangent is } y/x. x \text{ and } y \text{ can be any values. If } y \text{ is 0, } \@ATAN2 \text{ returns 0; if both } x \text{ and } y \text{ are 0, } \@ATAN2 \text{ returns the value } \text{ URR. The result of } \@ATAN2 \text{ is in a value from } -\pi \text{ to } \pi. \text{ (Multiplying the result by } 180/\pi \text{ converts radians to degrees.)}

Example. \@ATAN2(15,2) = 0.327205 \text{ (radians)}.

@AVG

\@AVG(list) averages the values in list. List can contain one or more numbers, numeric formulas, references to ranges that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.

Example. \@AVG(C1..C3,D1,D3) returns the average of the values in cells C1, C2, C3, D1, D2, and D3.

@CELL

\@CELL(attribute, range) returns information about an attribute for the first cell in range.

Note

\@CELL evaluates the first cell in range at the point when that cell was last recalculated, so be sure to recalculate your work before using \@CELL.

Attribute can be any of the 10 strings in the following list. Attribute can be entered as a literal string, a string formula, or a reference to a cell that contains a label. Range can be any range name or address.

Attribute | Result
--- | ---
address | The absolute cell address (for example, $A$1).
col | The column letter, as a value from 1 to 256 (1 for column A, 5 for column E, and so on).
content | The contents of the cell.
filename | The name of the current file including the path.

14-18 \@Functions
The cell format:

C0 to C15 if Currency, 0 to 15 decimal places.
P0 to P15 if Fixed, 0 to 15 decimal places.
G if General.
P0 to P15 if Percent, 0 to 15 decimal places.
S0 to S15 if Sci (Scientific), 0 to 15 decimal places.
B to .B if (Commas), 0 to 15 decimal places.
A if /- format.
D1 if DD-MMYY.
D2 if DD-MDY.
D3 if MM-YY.
D4 if MM/DD/YY, DD/MM/YY, DD.MM.YY, or YY-MM-DD.
D5 if MM/DD, DD/MM, DD.MM, or MM-DD.
D6 if HH.MM:SS AM/PM.
D7 if HH.MM AM/PM.
D8 if HH.MM:SS (24-hour), HH.MM:SS (24-hour), HH.MM:SS (24-hour), or HH.MM:SS:SS.
D9 if HH:MM (24-hour), HH:MM (24-hour), HH.MM, or HH.MM:MM.
T if Text format.
H if Hidden format.

The label prefix:

' if the cell contains a left-aligned label.
" if the cell contains a right-aligned label.
` if the cell contains a centered label.
\ if the cell contains a repeating label.
/ if the cell contains a non-repeating label.
Blank (no symbols) if the cell is empty or contains a value.

The protecting status:

1 if the cell is protected.
0 if the cell is not protected.
The row number, from 1 to 8192.

The type of data in the cell:
- 'b' if the cell is blank (that is, has no entry).
- 'v' if the cell contains a numeric value or a formula.
- 'l' if the cell contains a label.

The column width.

Example. You can use @CELL to check input during a macro to guard against certain types of errors; you can also use it to check whether a particular cell contains data, with the result directing a macro subroutine. For example, in the macro instructions:

```
[IF @CELL("type",CS)="b"](BEEP)[INDICATE "Do Not Leave Blank!"]
```

If CS is blank, @CELL("type",CS) returns B; 1-2-3 then beeps and the mode indicator changes to Do Not Leave Blank!

@CELL POINTER

@CELL POINTER(attribute) returns information about an attribute for the current cell. Attribute can be any of the |O valid attribute arguments for @CELL.

1-2-3 automatically updates @CELL POINTER only when you make an entry. To make @CELL POINTER return information about the current cell if you have simply moved the cell pointer to '4, you must recalculate the workbooks.

Example. In the macro instructions:

```
[IF @CELL POINTERS("type")="b"](BEEP)2 QUIT
```

@CELL POINTER is used to evaluate the contents of the current cell. If the current cell is blank, 1-2-3 beeps and ends the macro.

@CHAR

@CHAR(x) returns the character that the Lotus International Character Set (LC) produces. (For information on LC, see Appendix F.) X can be any integer from 1 to 255. Values outside this range yield ERR.
@CHAE is useful for entering foreign language characters and mathematical symbols. Whether a character prints depends on the capabilities of your printer.

Example. The formula
\[ \text{"Champe"} \& \text{@CHAR(201)} \& \text{"yes"} \& \text{@CHAR(232)} \& \text{"co"} \]
returns Champe-Physics.

@CHOOSE

@CHOOSE(offset, list) finds the value or string in list that is specified by offset. Use @CHOOSE to enter a list of lookup values without setting up a lookup table.

Offset represents an offset number. The first item has an offset of 0; the second, 1; the third, 2; and so on.

List can contain one or more values, strings, references to ranges that contain values or strings, or any combination of values, strings, and range references.

Example. The worksheet in the following figure contains a list of labels (A1..A4) and their offset numbers (B1..B4). @CHOOSE(B3, A1..A4) entered in D5 returns Accounting, the label in A3, which is the item whose offset number is 2 (2 is the value in B3) in list.

[@Functions 14-21]
@CLEAN
@CLEAN(strap) removes the following control characters from string:

- Control characters with ASCII codes below 31.
- The begin and end attribute characters, as well as the attribute character itself.
- The space character (LICS code 155) and the character following.

Example. If cell A45 was exported to 1-2-3 from a word processing program and contains:

"Second, we must act soon."

@CLEAN(A45) = Second, we must act soon.

@CODE
@CODE(string) returns the Lotus International Character Set (LICS) code that corresponds to the first character in string. (For information on LICS, see appendix F.) String can be a literal string, a range name or address of a cell that contains a label, or a formula or function that evaluates to a string. If string is a cell address or range name that refers to a blank cell or a value, @CODE returns the value ERR.

Example. @CODE(C5) = 77 if C5 contains the label Mrs. Jones, because 77 is the LICS code for M

@COLS
@COLS(range) counts the number of columns in range.

Example. @COLS(EMPLOYEES) = 20 if EMPLOYEES is the range name for B1..U10.

@COS
@COS(z) calculates the cosine of angle z measured in radians.

(Multiply the result by 180/PI() converts radians to degrees.)

Example. @COS(45*PI/180) = 0.707106

14.22 @Functions
@COUNT

@COUNT(list) counts the nonblank cells in a list of ranges. List can be any combination of ranges. Keep the following in mind about the list argument for @COUNT:

- If the list contains only blank ranges, @COUNT evaluates to 0.
- If you enter a single cell address in list it will increase the count by one even if the cell is blank. For example, if A2 is blank, @COUNT(A2) = 1.
- @COUNT considers cells that contain labels, as well as those that contain values, to be nonblank. If you want to keep an accurate count if values in a range, make sure the range does not contain any label, such as column headings.
- @COUNT does not ignore cells that evaluate to ERR or NA.

Examples. @COUNT(C5,C10,D5,E5:F10) = 1 if all the cells are blank because D5 is not entered as a range.

Use @COUNT to stop a macro when the cell pointer reaches a blank row. For example, IF @COUNT(WORK=0) QUIT stops the macro because the range WORK is a blank row.

@CTERM

@CTERM(interest, future-value, present-value) calculates the number of compounding periods it takes for an investment (present-value) to grow to a future-value, earning a fixed interest rate per compounding period. Interest can be any value greater than -1. Future-value and present-value can be any values, but must be of the same sign, that is both must be positive or negative.

Example. You just deposited $10,000 in an account that pays an annual interest rate of 10% (0.10), compounded monthly. You want to determine how many years it will take to double your investment. @CTERM(0.10/12,20000,10000)/12 = 6.660312; in other words, it will take about 7 years to double the original investment of $10,000.
Note: Because @TERM calculates the total number of compounding periods, you may need to include the number of periods the interest rate is compounded in order to express the term and interest rate in the same unit of time. In the example above, the annual interest rate of 19%, compounded monthly, is entered as 0.10/12 (interest divided by the number of compounding periods per year).

@DATE

@DATE(year,month,day) calculates the date number for the specified year, month, and day. (For an explanation of date numbers, see "Date and Time @Functions" earlier in this chapter.) Year can be any integer from 0 (the year 1990) to 199 (the year 2099). Month can be any integer from 1 (January) to 12 (December). Day can be any integer from 1 to 31. The value you use for day must be a valid day for month—for example, you cannot use 31 for day if you use 4 (April) for month.

Use @DATE to sort by date or to set up search criteria using dates.

Note: Even though February 29, 1900 did not exist (1900 was not a leap year), 1-2-3 assigns a date number to this "day." This does not affect your date calculations, unless you use dates between January 1, 1900 and March 1, 1900. If you are using dates within that period, subtract 1 from any results within the period.

Example. @DATE(01,1,7) returns 01245, the date number for January 7, 1991. /Range Format Date commands can be used to format the date numbers to more traditional formats.
@DATEVALUE

@DATEVALUE(string) calculates the date number for a string that looks like a date. (For an explanation of date numbers, see "Date and Time @Functions" earlier in this chapter.) String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. String must be in one of the 1-2-3 date formats (see "Range Format" in chapter 11).

Use @DATEVALUE when you want to convert dates entered as labels to date numbers so that you can use the dates in calculations. @DATEVALUE is also useful with data that has been imported from another program, such as a word processing program.

Example. @DATEVALUE("7-Jan-91") returns the date number 33245.

@DAVG

@DAVG(input_field, criteria) averages values in a field of the input range that meet criteria in the criteria range. (For an explanation of the way database @functions work, see "Database @Functions" earlier in this chapter.)

Example. @DAVG(Expenses,2,Crit. Range) searches a database input range EXPENSES for records that match the criteria in the criteria range CRIT_RANGE, and then averages the selected values in the field whose offset number is 2.

@DAY

@DAY(date-number) calculates the day of the month (an integer from 1 to 31) in date-number. (For an explanation of date numbers, see "Date and Time @Functions" earlier in this chapter.) Date-number can be any integer from 1 (January 1, 1900) to 36500 (December 31, 2009). Usually, another date @function supplies date-number.

Example. @DAY(@NOW) = the current day of the month.
@DCOUNT

@DCOUNT(input_field, criteria) counts nonblank cells in a field of the input range that meet criteria in the criteria range. (For an explanation of the way database @functions work, see "Database @Functions" earlier in this chapter.)

Example. @DCOUNT(EXPENSES1, CRIT_RANGE) searches the database input range EXPENSES for records that match the criteria in the criteria range CRIT_RANGE, and then counts the selected values in the field whose offset number is 1.

@DDDB

@DDDB(cost, salvage, life, period) calculates the depreciation allowance of an asset for a specified period, using the double-declining balance method.

Cost represents the amount paid for the asset. Cost can be any value greater than or equal to salvage.

Salvage represents the estimated value of the asset at the end of its useful life. Salvage can be any value.

Life represents the number of periods it will take to depreciate the asset to its salvage value. Life can be any value greater than 2.

Period represents the time period for which you want to find the depreciation allowance. Period can be any value greater than or equal to 1.

Example. @DDDB(10000, 1250, 8, 5) returns $791.02, which is the depreciation expense in the 5th year for a $10,000 machine with a useful life of 8 years and a salvage value of $1250.

@DMAX

@DMAX(input_field, criteria) finds the largest value in a field of the input range that meets the criteria in the criteria range. (For an explanation of the way database @functions work, see "Database @Functions" earlier in this chapter.)

Example. @DMAX(EXPENSES1, CRIT_RANGE) searches the database input range EXPENSES for records that match the criteria
in the criteria range CRIT_RANGE, and then selects the largest value in the field whose offset number is 1.

@DMIN

@DMIN(input_field, criteria) finds the smallest value in a field of the input range that meets the criteria in the criteria range. (For an explanation of the way database @functions work, see “Database @Functions” earlier in this chapter.)

Example. @DMIN(EXPENSES, CRIT_RANGE) searches the database input range EXPENSES for records that match the criteria in the criteria range CRIT_RANGE, and then selects the smallest value in the field whose offset number is 1.

@DSTD

@DSTD(input_field, criteria) calculates the population standard deviation of the values in a field of an input range that meet the criteria in the criteria range. (For an explanation of the way database @functions work, see “Database @Functions” earlier in this chapter.)

@DSTD produces most accurate results when the number of observations is large.

Example. @DSTD(REGION, CRIT_RANGE) searches the input range region for records that match the criteria in the criteria range CRIT_RANGE, and then calculates the standard deviation of the selected values from the field whose offset is 2.

@DSUM

@DSUM(input_field, criteria) sums the values in a field of an input range that meet the criteria in the criteria range. (For an explanation of the way database @functions work, see “Database @Functions” earlier in this chapter.)

Example. @DSUM(EXPENSES, CRIT_RANGE) searches the input range EXPENSES for records that match the criteria in the criteria range CRIT_RANGE, and then adds the selected values from the field whose offset number is 3.
@DVAR

@DVAR(input_range, field, criteria) calculates the population variance of the values in a field of an input range that meet the criteria in the criteria range. (For an explanation of the way database functions work, see "Database @Functions" earlier in this chapter.)

@DVAR produces most accurate results when the number of observations is large.

Example. @DVAR(REGION, "P", CRT..RANGE) searches the input range REGION for records that match the criteria in the criteria range CRT..RANGE, and then calculates the population variance of the selected values from the field whose offset number is 2.

@ERR

ERR is a special value in 1-2-3 that indicates an error in a formula. ERR has a ripple-through effect on formulas. ERR is seldom used by itself, but is often used with @IF to indicate an ERR value only under certain conditions.

Note: You cannot substitute the label ERR for the value ERR in formulas. For example, the formula

+A1=34 = ERR if A1 contains @ERR, but equals 34 if A1 contains the label ERR.

Example. @IF(B14<3, @ERR, B14) = ERR when the value in B14 is greater than 3.

@EXACT

@EXACT(string1, string2) tests whether string1 and string2 match exactly. If the two strings are identical, @EXACT returns 1 (true); if the two strings are not the same, @EXACT returns 0 (false).

String1 and string2 can be literal strings, range names or addresses of cells that contain labels, or formulas or @functions that evaluate to strings.

You can use @EXACT in a macro to check user input against a required entry before the macro continues processing.

14-28 @Functions
**EXACT**

@EXACT(A6,"Posted") returns the text "Posted" if A6 contains the label "Posted." If A6 contains any other label, the formula returns the value NA.

**EXP**

@EXP(x) calculates the value of $e$ (approximately 2.71828) raised to the power x. The constant $e$ is used as the base in natural logarithms.

- If x is a number less than or equal to 709, the calculation is exact to 1-2-3, 1-2-3-see calculate and store the result of EXP but cannot display it.
- If x is equal to 709, the calculation is too large for 1-2-3 to store, and @EXP returns the value ERR. If x is less than -708, @EXP returns the value 0.

Example: @EXP(1.23) = 3.490342.

**FALSE**

@FALSE returns the logical value 0 (false). Use @FALSE with macros or @functions such as @IF that require a logical value of 0 (false). You can use either @FALSE or the value 0 in formulas that evaluate logical conditions, but @FALSE makes the formulas easier to read.

Example: @IF(A6=0,TRUE, @FALSE) = 0 when A6 contains a value less than 0.

**FIND**

@FIND(search-string,string, start-number) calculates the position in string at which 1-2-3 finds the first occurrence of search-string.

- @FIND begins searching string at the position indicated by start-number. If 1-2-3 does not find search-string in string, @FIND returns the value ERR.

- Search-string and string can be literal strings, range names or addresses of cells that contain labels, or formulas that evaluate to strings. Start-number represents an offset number of a character in string. The first character has an offset number of 0; and the second, 1; and so on.

- @FIND is case sensitive; for example, @FIND will not find search-string pay in string PAYMENT.

**Functions** 14-29
Example. \texttt{FIND("P", "Accounts Payable") = 9} because search-string \texttt{P} is at position 9 in string \texttt{Accounts Payable}.

\@FV

\texttt{FV(payments, interest, term)} calculates the future value of an investment, based on a series of equal payments, earning a periodic interest rate, over the number of payment periods in term. \texttt{Payments} and \texttt{term} can be any values. \texttt{Interest} can be any value greater than -1.

1-2-3 assumes that calculations made with \texttt{FV} are on an investment that is an ordinary annuity (payments at the end of each period).

Examples. You plan to deposit $2,000 each year for the next 20 years into an individual retirement account. The account pays 7.5\% interest, compounded annually; interest is paid on the last day of each year. You want to calculate the value of your account in 20 years. \texttt{FV(2000, 0.075, 20)} returns 88,659, the value of your account at the end of 20 years.

If you make each year's contribution on the first day of the year, you would calculate the amount for an annuity due. To calculate the future value of an annuity due, use the formula \texttt{FV(payments, interest, term) \times (1 + interest)}. For example, \texttt{FV(2000, 0.075, 20) \times (1 + 0.075)} = 93,165, the value of your account in 20 years if you make each deposit on the first day of each year.
@HLOOKUP

@HLOOKUP(x; range; row-offset) finds the contents of a cell in the specified row of a horizontal lookup table. A horizontal lookup table is a range with value information in ascending order in the top row.

@HLOOKUP compares the value x to each cell in the top row of the table. When 1-2-3 locates a cell in the top row that contains the value x (or the value closest to, but not larger than, x) it moves down the column that number of rows specified by row-offset and returns the contents of the cell as the answer.

x can be any value greater than or equal to the first value in range. If x is smaller than the first value in range, @HLOOKUP returns the value ERR. If x is larger than the last value in range, @HLOOKUP stops at the last cell in the row and returns the contents of that cell.

Row-offset represents an offset number.

Use @HLOOKUP to locate entries in a table, such as a tax table or a sales commissions table.

Example. The table in the previous figure contains the number of employees in various departments of a company during a 10-year period. @HLOOKUP(1985; B3..H7; 1) returns a D8 return 35. 1985 does not appear in the top row of the table, so @HLOOKUP stops at column C, because 1985 is the value closest to, but not larger than, 1986.
@HOUR

@HOUR(time-ramber) calculates the hour, as integer from 0 (midnight) to 23 (11:00 PM), in a time-ramber. (For an explanation of time numbers, see "Date and Time @Functions" entry in this chapter.) Time-number is a decimal value from .000000 (midnight) to .99998 (11:59:59 PM). Usually, another time @function supplies

Example. @HOUR(@TIME(13,45,16)) = 1 (1:00 PM), because 13 is the hour argument for @TIME(13,45,16).

@IF

@IF(condition, x, y) evaluates condition and takes one of two actions, depending on the result of the evaluation. If condition is true, @IF returns x; if condition is false, @IF returns y.

Condition is usually a logical formula or a reference to a cell that contains a logical formula. However, you can use any formula, number, literal string, or cell reference as condition. '2-3' evaluates any condition that does not equal zero as true and any condition that does equal zero as false. Blank cells and strings equal zero when used as condition.

x and y can be values or strings.

Example. @IF(@BD>250,"Too Low") returns the contents of the cell @BD if it contains a value greater than or equal to 250. If @BD contains a value less than 250 or a label, the formula returns the string "Too Low".

@INDEX

@INDEX(range, column-offset, row-offset) finds the value in the cell located at a specified column-offset and row-offset of range. Range can be any range name or address. Column-offset and row-offset represent offset numbers.

Use @INDEX instead of @HLOOKUP or @VLOOKUP when you want to use a lookup table but need to use the relative positions of the rows or columns, instead of specified values, to find an entry.
Example. The table is the following figure shows the number of children enrolled in kindergarten through third grade at an elementary school. \( \text{INDEX(SCHOOL, 3, 4)} \) entered in D9 returns 102, the number of students in the third grade (row offset number 4) in 1988 (column offset number 3).

@INT

@INT\( (x) \) returns the integer portion of \( x \), without rounding the value. \( x \) can be any value.

Example. @INT(-35.67) = -35.

@IRR

@IRR\( (\text{guess, range}) \) calculates the internal rate of return expected from a series of cash flows generated by an investment. 1-2-3 assumes the cash flows are received at regular, equal intervals.

\( \text{Guess} \) represents your estimate of the internal rate of return. \( \text{Guess} \) can be any value. \( \text{Range} \) can be the name or address of the range that contains the cash flows. 1-2-3 considers negative numbers as cash outflows and positive numbers as cash inflows. Normally, the first cash flow in \( \text{Range} \) is a negative number representing the investment.

@Functions 14-33
@IRR uses a series of approximations to calculate the internal rate of return. Because @IRR uses approximations, you enter a guess as the first argument. Enter a guess that you think is reasonable for the internal rate of return. In most cases, your guess should be a percentage between 0 (0%) and 1 (100%). Because more than one solution may be possible, try another guess if the result is less than 0 or greater than 1.

If @IRR cannot approximate the result to within 0.0000001 after 30 calculation iterations, the formula evaluates to ERR. If your guesses continue to return ERR, use @NPV to determine a better guess.

If @NPV returns a positive value, your guess is too low. If @NPV returns a negative value, your guess is too high. @NPV returns 0 if your guess is accurate.

**Note**

@IRR assigns the value 0 to all blank cells in range and includes them in the calculation.

Example. In the following figure, @IRR(A2:B2, B1) entered in C11 returns 5%, the initial investment is $1000 (in B2) and the cash flows are shown in B3..B11.
@ISAAF
@ISAAF(name) tests name for a defined add-in function. If name is a defined add-in function, @ISAAF returns 1 (true); if name is not a defined add-in function, @ISAAF returns 0 (false). Do not include the initial @ (at sign) in name.

Example. @ISAAF("SUM") = 0 because @SUM is a built-in 1-2-3 function, not an add-in function.

@ISAPP
@ISAPP(name) tests name for an attached add-in. If name is an attached add-in, @ISAPP returns 1 (true); if name is not an attached add-in, @ISAPP returns 0 (false). Do not include the initial @ADN extension in name.

Note  @ISAPP returns 1 (true) only for any add-in you invoke using /Add-In Invoke.

Example. @ISAPP("Finance") = 1; if an add-in called Finance is currently attached.

@ISERR
@ISERR(x) tests x for the value ERR. If x is the value ERR, @ISERR returns 1 (true); if x is not the value ERR, @ISERR returns 0 (false). x can be any string, value, location, or condition. Use @ISERR to stop the ripple-through effect of the value ERR. (For an explanation of the ripple-through effect, see "Logical Functions" earlier in this chapter.)

Example. @ISERR is frequently used to block errors that arise from division by 0. For example, @F(@ISERR(A1/A2);0,A1/A2) tests the result of the division A1/A2. If the result is the value ERR, the formula returns 0. If the result is any other value, the formula returns that result.
@ISNA

@ISNA(x) tests x for the value NA. If x is the value NA, @ISNA returns 1 (true); if x is not the value NA, @ISNA returns 0 (false). x can be any string, value, location, or condition. Use @ISNA to stop the ripple-through effect of the value NA. (For an explanation of the ripple-through effect, see "Logical @functions" earlier in this chapter.)

Example. @ISNA(B1) = 1 if B1 contains the value NA; @ISNA(B1) = 0 if B1 contains any other entry.

@ISNUMBER

@ISNUMBER(x) tests x for a value. If x is a value or a blank cell, @ISNUMBER returns 1 (true); if x is a string, @ISNUMBER returns 0 (false). x can be any string, value, location, or condition. Use @ISNUMBER to prevent errors that would occur if a cell used in a formula contained the wrong type of data.

Example. @ISNUMBER is often used in macros to make sure a user enters the correct type of information (values or labels). The macro instructions (IF @ISNUMBER(C9)=0) (BEEP) (QUIT) returns 0 if C6 contains a label; 1-2-3 then beeps and ends the macro.

@ISTRING

@ISTRING(x) tests x for a string. If x is a literal string or cell that contains a label or string formula, @ISTRING returns 1 (true); if x is a value or blank cell, @ISTRING returns 0 (false). x can be any string, value, location, or condition. Use @ISTRING to prevent errors that would occur if a cell used in a formula contained the wrong type of data.

@ISTRING returns 1 even if a cell contains only a label prefix or space.

Example. @ISTRING is often used in macros to make sure a user enters the correct type of information (values or labels). The macro instructions (IF @ISTRING(C9)=0) (BEEP) (QUIT) returns 0 if C6 contains a value or is blank; 1-2-3 then beeps and ends the macro.

14-36 @Functions
@LEFT

@LEFT(string, n) returns the first n characters in string. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. n can be any positive integer or 0. If n is 0, the result of @LEFT is an empty string; if n is greater than or equal to the length of string, @LEFT returns the entire string.

1-2-3 counts punctuation and spaces as characters in @LEFT.

@LEFT is useful for copying only part of a label into another cell.

Example: In the following figure, the formula @LEFT(A4:J4) enters in B4 generates an account number by combining the first three letters of a customer’s last name (in A4) with her zip code (in D4).

![Example figure]

Note: Zip codes in D4 and D5 must be entered as labels, not values.

@LENGTH

@LENGTH(string) counts the number of characters in string. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. 1-2-3 counts punctuation and spaces as characters in @LENGTH.
Example. @LENGTH(B1) = 16 when B1 contains the label Accounts Payable.

@LN
@LN(x) calculates the natural logarithm (base e) of x.
Example. @LN(2) = 0.693147.

@LOG
@LOG(x) calculates the common logarithm (base 10) of x.
Example. @LOG(4) = 0.60206

@LOWER
@LOWER(string) converts all uppercase letters in string to lowercase. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string.
Example. @LOWER("EXPENSES") = expenses.

@MAX
@MAX(list) finds the largest value in list. List can contain one or more numbers, numeric formulas, references to ranges that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.
Example. @MAX(A1..C10) returns the largest value is A1..C10.

@MID
@MID(string,start-number,s) returns characters from string, beginning with the character at start-number. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. Start-number represents the offset number of a character in string. If start-number is greater than the length of string minus 1, the result of @MID is an empty string. s can be any positive integer or 0. If s is 0, the result of @MID is an empty string. The first character has an offset of 0, the second, 1, and so on.
Use a large number for \( n \) if you don't know the length of string; 1-2-3 will return the remainder of string.

1-2-3 counts punctuation and spaces as characters in @MIN.

Use @MIN when you need to extract a part of a label that is not located at the beginning or end of the label. If you need to extract part of a label but you don't know its start-number, use @MIN with @FIND.

Example: @MIN("Daily Account Balance",5,7) = Account.

@MIN
@MIN(first) finds the smallest value in list. first can contain one or more numbers, numeric formulas, references to ranges that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.

Example: @MIN(A1..C15) returns the smallest value in A1..C15.

@MINUTE
@MINUTE(time-number) calculates the minutes, an integer from 0 to 59, in time-number. (For an explanation of time numbers, see "Date and Time @functions" earlier in this chapter.) Time-number can be any decimal value from .000000 (midnight) to .999998 (11:59:59 PM). Usually, another time @function supplies time-number.

Example: @MINUTE(@TIME(11,16,45)) = 15 because 15 is the minutes argument for @TIME(11,15,45).

@MOD
@MOD(x,y) calculates the remainder (modulo) of \( x/y \). \( x \) can be any value. If \( x \) is 0, @MOD returns 0. The sign (+ or -) of \( x \) determines the sign of the result. \( y \) can be any value except 0.

Example: @MOD(54) = 1.
@MONTH

@MONTH(date-number) calculates the month, an integer from 1 (January) to 12 (December) in date-number. (For an explanation of date numbers, see "Date and Time @Functions" earlier in this chapter.) Date-number can be any integer from 1 (January 1, 1900) to 73950 (December 31, 2099). Usually, another date @function supplies date-number.

Example: @MONTH(20181) = 4 because 20181 is the date number for April 2, 1955.

@N

@N(range) returns the entry in the first cell in range as a value; if the cell contains a value, @N returns that value; if the cell contains a label, @N returns the value 0. Range can be any range name or address.

Example. Use @N in error-trapping routine in macro to prevent errors that would result if a cell used is formulas contained the wrong type of data. The macro instructions if @N(B6)=01(BEEP)(INDICATE "ENTRY MUST BE NUMERIC") return 0 if B6 contains a label; 1-2-3 then beeps and changes the mode indicator to ENTRY MUST BE NUMERIC.

@NA

@NA returns the value NA (not available). NA is a special value in 1-2-3 that indicates a value needed to complete a formula is not available. NA has a ripple through effect on formulas.

Use @NA when you are building a worksheet that will contain data that you have not yet determined. You can use @NA in cells where you will enter real data; formulas that refer to those cells will have the value @A until you supply the data.

Note: You cannot substitute the label NA for the value N/A in formulas. For example, the formula =A2+34 = NA when A1 contains @NA but equals 34 when A1 contains the label NA.

1-40 @Functions
Example. If([=IF(=CELL("type",B14)="b"),@NA,B14]) returns the value NA when B14 is blank.

@NOW
@NOW calculates the value that corresponds to the current date and time on the computer's clock. This includes both a date number (integer portion) and a time number (decimal portion). (For an explanation of date numbers and time numbers, see "Date and Time @Functions" earlier in this chapter.)

You can format the value of @NOW in any of the 1-2-3 Date or Time formats. If you format @NOW as a date, 1-2-3 displays only the date (integer) portion of the date and time number; if you format @NOW as a time, 1-2-3 displays only the time (decimal) portion of the date and time number. In both cases, 1-2-3 continues to calculate with the entire date-and-time number.

@NOW recalculates each time you recalculate your work. If you set recalculation to Automatic, 1-2-3 recalculates @NOW whenever it recalculates another value.

Example. If column E in a spreadsheet contains dates of employees' last reviews as date numbers, the formula @IF(@NOW-D5>=180,"Yes","No") in column E subtracts the rate of an employee's last review from the current date and tells you whether or not the employee is due for a review.

@NPV
@NPV(interest, range) calculates the net present value of a series of future cash flows discounted at a fixed, periodic interest rate. (@NPV is similar to @PV, except that with @PV all cash flows are equal amounts.) interest can be any value greater than -1. range can be the name or address of the range that contains the cash flows.

1-2-3 assumes that the cash flows occur at equal time intervals, that the first cash flow occurs at the end of the first period, and subsequent cash flows occur at the end of subsequent periods.

Example. In the following figure, @NPV(B1:B5,D2:D6) entered in B9 returns $6,707.94, the net present value of the cash flows in D2:D6.

@Functions 10-41
### Troubleshooting

To determine the net present value of an investment where you make an initial cash outflow immediately, followed by a series of future inflows, you must factor the initial outflow separately, because it is not affected by the interest. For example, if $INITIAL = -$1000 (initial outflow), $RATESERIES = 0.04 (interest rate), and $SERIES = 5$ (series of future cash inflows), then $NPV = -$1094.87.

---

### PI

@PI returns the value $\pi$ (calculated at 3.1415926536), the ratio of the circumference of a circle to its diameter.

**Example:** $\pi \times 1^2 = 3.1415926536$, the area of a circle with a radius of 1.

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### PMT

@PMT(principal, interest, term) calculates the amount of the periodic payment needed to pay off a loan given a specified periodic interest rate and number of payment periods. 1-2-3 assumes your calculations are for payments you make at the end of each payment period (an ordinary annuity).

**Principal** represents the value of the loan and can be any value. **Interest** represents the periodic interest rate and can be any value greater than -1. **Term** represents the number of payment periods and can be any value except 0.
Enter interest and term in the same units of time. For example, if you are calculating a monthly payment, enter the interest and term in monthly increments.

Example. You are considering taking out an $8,000 loan for 3 years at an annual interest rate of 1%, compounded monthly. You want to determine your monthly payment. \( \text{PMT}(8000,0.14/12,36) \) returns $273.42, the monthly payment.

Note

If you make payments at the beginning of each month, you would calculate the amount for an annuity due. To calculate the amount of the periodic payments on an annuity due, use the formula:

\( \text{PMT}[(\text{principal} \text{interest} \text{term})/ (1 + \text{interest})] \)

@PROPER

@PROPER(string) converts the letters in string to proper capitalization: the first letter of each word uppercase, and the remaining letters in each word lowercase. String can be a literal string, the range name or address of a cell that contains a label, or a formula or a function that evaluates to a string.

Use @PROPER when you combine data from several sources and want labels to be consistent throughout your worksheet.

Example. @PROPER("$354.4 babcock") = $354.4 Babcock.

@PV

@PV(payments, interest, term) determines the present value of an investment. @PV calculates the present value based on a series of equal investments (payments), discounted at a periodic interest rate over the number of periods in term. Payments and term can be any values. Interest can be any value greater than -1.

Example. You won $1,000,000. You can receive either 20 annual payments of $50,000 at the end of each year or a single payment of $400,000 instead of the $1,000,000 today. You want to find out which option is worth more in today's dollars.

If you were to accept the annual payments of $50,000, you assume that you would invest the money at a rate of 8%, compounded annually.
@PV(50000,0.08,20) returns $400,907, which tells you that the $1,000,000 paid over 20 years is worth $400,907 in today's dollars.

If you received the annual payments at the beginning of each year, you would calculate the amount for an annuity due. To calculate the present value of an annuity due, use the formula:

\[ \text{@PV}(\text{payments}, \text{interest}, \text{term}) \times (1 + \text{interest}) \]

For example, \( \text{@PV}(50000,0.08,20) \times (1 + 0.08) = 500,180 \), the value of $1,000,000 paid over 20 years as an annuity due in today's dollars.

---

@RAND

@RAND generates a random value between 0 and 1. Each time 1-2-3 recalculates your work, @RAND generates a new random value. @RAND is useful for generating test data for simulations.

To generate random values in different numeric intervals, multiply @RAND by the size of the interval.

Examples: @RAND*10 = 0.533674 or any value between 0 and 10. @INT(@RAND*50)+1 = 49 or any integer from 1 to 50.

@RATE

@RATE(future-value, present-value, term) calculates the periodic interest rate necessary for an investment (present-value) to grow to a future-value over the number of compounding periods in term. Future-value can be any value. Present-value and term can be any values except 0.

Example: You invested $10,000 in a bond. The bond matures in 5 years and has a maturity value of $18,000. Interest is compounded monthly. You want to determine the periodic interest rate for this investment.

@RATE(18000,10000,60) returns 0.884%, the periodic (monthly) interest rate. To determine the annual rate, multiply the above formula by 12. This yields a result of 10.6% annually.
@REPEAT

@REPEAT(string, n) duplicates string n times. String can be a literal string, the range name or address of a cell that contains a label, or a formula or function that evaluates to a string. n can be any positive integer.

Note

@REPEAT differs from the repeating label prefix \ (backslash) in that the repeating label prefix repeats a label only as many times as will fill the current cell. @REPEAT duplicates the string as many times as you specify, it is not limited by the current column width.

Example: @REPEAT("++", 50) returns +++++++++++.

@REPLACE

@REPLACE(original-string, start-number, n, new-string) replaces n characters in original-string, beginning at start-number, with new-string. Original-string and new-string can be literal strings, the range name or address of cells that contain labels, or formulas or functions that evaluate to strings. Start-number represents the offset number of a character in original-string, n can be any positive integer or 0.

You can perform several procedures with @REPLACE:

- By making n equal the number of characters in original-string, you can replace the entire original-string with new-string.
- By specifying a position immediately beyond the end of original-string as start-number, you can append new-string to original-string.
- By making n equal 0, you can insert a new string.
- By making new-string an empty string, you can delete a string.

1-2-3 counts punctuation and spaces as characters in @REPLACE. If you use @REPLACE to append or insert strings, remember to include the necessary spaces.

Example: @REPLACE(CEL1, @FIND("=", CEL1), 1, "/") copies the label in CEL1, 4/24 as 4/24.

@Functions 14-46
@RIGHT

@RIGHT(string, n) returns the last n characters in string. String can be a literal string, the range name or address of a cell that contains a label, or a formula or function that evaluates to a string. n can be any positive integer or 0.

If n is 0, the result of @RIGHT is an empty string. If n is greater than or equal to the length of string, @RIGHT returns the entire string.

1-2-3 counts punctuation and spaces as characters in @RIGHT.

@RIGHT is useful for copying only part of a label to another cell.

Example. @RIGHT("Average Daily Balance", 7) = Balance.

@ROUND

@ROUND(x, n) rounds the value x to n places. x can be any value. n can be any integer from -15 to 15.

If n is positive, 1-2-3 rounds x to n digits to the right of the decimal point. If n is negative, 1-2-3 rounds x to the positive nth power of 10. For example, if n is -2, 1-2-3 rounds x to the nearest hundred. If n is 0, 1-2-3 rounds x to an integer.

If you want to display values with a specific number of decimal places but want 1-2-3 to calculate those values to their full precision, use /Range Format Fixed or /Worksheet Global Format Fixed. Do not use @ROUND.

Example. @ROUND(131.5783, 2) = 131.58.

@ROWS

@ROWS(range) counts the number of rows in range. Range can be any range name or address.

You can use @ROWS to find the length of a range you want to print.

Example. @ROWS(SCORES) = 43 if SCORES is the range B3..B45.
@S
@S(@S(range)) returns the entry in the first cell in range as a label; if the cell contains a label, @S returns that label; if the cell contains a value, @S returns an empty string. Range can be any range name or address.

Example. Use the @S in error-trapping routines it macro to prevent errors that would result if a cell used in a formula contained the wrong type of data. The macro instruction

(IF @S(B6):="") [PEEP] [INDICATE "ENTRY MUST BE A LABEL"]

returns an empty string if B6 contains a value; 1-2-3 then beeps and changes the mode indicator to ENTRY MUST BE A LABEL.

@SECOND
@SECOND(time-number) calculates the seconds, an integer from 0 to 59, in time-number. (For an explanation of time numbers, see "Date and Time @Functions" earlier in this chapter.) Time-number can be any decimal value from 0.000000 (midnight) to 0.369988 (11:36:59 PM). Usually, another time @function supplies time-number.

Example. @SECOND(@TIME(11,15,45)) = 45 because 45 is the seconds argument for @TIME(11,15,45).

@SIN
@SIN(x) calculates the sine of angle x measured in radians. (To convert degrees to radians, multiply by @PI/I88.) x can be any value.

Example. @SIN(882) = 0.772446.

@SLN
@SLN(cost, salvage, life) calculates the straight-line depreciation allowance of an asset for one period. Cost represents the amount paid for the asset and can be any value. Salvage represents the estimated value of the asset at the end of its life and can be any value. Life represents the number of periods it will take to depreciate the asset to its salvage value and can be any value except 0.
Example. You have an office machine worth $18,000, with a useful life of 12 years, and a salvage value of $1200. You have a worksheet with the $19,000 cost in cell E2, the $1200 salvage value in D3, and the 16-year life in D4. @SLN(D2,D3,D4) returns $980, the yearly, straight-line depreciation allowance.

@SQRT
@SQRT(a) calculates the positive square root of a. a can be any positive value or 0.
Example. @SQRT(9) = 3 because 3^2 = 9.

@STD
@STD(list) calculates the population standard deviation of the values in list. List can contain one or more numbers, numeric formulas, references to ranges that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.
Population standard deviation is most accurate when the number of observations is large.
Example. @STD(C3..C44) returns the population standard deviation of a list of test scores in C3..C44.

@STRING
@STRING(x,n) converts the value x into a string with n decimal places. x can be any value. n can be any integer from 0 to 15.

Note
@STRING ignores any formatting characters included in x. For example, if A7 contains the formatted value $45.23, @STRING(A7,2) returns the string $45.23.

Example. @STRING(123.456,2) = the string 123.46.

14-48 @Functions
@SUM

@SUM(ist) adds the values in ist. List can contain one or more numbers, numeric formulas, references to ranges that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.

Example: @SUM(B5..B9) returns the sum of the values in B5..B9.

@SYD

@SYD(cost, salvage, life, period) 'calculates the sum-of-the-years'-digits depreciation allowance for an asset for a specified period.

Cost represents the amount paid for the asset and can be any value.

Salvage represents the value of the asset at the end of its life and can be any value.

Life represents the number of periods (typically years) it will take to depreciate the asset to its salvage value. Life can be any value greater than or equal to 1.

Period represents the time period for which you want to find the depreciation allowance. Period can be any value greater than or equal to 1.

Example: You have an office machine worth $10,000, with a useful life of 10 years, and a salvage value of $1200. You have a worksheet with the $10,000 cost in cell D2, the $1200 salvage value in D3, and the 10-year life in D4. @SYD(D2,D3,D4,5) returns $996, the sum-of-the-years'-digits depreciation allowance for the fifth year.

@TAN

@TAN(z) calculates the tangent of angle z measured in radians. (To convert degrees to radians, multiply by @PI/180.) z can be any value.

Example: @TAN(35*@PI/180) = 0.700207.
@TERM

@TERM(payment, interest, future-value) calculates the number of payment periods in the term of an investment necessary to accumulate a future-value, assuming payments of equal value, when the investment earns a periodic interest rate. Payments can be any value except 0. Interest can be any value greater than 1. Future-value can be any value.

1-2-3 assumes that calculations made with @TERM use an investment that is an ordinary annuity (payments at the end of each period).

Examples. You deposit $2,000 at the end of each year into a bank account that earns 7.5% a year, compounded annually. You want to determine how long it will take to accumulate $100,000. @TERM(2000,0.075,100000) returns 21.5, the number of years it will take to accumulate $100,000 in your account.

If you made payments at the beginning of each year, you would calculate the amount for an annuity due. To calculate the number of payment periods in an annuity due, use the formula @TERM(payment, interest, future-value/(1+interest)). For example, @TERM(2000,0.075,100000/(1+0.075)) = 20.8, the number of years it would take to accumulate $100,000 if you made deposits at the beginning of each year.

You can calculate the term necessary to pay back a loan by using @TERM with a negative future value. For example, you want to know how long it will take to pay back a $10,000 loan at 10% yearly interest, making payments of $1,174.60 per year. @ABS/@TERM(1174.6,0.1,-10000) = 20 years to pay back the loan.

@TIME

@TIME(hour, minute, second) calculates the time number for the specified hour, minute, and second. (For an explanation of time numbers, see "Date and Time Functions" earlier in this chapter.) Hour can be any integer from 0 (midnight) to 23 (11:00 PM). Minute and seconds can be any integers from 0 to 59.

Use @TIME to enter times as time numbers that 1-2-3 can use in time-arithmetic calculations—for example, to keep track of elapsed times. (To format time numbers, use /Range Format Date Time.)
Example: You want to determine a consultant's payment. The formula
\((\text{@TIME}(13,0,0)-\text{TIME}(9,15,0))*65\times24\) calculates the amount due on a given day by subtracting the start time (9:15 AM) from the stop time (1:00 PM) and multiplying the result by an hourly rate of $65.00. The result is $2550.00.

**@TIMEVALUE**

@TIMEVALUE (string) calculates the time number for a string that looks like a time. (For an explanation of time numbers, see “Date and Time @Functions” earlier in this chapter.) String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. String must be in one of the 1-2-3 time formats (see “Time Format” in chapter 11).

Use @TIMEVALUE when you want to convert times entered as labels to time numbers so that you can use the times in calculations. @TIMEVALUE is useful with data that has been imported from another program, such as a word processing program.

Example. In the following figure, times are entered as labels in column A. @TIMEVALUE(A1), entered in C1 returns the time number 0.8857/594. The formula is copied down column C.

![Diagram of times entered as labels and converted to time numbers]

**@TRIM**

@TRIM (string) removes leading, trailing, and consecutive spaces from string. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string.

Use @TRIM to control spacing during data entry or to combine strings that have unknown spacing.

@Functions 14-51
Example. In this example, each • (bullet) represents one space:
@TRIM("•45.556/8") = 45.56.

@TRUE
@TRUE returns the logical value 1 (true). Use @TRUE with @IF and @CHOOSE that require a logical value of 1 (true). You can use either @TRUE or any nonzero value in formulas that evaluate logical conditions, but @TRUE makes the formula easier to read.
Example. @IF(A6>60,TRUE,FALSE) < 1 when A6 contains a value greater than 600.

@UPPER
@UPPER(string) converts all lowercase letters in string to uppercase. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string.
Example. @UPPER("Warning") = WARNING.

@VALUE
@VALUE(string) converts a number stored as a string to its corresponding value. String can be a literal string, the range name or address of a cell that contains a label, or a formula or @function that evaluates to a string. String must contain only numbers or numeric symbols, it can resemble a standard number (455.7), a number in scientific format (4.5E+2), a mixed number (25/4), or a formatted number (25.85).
If string is a blank cell or empty string, @VALUE returns 0. If string contains non-numeric characters, @VALUE returns the value ERR.
@VALUE ignores leading and trailing spaces in string; however, if string contains spaces separating symbols from the numbers (such as $22.85 or \$22.85), @VALUE returns the value ERR.

Note
You cannot do calculations within a string argument in @VALUE; however, you can create a formula with several @VALUE functions. (See the example below.)
Use \$VALUE when you want to convert a string that contains numbers into values that can be used in mathematical calculations.

Example. \$VALUE("22" + "20") = 0, but \$VALUE("22") + \$VALUE("20") = 42.

@VAR
@VAR(list) calculates the population variance of the values in list. list can contain one or more numbers, numeric formulas, references to range that contain numbers or numeric formulas, or any combination of numbers, formulas, and references to ranges.

Example. @VAR(B3..B43) returns the population variance of a list of test scores in B3..B43.

@VLOOKUP
@VLOOKUP(x, range, column-offset) finds the contents of a cell in the specified column of a vertical lookup table. A vertical lookup table is a range with value information in ascending order in the first column.

@VLOOKUP compares the value x to each cell in the first column of the table. When 1-2-3 locates a cell in the first column that contains the value x (or the value closest to, but not larger than, x) it moves across that row the number of columns specified by column-offset and returns the contents of the cell as the answer.

@Functions 14-63
\( x \) can be any value greater than or equal to the first value in range.

If \( x \) is smaller than the first value in range, \( \text{VLOOKUP} \) returns the value \( \text{ERR} \). If \( x \) is larger than the last value in range, \( \text{VLOOKUP} \) stops at the last cell in the column and returns the contents of that cell.

\( \text{Range} \) represents the location of the vertical lookup table. \( \text{Range} \) can be any range name or address.

\( \text{Column-offset} \) represents an offset number. The first column has an offset number of 0, the second, 1, and so on.

Use \( \text{VLOOKUP} \) to locate entries in a table, such as a tax table or a sales commissions table.

Example. The previous figure contains a tax table.
\( \text{VLOOKUP}(35150, A2..E6, 1) \) entered in A9 returns the amount of tax you would pay if your income was $35,150 and you were a Status 1 taxpayer. $35,150 does not appear in the first column of the table, so \( \text{VLOOKUP} \) stops at row 6, because $35,150 is the value closest to, but not larger than, $35,150.

**@YEAR**

\( \text{@YEAR} \) (date-number) calculates the year, an integer from 0 (1900) to 199 (2099), in date-number. (For an explanation of date numbers, see "Date and Time @Functions" earlier in this chapter.) Date-number can be any integer from 1 (January 1, 1900) to 73100 (December 31, 2099).

Examples. \( \text{@YEAR}(20181) = 55 \) because 20181 is the date number for April 2, 1955.
\( \text{@YEAR}(@NOW) \) is the current year.

Add 1900 to the result of an \( \text{@YEAR} \) calculation to convert it into a four-digit year. For example, \( \text{@YEAR}(20181)+1900 \) returns 1955.
1-2-3 Macros

A macro is a set of commands and keystroke instructions that you create to perform a 1-2-3 task. You enter the macro in a worksheet as one or more labels in a column and assign it a range name. Then, whenever you run the macro, 1-2-3 reads and executes the commands and keystroke instructions automatically.

Macros expedite your work. They save time that would otherwise be spent performing simple but repetitive tasks, and they streamline complex procedures. You can use a macro to enter data or to perform a series of commands that format worksheets, calculate complex formulas with variable data, extract database records for use in a report, and so on.

Note

Some macros that were written assuming an 80 x 25 display may exhibit unexpected behavior on the HP 95LX. (For example, {FGUP}, {FGDN}, {BIGLEFT}, and {BIGRIGHT} commands assume an 80 column display and may not function properly in a macro on the HP 95LX.)

Creating a Macro

Creating a macro involves seven steps:

1. Planning the macro.
2. Entering the macro in a worksheet.
3. Naming the macro.
4. Documenting the macro.
5. Running the macro.
6. If necessary, debugging (correcting problems in) the macro.
7. Saving the macro by saving the worksheet.
Planning a Macro

The first step in creating a macro involves identifying the tasks you want to automate. For example, suppose you want to create a macro that sets the width of a column to 15. To create the macro, you must know that the task involves selecting (Worksheet Column Width), typing 15 as the column width, and pressing ENTER.

In some cases, identifying the steps means performing the task once manually and noting each key that you press. In other cases, mapping out the procedure with a flowchart may help you work out the steps of the task.

Entering a Macro

To enter a macro you need to know two things:

- The worksheet location where you will enter the macro.
- How to write the macro instructions.

Choosing a Macro Location

When you enter macros in a worksheet with data, enter the macros below and to the right of the data. This keeps you from writing over data when you enter the macros or changing the macros when you insert or delete rows and columns in the data area. For example, if the data occupies the range A1..Z240, put the macro below row 246 and to the right of column Z.

Writing Macro Instructions

Macro instructions are like programming code—they tell 1-2-3 what actions to perform. For example, /ws/215/ means a set of macro instructions that tells 1-2-3 to widen the current column to 15 characters.

Macro instructions can be either keystroke instructions (as in the example above) or advanced macro commands. (For information on advanced macro commands, see "Using the Advanced Macro Commands" later in this chapter.)
Keystroke instructions can be divided into two groups:

- Instructions that consist of a single character, such as / (slash), w, and ~ (tilde).
- Instructions that consist of a key name within { } (braces), such as {RIGHT}.

The single-character keystroke instructions represent the typewriter keys on your keyboard. Most of these instructions duplicate the character on the key they represent. For example, the keystroke instruction that displays the 1-2-3 main menu is / (slash); the keystroke instruction that selects Worksheet from the main menu is w, and so on.

The only single-character keystroke instruction not identical to the key 5 represents is the ~ (tilde). The tilde is the keystroke instruction for ENTER in the example /w/5~w; the tilde enters the specified column width to complete the /Worksheet Column Set-Width command.

Note

Screen scrolling macro commands from macros created on PCs that depend on the 80 x 25 screen size will not be compatible with the HP 90LX. These commands include {BIGEGFT}, {BIGLEFT}, {PGUP}, and {PGDN}.

Macros 15-3
The keystroke instructions that consist of a key name within { } (braces) represent the pointer-movement keys, function keys, and a few other keys as shown in the following table:

<table>
<thead>
<tr>
<th>1-2-3 key</th>
<th>Macro Keystroke Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>[D] or [U]</td>
<td>{DOWN} or {UP}</td>
</tr>
<tr>
<td>[L] or [R]</td>
<td>{LEFT} or {RIGHT}</td>
</tr>
<tr>
<td>{ABS}</td>
<td>{ABS}</td>
</tr>
<tr>
<td>{APP1}</td>
<td>{APP1}</td>
</tr>
<tr>
<td>{APP2}</td>
<td>{APP2}</td>
</tr>
<tr>
<td>{APP3}</td>
<td>{APP3}</td>
</tr>
<tr>
<td>{APP4}</td>
<td>{APP4}</td>
</tr>
<tr>
<td>{BS}</td>
<td>{BACKSPACE} or {BS}</td>
</tr>
<tr>
<td>{TAB}</td>
<td>{TAB}</td>
</tr>
<tr>
<td>{DEL}</td>
<td>{DELETE} or {DEL}</td>
</tr>
<tr>
<td>{EDIT}</td>
<td>{EDIT}</td>
</tr>
<tr>
<td>{END}</td>
<td>{END}</td>
</tr>
<tr>
<td>{ESC}</td>
<td>{ESC}</td>
</tr>
<tr>
<td>{GTO}</td>
<td>{GOTO}</td>
</tr>
<tr>
<td>{GRAPH}</td>
<td>{GRAPH}</td>
</tr>
<tr>
<td>{HELP}</td>
<td>{HELP}</td>
</tr>
<tr>
<td>{HOME}</td>
<td>{HOME}</td>
</tr>
<tr>
<td>{INS}</td>
<td>{INSERT} or {INS}</td>
</tr>
<tr>
<td>{NAME}</td>
<td>{NAME}</td>
</tr>
<tr>
<td>{PGDN}</td>
<td>{PGDN}</td>
</tr>
<tr>
<td>{PGUP}</td>
<td>{PGUP}</td>
</tr>
<tr>
<td>{QUERY}</td>
<td>{QUERY}</td>
</tr>
<tr>
<td>{TAB}</td>
<td>{TAB}</td>
</tr>
<tr>
<td>{WIND}</td>
<td>{WIND}</td>
</tr>
<tr>
<td>{MENU}</td>
<td>{MENU}</td>
</tr>
<tr>
<td>{= or open brace}</td>
<td>{=}</td>
</tr>
<tr>
<td>{close brace}</td>
<td>{}}</td>
</tr>
</tbody>
</table>
Guidelines for Entering a Macro

When you enter a macro, observe the following guidelines:

- **Macro instructions** must be entered as labels. You can either include the entire set of macro instructions (up to 240 characters) in one label or divide the instructions among a series of labels in consecutive cells in a column. Unless a macro is very short, divide the macro instructions among a series of labels. Doing this makes the macro easier to read and debug.

- If you divide the macro instructions among a series of labels, enter the labels in consecutive cells in a column. 1-2-3 reads a macro by starting at the first cell and moving down the column until it reaches a blank cell, a cell that contains a numeric value, or the advanced macro command (QUIT).

- When a macro instruction begins with a number, / (slash), \ (backslash), < (less-than symbol), or one of the numeric symbols , + - @ ( # or %), type a label prefix (' ' or ]) before typing the label.

- Begin and end any instruction in { } (braces), such as {DOWN}, in the same cell. Splitting the instruction between two or more cells results in an error.

- You can type any instruction in braces in uppercase or lowercase letters, or a combination of both.

**Note**

This section has presented guidelines for entering a macro directly in the worksheet. You can also use the learn feature to enter a macro. See “Using the Learn Feature to Create Macros” later in this chapter.
Naming a Macro

After you enter a macro, assign it a range name. You use the range name to run the macro.

Use /Range Name Create to assign a range name to the macro.

1. Select /Range Name Create.
2. Specify the macro's name as the range name.
3. Specify the first cell of the macro as the range to name.

Note: If you expect to move the macro around the worksheet, specify the entire macro as the range, not just the first cell. You can then use the range name when moving the macro.

When deciding on a name for your macro, be aware of the following:

- Macro range names can consist of any combination of up to 15 characters. Like any range name, they should not duplicate cell addresses; they should not include spaces, commas, colons, periods, or periods; and they should not duplicate function names, advanced macro command keywords, or 1-2-3 key names.
- If you use a macro range name that consists of a backslash and a single letter, such as \N, you can use the \(\text{ALT}\) key as well as RUN to run the macro. For example, to run the macro named \(\text{N}\), you would hold down \(\text{ALT}\) and press \(\text{N}\). Using \(\text{ALT}\) is the simplest way to run a macro.
- If you use a macro range name that consists of any other combination of characters, such as N:SW..ROW, you must either use RUN (\(\text{ALT}\) + \(\text{F2}\)) to execute the macro or call it or branch to it from another macro.

Documenting a Macro

After entering and naming a macro, consider documenting the macro's range name and the macro instructions. This documentation has several functions: it quickly identifies which range name belongs to the macro (particularly useful in a worksheet that contains many named ranges); it clarifies the macro's purpose; and it describes the steps of the macro procedure. Documentation can be extremely useful when
you or someone else needs to revisit the macro or what you are trying to figure out what a macro does if you haven't used it for a while.

- Document the macro's range name by entering the name as a label to the left of the first cell of macro instructions.
- Document the macro instructions by entering comments to the right of the cell or cells containing the macro. Do not enter documentation in the same cell as macro instructions. 1-2-3 considers anything in a cell within a macro to be part of the macro and thus will try to run the documentation as part of the macro.

The following figure shows a documented macro. The macro is in column B, the macro's range name is documented in column A, and the macro instructions are documented in column C.

![Diagram of macro documentation]

**Running a Macro**

After you have entered, named, and documented the macro, try running it to see if it works as planned. If it performs as expected, you can go ahead and use the macro at any time during the current 1-2-3 work session. To use the macro in future sessions, save the worksheet.

You run a macro in one of two ways: with **ALT** or with **RUN** (**ALT** 5). The method you use depends on the macro's name.
Caution
Before you run the macro, use /File Save to save your work. That way, if the macro produces unexpected results, you can easily retrieve the original version of the worksheet. If the undo feature is on, you can press UNDO (Alt+Z) immediately after the macro is done executing to restore the worksheet to the way it was before you ran the macro.

Running a Macro with ALT
If the macro's name consists of a backslash and a single letter (for example, \V), you can run the macro by holding down Alt and pressing the letter as the macro range name. For example, to run a macro named \N, you would press Alt-N.

Running a Macro with RUN
If the macro's name consists of any other combination of characters (for example, NEW.ROW), you must use RUN (Alt+P) to run the macro.
2. To specify the macro to run, do one of the following:
   • Type the macro range name or address and press Enter.
   • Highlight the macro range name in the list of range names and press Enter.
   • Press ESC to switch 1-2-3 to POINT mode, move the cell pointer to the first cell of the macro, and press Enter.

Debugging a Macro
If a macro does not perform as you expect it to, or if 1-2-3 does not finish running it because of an error, you need to debug the macro— that is, find out which macro instructions are causing the problem and edit them.

Troubleshooting Checklist
If 1-2-3 displays an error message when you run a macro, press HELP (F1), while the error message is on the screen to get an explanation of...
the message. When you are done using the Help system, press [ESC] or [ENTER] to clear the error message. Then move to the macro and look for the problem. Here are some common mistakes made when entering macro instructions:

- Spelling errors in a macro key name, advanced macro command keyword, or range name, such as \WINDX WOFF] instead of \\WINDXWOFF
- Spaces where there shouldn't be any, for example, between arguments in an instruction or advanced macro command.
- Missing tildes in a command sequence, for example, /dpb~ instead of /dpb~
- Missing steps in a command sequence, for example, /20~ instead of /dpb~
- Square brackets or parentheses instead of braces around a key name or advanced macro command, for example, [up] or (up) instead of \{up\}
- Incorrect cell or range references, for example, A1, YV3 (a nonexistent range) or RANGES when RANGES is a nonexistent range name.
- Range names that duplicate macro key names or advanced macro command keywords, for example NAME, END, HELP, or QUIT.
- Missing arguments, arguments of the wrong type, or misplaced or missing argument separation in macros that include advanced macro commands.

Macro error messages include the location of the instruction 1-2-3 was executing at the time it encountered the error. Check the cell cited in the error message for typographical errors, missing braces or tildes, or anything else listed in the troubleshooting checklist.

If you find no problems in the referenced cell, check to see if a macro instruction in a cell above it could have caused the problem. For example, if 1-2-3 reports an error in a cell that apparently contains none, but the cell does contain a range name assigned at an earlier point in the macro, check the cell that contains the range name assignment instructions to see whether you spelled the range name the same way in both places.

When you find the error, move the cell pointer to the appropriate cell, press EDIT (F2), correct the error, and press ENTER.
Debugging a Macro in STEP Mode

The instructions that cause an error in a lengthy or complicated macro may not be easy to find. To help you diagnose problems in a macro, 1-2-3 has a feature called STEP mode. STEP mode lets you run a macro one instruction at a time, until you locate the error.

1. With 1-2-3 in READY mode, press STEP (ALT (P)) to turn on STEP mode. The STEP indicator (S) appears at the bottom of the screen.

2. Start the macro using one of the methods described in “Running a Macro” earlier in this chapter.

3. Press the space bar (or any key) to execute the first macro instruction.

4. Repeat step 3 as many times as necessary to find the part of the macro that contains the error.

   Each time you press a key, 1-2-3 executes another instruction in the macro and replaces the status line with two pieces of information: the cell address of the cell that contains the macro instructions being executed and the contents of that cell. The current macro instruction (the one to be executed next) is highlighted.

   If the instruction includes an instruction or label, each time you press a key, 1-2-3 steps through one character of the instruction or label.

   If the macro is getting input because of an advanced macro command such as (GETLABEL) or (?), key indicators such as (C) may appear in the status line to show you what kind of input the macro is expecting. (Single-step mode indicates that the macro is waiting for user input.)

5. Once you find the error, and the macro by pressing CTRL (BREAK) followed by (ESC or (ENTER)

   When you exit the macro to edit it, the STEP indicator reappears to remind you that STEP mode is still on. You do not need to turn off STEP mode to edit the macro.

6. Edit the macro to correct the problem.

7. Run the macro in STEP mode again if you need to locate any other problems.

8. To turn off STEP mode in order to run the macro normally, press STEP (ALT (P)) again and then press any key.

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Saving a Macro

When the macro is running correctly, save it for future use by saving the worksheet with /File Save. Then you can run the macro any time you require the worksheet.

Using the Learn Feature to Create Macros

In addition to typing macros directly into the worksheet, you can use the 1-2-3 learn feature to create a macro. When you use this feature, 1-2-3 records all your keystrokes in a learn range, a single column range that you define.

The learn feature has the advantage of letting you record a macro and test it at the same time. Because you are performing the procedure that will be automated in the macro, you see on the screen exactly what will happen when the macro runs. The learn feature also minimizes the possibility of syntax errors because it records the keystrokes in the learn range in the correct format. You simply press keys and respond to the menus and prompt lines as they appear.

To create a macro with the learn feature, you go through four basic steps:
1. Specify a learn range for the macro and turn on the learn feature.
2. Record keystrokes in the learn range by performing the task you want to automate.
3. Name the macro by assigning a range name to the first cell of the learn range.
4. Run the macro to see if it works and, if necessary, edit it so it works the way you planned.
Specifying a Learn Range

To use the learn feature, you must first specify a learn range: in an empty part of the worksheet where the macro cannot interfere with data. You need to specify a single column range.

1. Select /Worksheet Learn Range.
2. Specify a single column range when prompted.

You are now ready to turn on the learn feature and start recording keystrokes.

Recording Keystrokes in the Learn Range

The 1-2-3 learn feature records keystrokes in macro instruction format. For example, when you press GOTO (F2), type z5, and press ENTER. 1-2-3 records (GOTO)z5-. Also, the program uses abbreviated instructions (like {D} for {DOWN}) whenever it can.

1-2-3 does not record any /Worksheet, Learn commands while you’re using the learn feature. It also doesn’t record the following keys in the learn range: CONTROL, [SHIFT], [CTRL], [ALT], and [ESC]. In addition, learn will not record {HELP} or any keystrokes you enter while using Help.

1. Move the cell pointer to the cell where you want to start the task.
2. Press LEARN (ALT-F9). The Learn indicator (Learn) appears at the bottom of the screen. As long as the Learn remains on, 1-2-3 records each of your keystrokes in the learn range.
3. Perform the task or series of tasks you want to record. If you want to include another macro in the one you’re recording, enter its range name in braces, for example, (TOTAL). When you execute the macro, 1-2-3 will execute the macro you have included and then return control to the original macro.
4. After you finish, press LEARN (ALT-F9) again to stop 1-2-3 from recording any more keystrokes.

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5. Move the cell pointer to the learn range and examine the recorded keystrokes. If you made mistakes while performing the task, 1-2-3 recorded them, so edit them before going any further. (Be sure not to leave any empty cells in the middle of the macro or 1-2-3 will interpret the blank cell as the end of the macro.)

If you made many mistakes and want to start over, erase the learn range with /Worksheet Learn Erase and start again at step 1.

6. If the macro looks correct, name it and run it just as you would a macro you had entered yourself.

The following figure shows a learn range with the recorded keystrokes for performing a print operation.

Using the Advanced Macro Commands

An advanced macro command is a macro instruction that tells 1-2-3 to perform a built-in programming function. For example, the advanced macro command (LET) tells 1-2-3 to enter a label or number in a cell, and (BEEP) tells 1-2-3 to sound your computer's bell.
Types of Advanced Macro Commands

The 50 advanced macro commands in 1-2-3 can be grouped in five command categories:

- **Data manipulation commands** enter data, edit existing entries, erase entries, and clear control panel prompts.
- **File manipulation commands** work with text files. Text files, also called print files, are files on disk in ASCII format. You can use these file manipulation commands to create a new text file, copy data from a text file to a worksheet, or copy data from a worksheet to a text file.
- **Flow-of-control commands** direct the path of macro execution so you can create a macro that includes for loops, branches, subroutine calls, and conditional processing.
- **Interactive commands** suspend macro execution for keyboard input, control the timing of macro execution, and prevent undesired changes to a worksheet while a macro is running.
- **Screen control commands** control different parts of the screen display, change the contents of the mode indicator, and sound your computer's bell.

The following tables list the 50 advanced macro commands by category and briefly describe each command. For a more complete description of the commands and examples of how they work, see "Advanced Macro Command Descriptions."
### Data Manipulation

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLANK</td>
<td>Erases a cell or range.</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>Copies the formatted value of one cell to another cell as a label.</td>
</tr>
<tr>
<td>LET</td>
<td>Inserts a label or number in a cell</td>
</tr>
<tr>
<td>PFT</td>
<td>Erases a label or number in a range</td>
</tr>
<tr>
<td>RECALC</td>
<td>Recalculates formulas in a range row by row.</td>
</tr>
<tr>
<td>RECALC Col</td>
<td>Recalculates formulas in a range column by column.</td>
</tr>
</tbody>
</table>

### File Manipulation

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSE</td>
<td>Closes the open text file (the file you are currently working with).</td>
</tr>
<tr>
<td>SIZE</td>
<td>Records in a cell the number of bytes in the open text file.</td>
</tr>
<tr>
<td>GETPOS</td>
<td>Determines the position of the byte pointer in the open text file and records that position in a cell.</td>
</tr>
<tr>
<td>OPEN</td>
<td>Opens a text file so you can work with that file using the other file manipulation commands.</td>
</tr>
<tr>
<td>READLN</td>
<td>Copies a series of bytes from the open text file to a cell.</td>
</tr>
<tr>
<td>SETPOS</td>
<td>Repositions the byte pointer in the open text file.</td>
</tr>
<tr>
<td>WRITE</td>
<td>Writes a string to the open text file and adds an end-of-line sequence.</td>
</tr>
</tbody>
</table>

---

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<table>
<thead>
<tr>
<th>Subroutine</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch</td>
<td>Performs a branch; transfers macro control from the current column of macro instructions to another location.</td>
</tr>
<tr>
<td>Define</td>
<td>Evaluates and stores information that you pass to a subroutine or a (subroutine) command.</td>
</tr>
<tr>
<td>Dispatch</td>
<td>Performs an indirect branch by directing 1-2-3 to a cell that contains the name or address of the branch location.</td>
</tr>
<tr>
<td>For</td>
<td>Creates a for loop; repeats a subroutine a specified number of times.</td>
</tr>
<tr>
<td>Forbreak</td>
<td>Cancels a for loop.</td>
</tr>
<tr>
<td>If</td>
<td>Sets up a condition that 1-2-3 evaluates to determine whether to continue with the macro instructions that follow (IF) in the same cell or go directly to the instructions in the next cell.</td>
</tr>
<tr>
<td>Onerror</td>
<td>Performs a branch if an error occurs while a macro is running, so macro execution continues instead of terminating at the error.</td>
</tr>
<tr>
<td>Quit</td>
<td>Ends a macro, warning keyboard control to the user.</td>
</tr>
<tr>
<td>Restart</td>
<td>Clears the subroutine stack. Keeps 1-2-3 from returning to the location from which the subroutine call was made after completing the instructions in the subroutine.</td>
</tr>
<tr>
<td>Return</td>
<td>Used in subroutine. If a (subroutine) command called the subroutine, (Return) ends the subroutine immediately and returns macro control to the instruction following the (subroutine) command. If a (FOR) command called the subroutine, (Return) ends the current repetition immediately and starts the next repetition.</td>
</tr>
<tr>
<td>System</td>
<td>The (SYSTEM) macro command is not available in the WP 5.5.2.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BREAK</td>
<td>Suspends macro execution to let you move the cell pointer or enter data.</td>
</tr>
<tr>
<td>BREAKOFF</td>
<td>Has the effect of pressing ( \text{CTRL} + \text{BREAK} ) (equivalent to pressing ( \text{ESC} ) one or more times) so you can return to the READY mode.</td>
</tr>
<tr>
<td>BREAKON</td>
<td>Disables ( \text{CTRL} + \text{BREAK} ) while a macro is running, protecting the facts from interruption.</td>
</tr>
<tr>
<td>GET</td>
<td>Restores use of ( \text{CTRL} + \text{BREAK} ) undoing ( \text{BREAKOFF} ).</td>
</tr>
<tr>
<td>GETLBL</td>
<td>Suspends macro execution until you press a key, then records that key in a cell.</td>
</tr>
<tr>
<td>GETNUM</td>
<td>Displays a prompt in the control panel, waits for a numeric response to the prompt, and enters the response as a number in a cell.</td>
</tr>
<tr>
<td>GETNUMBR</td>
<td>Displays a prompt in the control panel, waits for a numeric response to the prompt, and enters the response as a number in a cell.</td>
</tr>
<tr>
<td>LOOK</td>
<td>Checks the computer's keyboard buffer (the buffer in which 1-3-3 stores breakpoints during noninteractive parts of a macro) and records the first keystroke in the buffer in a cell.</td>
</tr>
<tr>
<td>MENUBRANCH</td>
<td>Displays a rectangular menu in the control panel, waits for you to select a menu item, then branches to the macro instructions associated with that menu item.</td>
</tr>
<tr>
<td>MENUCALL</td>
<td>Displays a customized menu in the control panel, waits for you to select a menu item, and then executes the macro instructions associated with that menu item as a subroutine. (In other words, after completing those instructions, returns to the location from which the ( \text{MENUCALL} ) command was issued and resumes the macro there.)</td>
</tr>
<tr>
<td>WAIT</td>
<td>Suspends macro execution for a specified duration.</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>[BORDERSOFF]</td>
<td>Turns off display of the worksheet frame (column letters and row numbers). (Works the same as [FRAMEOFF].)</td>
</tr>
<tr>
<td>[BORDERSON]</td>
<td>Resume display of the worksheet frame, reverting [BORDERSOFF]. (Works the same as [FRAMEON].)</td>
</tr>
<tr>
<td>[FRAMEOFF]</td>
<td>Turns off display of the worksheet frame (column letters and row numbers). (Works the same as [BORDERSOFF].)</td>
</tr>
<tr>
<td>[FRAMEON]</td>
<td>Resume display of the worksheet frame, reverting [FRAMEOFF]. (Works the same as [BORDERSON].)</td>
</tr>
<tr>
<td>[GRAPHOFF]</td>
<td>Reserves a graph displayed by [GRAPHON] and redispays the worksheet.</td>
</tr>
<tr>
<td>[GRAPHON]</td>
<td>Without suspending macro execution, creates a full-screen view of the current graph or makes a named graph the current graph (with or without displaying the graph).</td>
</tr>
<tr>
<td>[INDICATE]</td>
<td>Changes the mode indicator to the upper right corner of the screen.</td>
</tr>
<tr>
<td>[PANELOFF]</td>
<td>Fruces the control panel either in its current state or after clearing it.</td>
</tr>
<tr>
<td>[PANELON]</td>
<td>Unfraces the control panel, undoing [PANELOFF].</td>
</tr>
<tr>
<td>[WINDOWOFF]</td>
<td>Fruces the worksheet area of the screen.</td>
</tr>
<tr>
<td>[WINDOWSON]</td>
<td>Unfraces the worksheet area of the screen, undoing [WINDOWOFF].</td>
</tr>
</tbody>
</table>
Syntax of Advanced Macro Commands

Each advanced macro command has a specific structure, or syntax. Unless you follow this syntax exactly, 1-2-3 cannot interpret the command. The following figure shows the syntax of advanced macro commands:

\[
\{\text{KEYWORD}\}\]

or

\[
\{\text{KEYWORD arg1, arg2, ..., argn}\}\]

The first word in an advanced macro command is the keyword. The keyword is often the verb in the command—it tells 1-2-3 what action to perform.

Most advanced macro commands also include one or more arguments. Arguments supply the information 1-2-3 needs to complete the command. For example, in the \( \text{LET TOTAL} \text{ SUM( EXPENSES) } \) command (let TOTAL equal SUM of EXPENSES), the first argument, TOTAL, tells 1-2-3 where to enter the data (in the cell named TOTAL) and the second argument, SUM( EXPENSES), tells 1-2-3 what data to enter (the value of SUM of EXPENSES).

Arguments

Advanced macro commands use four types of information as arguments: numbers, strings, locations (cells or ranges), and conditions (usually logical formulas).

- For number arguments, you can use a number, a numeric formula, or the range name or address of a cell that contains a number or numeric formula.

- For string arguments, you can use a literal string (any sequence of letters, numbers, and symbols enclosed in quotation marks), a string

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formula, or the range name or address of a cell that contains a label or string formula.

**Note**

Every literal string used as a string argument should be enclosed in quotation marks. This prevents 1-2-3 from interpreting the literal string as a number, formula, address, or range name. It also prevents 1-2-3 from interpreting commas, semicolons, or periods within the literal string as argument separation, or colons within the literal string as argument-type specifiers (see "Decoding Argument Types" in the [DEFINE] section later in this chapter).

- For location arguments, you can use a range name, address, or any formula that evaluates to a range name or address. You can precede the location with a + (plus) if you want to indicate that this contains a reference to another cell or range.
- For condition arguments, you typically use a logical formula (a formula that uses one of the logical operators < > <= <> >=, #NOT#, #AND# and #OR#) or the range name or address of a cell that contains a logical formula. However, you can also use any numeric or string formula, number, literal string, or cell reference as a condition argument.

Also, you can use a link to data in another file as an argument to a macro, for example, {let revenues: +<chicago> = sales} For more information on links, refer to "Linking Files" in chapter 2.

**Basic Rules of Syntax**

To include an advanced macro command in a macro, follow these guidelines:

- Start and end the advanced macro command in the same cell.
- Start the command with { (open brace) and end it with } (close brace).
- Immediately after the open brace, type the keyword. You can type it in uppercase or lowercase letters.
- If the command includes arguments, separate the keyword from the first argument with one space.
If the command includes two or more arguments, separate the arguments from one another with argument separators. By default, semicolons and commas are valid argument separators for advanced macro commands, and the examples in this chapter always use commas. You can, however, see /Worksheet Global Default Other International Punctuation to set a different argument separator. See chapter 13 for information on this command.

- The only space in the command syntax occurs between the keyword and the first argument. Do not include any other spaces in the command, unless they are part of an argument (for example, the prompt in a [GETLABEL] command can include spaces between the words in the prompt). If the command takes no arguments, the command should include no spaces.

- You can include any combination of advanced macro commands and keystroke instructions in the same cell, as long as the total number of characters does not exceed 240.

**Worksheet Recalculation and Advanced Macro Commands**

When you run a macro with the worksheet recalculation method set to Automatic (see /Worksheet Global Recalculation Automatic in chapter 13), 1-2-2 does not recalculate all data continuously. Automatic recalculation of advanced macro commands occurs if the user enters data in the worksheet in response to a (?) command or if you have followed a command such as [LET] or [GET] with a ~ (tilde) to represent the [LET] key (which 1-2-3 interprets as any input). Suppose you have a series of [LET] commands, but no user data entry in response to a (?) command. If any other commands is the macro depend on the results of the [LET] command, you'll need to recalculate the worksheet, either by following the last [LET] command with a ~ (tilde) or by including a [RECALC] or [RECALCOL] command.
Advanced Macro Command Descriptions

This section lists the advanced macro commands alphabetically by keyword. The \texttt{subroutine} command is listed first because it does not have a standard keyword.

\begin{itemize}
    \item \texttt{(subroutine \texttt{[arg]};\texttt{[arg]}; \ldots;\texttt{[arg]})} performs a subroutine call. A subroutine is a discrete unit of macro instructions. A subroutine call causes 1-2-3 to complete the instructions in the specified subroutine before continuing the current macro instructions.
\end{itemize}
When 1-2-3 encounters a \texttt{[subroutine]} command, it does the following:

1. Shifts macro control from the current macro cell to the specified subroutine. \texttt{[subroutine]} is the range name of the subroutine's starting cell.
2. \texttt{Passes} any included arguments to the \texttt{[DEFINE]} command in the subroutine for evaluation and storage (see \texttt{[DEFINE]}).
3. Executes the instructions in the subroutine.
4. When it reaches a \texttt{[RETURN]} command or a blank or numeric cell in the subroutine, returns to the original macro location and continues the macro as the instruction immediately following the \texttt{[subroutine]} command.

You can include up to 31 optional arguments \texttt{(arg1, arg2, \ldots, arg31)} in the \texttt{[subroutine]} command as information for the subroutine to use. These arguments can be anything: numbers, labels, formulas, or cell references. If you do include optional arguments, you must include a \texttt{[DEFINE]} command in the subroutine you are calling. \texttt{[DEFINE]} evaluates and stores the arguments so they can be used in the subroutine. See \texttt{[DEFINE]} for further information on \texttt{[subroutine]} command arguments.

Examples. These examples illustrate \texttt{[subroutine]} commands without arguments. See \texttt{[DEFINE]} for \texttt{[subroutine]} commands that include arguments.

The following macro executes subroutine \texttt{SUBR1} three times in three different cells. After the third time, 1-2-3 enters the message "All done!" in cell \texttt{MESSAGE.CELL}.

\begin{verbatim}
[GO]TO ONE--(SUBR1)
[GO]TO TWO--(SUBR1)
[GO]TO THREE--(SUBR1)
[GO]TO MESSAGE.CELL--All done!
\end{verbatim}

In this example from a macro, if the value of cell \texttt{AGE} is less than 21, 1-2-3 executes subroutine \texttt{MINOR}, then ends the macro. If the value of cell \texttt{AGE} is greater than or equal to 21, 1-2-3 executes subroutine \texttt{MAJOR}, then continues with any further macro instructions.

\begin{verbatim}
[IF AGE<21][MINOR][QUIT]
[MAJOR]
\end{verbatim}
Creating a Subroutine Stack

If 1-2-3 encounters a subroutine call while executing a subroutine, it immediately performs the second subroutine before completing the rest of the instruction in the first subroutine. Putting subroutine calls within other subroutines is called nesting subroutines, or creating a subroutine stack. The number of subroutines you can store in a stack is limited to 32. To clear a subroutine stack, use \{RESTART\}.

In general, avoid using a \{BRANCH\} command to leave a subroutine. Using it can cause stack nesting problems and result in an error.

\{?\}

\{?\} suspends macro execution to let you move the cell or menu pointer, complete part of a command, or enter data for the macro to process. When you press \{ENTER\} the macro continues.

Note

Pressing \{ENTER\} to end the \{?\} command only tells 1-2-3 to continue the macro. To have 1-2-3 enter what you typed while macro execution was suspended, follow the \{?\} command with a \{LINE\}.

Examples. The following macro selects /Range Format Currency 2 decimal places and then pauses to let you specify the range in format. When you press \{ENTER\}, 1-2-3 formats the specified range in Currency, 2 decimal places.

\{?\}/R#:F/C:2}~

The following macro moves the cell pointer to cell ERR_MSG, which contains an error message, and pauses so you can read the message. When you press \{ENTER\} the macro continues.

\{GOTO\}ERR_MSG~

15-24 Macros
BEEP

(BEEP [tone-number]) sounds your computer’s bell. Use (BEEP) to signal the end of a macro or waking period within a macro (see (WATT)), to alert a user to an on-screen message, or to signal the beginning of an interactive command.

The optional tone-number argument (1, 2, 3, or 4) specifies the tone of the bell. If you use a number other than 1, 2, 3, or 4 for tone-number, 1-2-3 interprets the number module 4 (divides it by 4 and uses the remainder). For example, (BEEP 7) is equivalent to (BEEP 3). (BEEP) without an argument is equivalent to (BEEP 1).

Example. The following macro sounds your computer’s bell twice, using two different tones, to draw your attention to the subsequent interactive command.

(BEEP (BEEP 4)

BLANK

(BLANK location) clears the contents of location. Location can be a cell or a range. (BLANK) does not change the cell format of the cells in location.

Example. This macro clears the current cell and then resets the cell to the worksheet’s global cell format:

(BLANK @CELLREF("address"))

BordersOff and BordersOn

(BORDERSOFF) suppresses display of the worksheet frame (column letter and row numbers). The worksheet frame remains hidden until 1-2-3 reaches a (BORDERSON) command or the macro ends. When the macro ends, the borders return to their default state of being displayed. (BORDERSOFF) and (BORDERSON) are identical in functionality to (FRAMOFF) and (FRAMON).
Note: If a [WINDOWSOFF] command was executed earlier in the macro, be sure to precede [BORDERSOFF] or [BORDERSON] with a [WINDOWSON] command. The effects of [BORDERSOFF] or [BORDERSON] will not be visible until you run screen redraw/hang on.

Example. The following macro turns off display of the worksheet frame during a [?] command so the column letters and row numbers do not distract the user, and then redisplays the worksheet frame.

```
[BORDERSOFF]
[
[BORDERSON]
```

[BRANCH]

[BRANCH location] transfers macro control from the current macro cell to location for further macro instructions. Use [BRANCH] in conjunction with [IF] to implement "if-then-else" processing—that is, to have a macro do different things depending on the current data. You can also use [BRANCH] to create an infinite loop (a series of macro instructions that repeats indefinitely, which only [CTRL][BREAK] can interrupt).

[BRANCH] produces different results from [SUBROUTINE]. [SUBROUTINE] executes the specified subroutine and then returns control to the original macro instructions. [BRANCH], on the other hand, transfers macro control to the new location permanently. Control does not return to the original macro instructions when 1-2-3 completes the instructions in the branch location.

Examples. This macro transfers macro control to location TALL or SHORT, depending on whether the value in cell HE1CF1 is greater than 196:

```
[IF HEIGHT>196][BRANCH TALL]
[BRANCH SHORT]
```

The following macro (named \A) creates an infinite loop for data entry. It enters the data you supply during the [?] command in subsequent cells down a column until you press [CTRL][BREAK] to end the macro.
{BREAK}

{BREAK} produces the effect of pressing {CTRL} {BREAK} so you can return 1-2-3 to READY mode. {BREAK} simulates pressing {ESC} one or more times; it will not interrupt a macro.

{BREAKOFF} and {BREAKON}

{BREAKOFF} disables {CTRL} {BREAK} while a macro is running. Normally, you can stop a macro at any time by pressing {CTRL} {BREAK}. While {BREAKOFF} is in effect, however, you cannot use {CTRL} {BREAK} to stop the macro.

{BREAKON} restores use of {CTRL} {BREAK} while a macro is running, undoing a {BREAKOFF} command.

You can use {BREAKOFF} to prevent users from stopping a macro to alter data or look at restricted data. {BREAKOFF} stays in effect until canceled with {BREAKON} or until the macro ends.

Caution

Add {BREAKOFF} commands to a macro only after you have thoroughly tested the macro. If {BREAKOFF} is in effect and the macro goes into an infinite loop, the only way to stop the macro is to restart your HP 95LX (press {CTRL} {ALT} {DEL}).

Example. In the following excerpt from a macro, we name subroutine PAYROLL INPUT extracts payroll information to a master file. The macro disables {CTRL} {BREAK} before starting the PAYROLL INPUT subroutine to make sure information is copied without any interruption. When the PAYROLL INPUT subroutine ends, it restores use of {CTRL} {BREAK}.

{BREAKOFF}
{PAYROLL INPUT}
{BREAKON}
[CLOSE] closes the open text file, if one is open. After executing a [CLOSE] command, 1-2-3 goes directly to the next cell in the macro. Any macro instructions that follow the [CLOSE] command in the same cell are never executed, so you should keep [CLOSE] on a separate line.

If a text file is already open when 1-2-3 executes an [OPEN] command, 1-2-3 automatically closes the currently open file before opening the new one—you don’t need a [CLOSE] command before the [OPEN] command. 1-2-3 does not, however, automatically close a text file that is open when a macro ends. To close the last-opened text file in a macro, you must use a [CLOSE] command.

Example. The following macro opens a text file named SCHEDULE.PRN with append access, adds a line to the file reporting the supervisor for a particular shift, and closes the file. (Without the [CLOSE] command, SCHEDULE.PRN would remain open at the end of the macro, so in a subsequent macro you could continue processing SCHEDULE.PRN without using an [OPEN] command.)

(OPEN SCHEDULE.PRN.A)
(WRITELN:"Shift:" & SHIFT & "Supervisor:" & SUPERVISOR)
(CLOSE)
(QUIT)

[CONTENTS]

[CONTENTS target-location,source-location [width],[cell-format]] - copy the contents of source-location to target-location as a label. Use [CONTENTS] to store a numeric value as a string so you can use it in a string formula.

For both source-location and target-location, you can specify either a cell or a range. If you specify a range, 1-2-3 uses the first cell of the range.

If you include the optional width argument, 1-2-3 creates a label of the specified width. If you include the optional cell-format argument, 1-2-3 creates a label whose contents look like a numeric cell in the specified format. The target-location does not have its format changed.

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Width can be a number, numeric formula, or reference to a cell that contains a number; or numeric formula whose value is from 1 to 240.

**Cell-format** must be one of the code numbers from the following list, a formula that evaluates to a code number, or a reference to a cell that contains a code number. For a description of each cell format, see "Range Format in chapter 1" or "Worksheet Global Format in chapter 13."

<table>
<thead>
<tr>
<th>Code Number</th>
<th>Corresponding Cell Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 15</td>
<td>Fixed, 6 to 15 decimal places</td>
</tr>
<tr>
<td>16 to 31</td>
<td>Scientific, 0 to 15 decimal places</td>
</tr>
<tr>
<td>32 to 47</td>
<td>Currency, 0 to 15 decimal places</td>
</tr>
<tr>
<td>48 to 63</td>
<td>Percent, 0 to 15 decimal places</td>
</tr>
<tr>
<td>64 to 79</td>
<td>Comma, 0 to 15 decimal places</td>
</tr>
<tr>
<td>112</td>
<td>+ / -</td>
</tr>
<tr>
<td>113</td>
<td>General</td>
</tr>
<tr>
<td>114</td>
<td>D1 (DD-MMM-YY)</td>
</tr>
<tr>
<td>115</td>
<td>D2 (DD-MMM)</td>
</tr>
<tr>
<td>116</td>
<td>D3 (MMM-YY)</td>
</tr>
<tr>
<td>117</td>
<td>Text</td>
</tr>
<tr>
<td>118</td>
<td>Hidden</td>
</tr>
<tr>
<td>119</td>
<td>D6 (HH:MM:SS AM/PM)</td>
</tr>
<tr>
<td>120</td>
<td>D7 (HH:mm AM/PM)</td>
</tr>
<tr>
<td>121</td>
<td>D4 (Long Int/r)</td>
</tr>
<tr>
<td>122</td>
<td>D5 (Short Int/r)</td>
</tr>
<tr>
<td>123</td>
<td>D8 (Long Int/r)</td>
</tr>
<tr>
<td>124</td>
<td>D9 (Short Int/r)</td>
</tr>
<tr>
<td>127</td>
<td>Worksheet’s global cell format (specified with /Worksheet Global Format)</td>
</tr>
</tbody>
</table>

You must include a *width argument* to use the **cell format** argument. If you do not include the *width* and **cell format** arguments, the label 1-2-3 creates in target-location has the same width and format as that in source-location.

**Examples.** In the examples that follow, assume cell INCOME contains the formula =GROSS-EXP, which evaluates to 167.24. Cell INCOME is formatted as Currency, 2 decimal places, and its column width is 5. In the explanations of the examples, each * (bullet) represents one space.
The following macro enters the six-character label $167.24$ in cell REPORT, then creates the sentence Today we earned $167.24$ and enters it in the current cell.

(CONTENTS REPORT.INCOME)  
+ "Today we earned" & REPORT +

The following macro enters the label $\text{GROSS-EXP}$ in REPORT (because 111 formats the cell as Text), then creates the sentence The formula for earnings is $111 \cdot \text{GROSS-EXP}$ and enters it in the current cell.

(CONTENTS REPORT.INCOME.1111)  
+ "The formula for earnings is" & REPORT +

**DEFINE**

(DEFINE location1, location2, \ldots, locationm) stores arguments passed to a subroutine in a (subroutine) command so those arguments can be used later in the subroutine. You must include a (DEFINE) command in any subroutine to which you pass arguments, and the (DEFINE) command must come before the point in the subroutine where the arguments are used.

Each location argument in a (DEFINE) command specifies the storage location for one argument in a (subroutine) command. Therefore, the (DEFINE) command must have the same number of arguments as the (subroutine) command. Otherwise, when 1-2-3 reaches the (DEFINE) command, the macro terminates with an error.

**Declaring Argument Types**

You can add one of two suffixes—string or :value (or an abbreviation of string or value, as long as the first letter is a s or v, respectively)—to each location argument in a (DEFINE) command. The suffix tells 1-2-3 how to process the corresponding argument in the (subroutine) command. Omitting the suffix is equivalent to specifying string.

The :string suffix tells 1-2-3 to store the argument as a left-aligned label, even if the argument looks like a number, formula, or cell or range reference.

The :value suffix tells 1-2-3 to evaluate the argument before storing it. If the argument is a number, 1-2-3 stores it as a number. If the argument is a formula, 1-2-3 evaluates the formula and stores the

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result either as a left-aligned label (for a string formula) or a number (for a numeric formula). If the argument is a cell address or range name, 1-2-3 evaluates the contents of the referenced cell and stores the result as a label or number.

When you use suffixes with {DEFINE}, 1-2-3 treats the suffix as an additional argument. This means that you can have a maximum of 15 arguments (rather than the usual 11) passed by a subroutine.

Examples (In these examples, each • (bullet) represents one space.)

In the following extract from a macro, the {subroutine} command in macro \A passes three arguments to SUBRI. The {DEFINE} command at the beginning of SUBRI evaluates all three arguments before storing them. Thus, it stores the value of the first argument, today's date, as a number in cell ONE; the value of the second argument, the string Closing Price, as a label in cell TWO; and the value of the third argument, the contents of cell CLOSING (presumably, the closing stock price), as a number in cell THREE.

The macro then formats the current cell as Date 2 and stores is that cell the number stored in cell ONE; moves right one cell and stores is that cell the label stored in cell TWO; and again moves right one cell, formats the cell as Currency 2 decimal places, and stores in the cell the number stored in cell THREE. The result of this macro might therefore be: 09-Mar Closing Price: $123.35.

\A
{SUBRI $NOW, +"Closing"& Price"," CLOSING"

SUBRI
{DEFINE ONE:V:, TWO:Y, THREE:V}
/let2- (LET &CELLPOINTER("address") ->ONE)[R]
[LET &CELLPOINTER("address") ->TWO][R]
/rfc2- (LET &CELLPOINTER("address") ->THREE)

In the next example, the {subroutine} command in macro \A passes three arguments to SUBRI. The {DEFINE} command at the beginning of SUBRI stores the label +"Closing"& Price" in cell TWO, and the label CLOSING in cell THREE. The {LET} commands then enter those labels in three consecutive cells. The result of this macro is therefore: $NOW +"Closing"& Price:" CLOSING.
[SUBR1 @NOW,+ "Closing" & wPrice:, CLOSING]

SUBR1 [DEFINE ONE, TWO, THREE]
[LET &CELLPOINTER("address"), ONE] [R]
[LET &CELLPOINTER("address"), TWO] [R]
[LET &CELLPOINTER("address"), THREE]

(DISPATCH)
(DISPATCH location) performs an indirect branch by transferring
macro control to the cell whose name or address is entered in location.
Use [DISPATCH] to have 1-2-3 branch to one of several possible
macro routines, depending on the contents of location when 1-2-3
executes the [DISPATCH] command. Location must be a single cell.

Example: The following excerpt from a macro includes a series of IF
commands that determine which range name (YOU_OWE, 1_OWE, or
NEITHER_OWES) 1-2-3 enters in cell SWITCH. When 1-2-3 gets to
the [DISPATCH] command, it transfers macro control to the routine
whose range name is in SWITCH.

{LET SWITCH, "NEITHER_OWES"}
{IF YOURS>MIN} (LET SWITCH, "YOU_OWE")
{IF YOURS<MIN} (LET SWITCH, "LOWE")
(DISPATCH SWITCH)

(FI LiE S I Z E )
(FI LiE S I Z E location) enters a number in location. This number
reports the number of bytes in the open text file. You must open a
text file with [OPEN] before using [FILESIZE].

If 1-2-3 succeeds in executing a [FILESIZE] command, it goes directly
to the next cell in the macro, skipping any further instructions in the
same cell as the [FILESIZE] command. If 1-2-3 cannot report on the
number of bytes because a file is not open, it continues to the next
macro instruction in the same cell as [FILESIZE].

Example: In the following macro, if a text file is open, 1-2-3 enters
in cell BYTES the number of bytes in the text file and then, with
the [READ] command, copies the contents of the text file into cell
FILECONTEXTS. If a text file is not open, 1-2-3 branches to cell NO_OPEN_FILE for further instructions. (Note that (SETPOS 0) resets the file position to the first byte in the file.)

{FSIZEBYTES} {BRANCH NO_OPEN_FILE}  
{SETPOS 0}  
{READ BYTES FILECONTEXTS}  

{FOR}  
{FOR counter,start-number,step-number,stop-number,subroutine} creates a for loop—it repeatedly performs a subroutine call to subroutine. The start, step, and stop numbers determine the total number of repetitions, and counter keeps a running count of the repetitions. You can precede both counter and subroutine with a + (plus) to indicate they contain an address of another cell.

When 1-2-3 encounters a {FOR} command, it does the following:
1. Enters start-number in counter (counter is a cell in the worksheet).
2. Compares the number in counter with stop-number. If the number in counter is less than or equal to stop-number, 1-2-3 performs a subroutine call to subroutine and goes to step 3. If the number in counter is greater than stop-number, 1-2-3 does not perform a subroutine call to subroutine. Instead, 1-2-3 returns to the location of the {FOR} command and continues the macro at the instruction following {FOE}.
3. Increases the number in counter by step-number and returns to step 2.

Examples: This macro repeats subroutine FORMAT 10 times, keeping track of the repetitions in a cell named REP_NUM:

{FOR REP_NUM,1,10,1,FORMAT}  
This macro repeats subroutine FORMAT four times:

{FOR REP_NUM,2,9,5,FORMAT}
(FORBREAK)

{FORBREAK} ends a for loop created by a {FOR} command. Macro execution continues at the instruction immediately following the {FOR} command. The {FORBREAK} only within a for loop or the macro will terminate with an error.

Example. In the following example, the {FOR} command is macro A names 1-2-3 to repeat subroutine ENTRY up to 10 times, to let you enter names in a roster. If you press ENTER at the {GETLABEL} command instead of typing a name, the {FORBREAK} command terminates the for loop and 1-2-3 continues immediately to the instructions following the {FOR} command. (In the example, each • (bullet) represents one space.)

\A
{BLANK ROSTER}
{GOTO}ROSTER--
{FOR 1..10,1,ENTRY}
:
ENTRY {GETLABEL,"Enter names",@CELLPOINTER("address")}
{DF @CELLPOINTER("content")=""}{FORBREAK}
{DOWN;}

{FRAMEOFF} and {FRAMEON}

{FRAMEOFF} and {FRAMEON} are identical to {BORDERSOFF} and {BORDERON}. Refer to those descriptions for information.

{GET}

{GET location} suspends macro execution until you press a key, then records your keystroke as a left-aligned label in location. You can press any typewriter key or any of the keys listed in the table in "Entering a Macro" earlier in this chapter, except for (EXEC BREAK).

Example. The following macro checks to see if it's after 6:00 PM when you press (EXEC BREAK) because you don't want to miss dinner for a long recalculation of the worksheet.

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(GETLABEL prompt,location)

GETLABEL displays prompt in the control panel and suspends macro execution while you type a response. When you press ENTER, 1-2-3 stores whatever you typed as a left-aligned label in location and continues the macro.

You can use any literal string, with as many characters as fit within the control panel edit line, as prompt. Prompt can also be the range name or address of a cell that contains the prompt string, or a string formula that evaluates to the prompt string.

The response to the prompt can include up to 240 characters. If you press CLEAR without typing anything, 1-2-3 enters an ' (apostrophe) label prefix in location. If you enter a numeric value, it's converted to a label in location.

Example. The following macro prompts you for your first name, enters it in cell FIRST, then prompts you for your last name and enters it in cell LAST. (In the example, each * (bullet) represents one space.)

-GETLABEL "Type your first name:* FIRST"
-GETLABEL "Now type your last name:* LAST"

(GETNUMBER prompt,location)

GETNUMBER displays prompt in the control panel and suspends macro execution while you type a response. When you press ENTER, 1-2-3 evaluates your response, stores the resulting number in location, and continues the macro.

You can use any literal string, with as many characters as fit on the control panel edit line, as prompt. Prompt can also be the range name or address of a cell that contains the prompt string, or a string formula that evaluates to the prompt string.

The response to the prompt must be a number, a numeric formula, or a reference to a cell containing a number or numeric formula. The
response can include up to 200 characters. If you enter a label, string formula, or reference to a cell containing a label or string formula as the response, 1-2-3 enters ERR in location. 1-2-3 also enters ERR if you press [ENTER] without typing anything.

Example. This macro prompts you for your age, then enters your response in the current cell. (In the example, each * (bullet) represents one space.)

{GETNUMBER "Age: *" @CELLPOINTER("address");}

**GETPOS**

{GETPOS location} enters a number in location. This number reports the current byte position position (the position at which data is read from or written to) in the open text file. You must open a text file with [OPEN] before using [GETPOS].

If 1-2-3 succeeds in executing the [GETPOS] command, it continues to the next cell in the macro. If no file is open, 1-2-3 ignores a [GETPOS] command and continues to the next macro instruction in the same cell as [GETPOS].

**Note**

The first position in a text file is reported as 0, not 1. Thus, if the byte pointer is on the first byte in the file, [GETPOS] enters 0 in location; if the byte pointer is on the tenth byte, [GETPOS] enters 9, and so on.

Example. The following excerpt from a macro accepts the current position of the byte pointer in cell POINTER, if a text file is open, and goes immediately to the next cell for further instructions. If a text file is not open, the macro branches to location NO.GO.

{GETPOS POINTER}[BRANCH NO.GO]
(GRAPHOFF) and (GRAPHON)

(GRAPHON [named-graph],[redisplay]) has three possible results, depending on the syntax you use:

- (GRAPHON) with no arguments displays a full-screen view of the current graph while the macro continues to run. When 1-2-3 reaches a (GRAPHOFF) command, another (GRAPHON) command, an [INDICATE] or ['?] command, a command that displays a prompt or menu in the control panel ([GETLABEL], [GETNUMBER], [MENICALL], [MENUBRANCH]), or the end of the macro, 1-2-3 removes the graph from the screen.

- (GRAPHON named-graph) makes the named-graph settings the current graph settings and displays a full-screen view of named-graph while the macro continues to run. When 1-2-3 reaches any of the conditions listed above, the named-graph is removed from the screen.

- (GRAPHON named-graph,redisplay) makes the named-graph settings the current graph settings without displaying the graph.

[GRAPHOFF] removes a graph displayed by a (GRAPHON) command and redispays the worksheet.

Examples. The following excerpt from a macro erases cell KEY in preparation for the [LOOK] [IF] sequence, then displays the current graph. 1-2-3 waits one second and then performs the [LOOK] [IF] sequence to determine whether the user pressed a key (as a signal to remove the graph from the screen). If the user did not press a key, 1-2-3 waits another second and then repeats the [LOOK] [IF] sequence. If the user pressed a key, 1-2-3 removes the graph and continues the macro. (The [GET KEY] statement removes the key from the keyboard buffer.)

```
\A
[BLANK KEY]
[GRAPHON]
LOOP
  [WAIT $NOW+$TIME(5.0,1)]
  [LOOK KEY]
  [IF KEY=""](BRANCH LOOP)
  [GET KEY]
  [GRAPHOFF]
```

Macros 15-37
This macro displays three consecutive graphs (LINE, BAR, and PIE) at 2-second intervals and then re-displays the worksheet:

\begin{verbatim}
(GRAPHON LINE)
(WAIT $NOW+$TIME(0,0,2))
(GRAPHON BAR)
(WAIT $NOW+$TIME(0,0,2))
(GRAPHON PIE)
(WAIT $NOW+$TIME(0,0,2))
(GRAPHOFF)
\end{verbatim}

\begin{itemize}
\item \textbf{IF} \textit{condition} evaluates \textit{condition} as \textit{true} or \textit{false}. If \textit{condition} is true, 1-2-3 continues to the macro instruction immediately following the \{IF\} command in the same cell. If \textit{condition} is false, 1-2-3 goes immediately to the next cell in the column, skipping any further instructions in the same cell as the \{IF\} command.
\end{itemize}

Typically, \textit{condition} is a logical formula or a reference to a cell that contains a logical formula. However, you can use any formula, number, literal string, or cell reference as \textit{condition}. 1-2-3 evaluates any \textit{condition} that does not equal zero as \textbf{true} and any \textit{condition} that does equal zero as \textbf{false}. Blank cells, strings, and ERR and NA values all equal zero when used as \textit{condition}.

\begin{itemize}
\item \textbf{Note} If you use \{IF\} to implement \textbf{if-then-else} processing in a macro, be sure to include a \{BRANCH\} or \{QUIT\} command at the end of the \textbf{"then\} instructions (the instructions that follow the \{IF\} command in the same cell). This keeps 1-2-3 from continuing to the \textbf{"else\} instructions (the instructions that start in the cell below the \{IF\} command).
\end{itemize}

\begin{itemize}
\item \textbf{Example}. In the following macro, if cell TESTVAL evaluates to \textbf{true} (not zero), the macro executes subroutine \{RTN1\} and subroutine \{RTN2\}. Otherwise, the macro executes only subroutine \{RTN2\}.
\begin{verbatim}
{[IF TESTVAL=\textbf{1}](RTN1)}
{[RTN2]}
\end{verbatim}
\end{itemize}
(INDICATE) displays string as the mode indicator. The indicator continues to display string until 1-2-3 reaches another (INDICATE) command or until you retrieve another file, select /Worksheet Erase You, or end the 1-2-3 session.

For string you can use any literal string, with as many characters as fit within the first line of the control panel. You can also use a reference to a cell that contains the indicator string, or a string formula that evaluates to the indicator string. Using an empty string as string ([INDICATE ""] removes the mode indicator from the control panel entirely.

(INDICATE) with no argument restores standard operation of the mode indicator in the control panel. The indicator displays READY, EDIT, WAIT, LABEL, VALUE, and so on, depending on the current operation.

Examples. This macro displays 1 in the mode indicator, whose width shrinks to one character:

(INDICATE "1")

This macro displays the contents of cell MSG in the mode indicator:

(INDICATE MSG )

(LET)

(LET location, entry) enters a number or left-aligned label in location.

You can specify a cell or a range as location. If you specify a range, 1-2-3 enters the number or label in the first cell of the range. You can also precede location with a + (plus) to indicate it contains the address of a cell where you want to store the entry. Entry can be a number, literal string, formula, or reference to a cell that contains a number, label, or formula. If you use a formula for entry, 1-2-3 evaluates the formula and enters the result in location. (LET) does not evaluate formulas.

Examples. In the following examples, each * (bullet) represents one space.
This macro, if cell QTR.1 exists, enters the result of 1.5 times the value of cell QTR.1 in cell QTR.2. Otherwise it enters 1.5*QTR.1 as a label in cell QTR.2.

\{LET QTR.2,1.5*QTR.1\}

The following macro, if cell NAME exists, enters the result of the string formula +"Mr."&NAME in cell CUSTOMER. If cell NAME does not exist, it enters +"Mr."&NAME as a label in cell CUSTOMER.

\{LET CUSTOMER,"Mr."&NAME\}

You can add a string or value-suffix to entry to cell 1-2-3 explicitly, whether to treat the argument as a literal string (enter the argument verbatim) or evaluate the argument before entering it.

The following macro, if cell NAME exists, enters the result of the string formula +"Mrs."&NAME in cell CUSTOMER. If cell NAME does not exist, the macro terminates with an error message.

\{LET CUSTOMER,"Mrs."&NAME\}

\{LOOK\}

\{LOOK location\} checks the keyboard buffer for keystrokes, and records the first keystroke (if any) in location as a left-aligned label. If the buffer is empty, 1-2-3 enters an apostrophe label prefix in location.

The keyboard buffer is the place 1-2-3 stores keystrokes you make during noninteractive parts of a macro. It contains all the keystrokes you made since the last interactive command (if there was one) or since the macro began. 1-2-3 uses the contents of the keyboard buffer in the next \{GET\}, \{GETLABEL\}, or \{GETNUMBER\} command.

Example. The following macro clears the current contents of cell IN. CLEAR in preparation for the \{LOOK\} command. It then displays an instruction in the status panel for 2 seconds and gives you 5 seconds to start typing after it clears the instruction. During those 5 seconds, 1-2-3 constantly checks the keyboard buffer to see if you typed anything. If you did, 1-2-3 goes on to the macro instructions that start at cell NEXT.STEP. If you did not type anything within 5 seconds, 1-2-3 begins, assigns you for your slowness, and ends the macro.

15-40 MACRO
(BLANK IN.CHAR)

Enter your name when this message clears

WAIT @NOW+@TIME(0.024)\(ESC\)

LET ENDTIME(@NOW+@TIME(0.05))

LOOK IN.CHAR

[IF IN.CHAR(>"\"){BRANCH NEXT_STEP}

[IF @NOW<ENDTIME) {BRANCH LOOP}

[KEEP] You're too slow! [GET IN.CHAR] [ESC] [QUIT]

[MENUBRANCH] and [MENUCALL]

[MENUBRANCH location] displays in the control panel the menu

menu that starts in the first cell of location, waits for you to select an

item from the menu, and then branches to the macro instructions

associated with the menu item you select.

[MENUKALL location] displays in the control panel the macro

menu found at location. After you select an item from the menu,

1-2-3 performs the associated macro instructions as a subroutine.

When 1-2-3 completes the instructions, macro control returns to the

statement in the original macro that follows [MENUKALL].

A macro menu is a menu you set up for use during a macro. Macro

menus work just like 1-2-3 menus—when the menu is activated, the

menu items appear in the second line of the control panel and the

description of the highlighted menu item appears in the third line

of the control panel. You select a menu item either by moving the

menu pointer to the item and pressing [ENTER] or by pressing the

first character of the item's name. A macro menu can include up to

eight items. The following figure shows a macro menu in a range

named FILE CHOICE (the macro menu is part of macro VM) and the

control panel when the menu is activated with the command

[MENUBRANCH FILE CHOICE] (in macro VM).
Creating a Macro Menu

1. Decide on a location for the macro menu.
2. Enter up to eight menu items in consecutive cells in the first row of the menu location. Leave the cell after the final menu item blank.

Follow these guidelines when entering menu items:
- You can enter labels or string formulas as the menu items. If you enter a formula, 1-2-3 displays the resulting label as the menu item.
- You can have up to eight menu items.
- Make sure each menu item starts with a different letter or number so you can select an item by pressing the first character. If two or more menu items have the same first character, 1-2-3 selects the first item (reading from left to right) when you press that character.

Note

If menu items are greater than the screen width (including the space between each menu), they will wrap to the third line of the control panel, and no long prompts will display.
Try to make each menu item a single word. If you use multiple word items, connect the words with a -- (hyphen), for example, First-Quarter. Otherwise, a user might think the words are separate menu items.

The combined menu items and delimiting spaces are restricted to the screen width. If you exceed the width of the screen, an error will occur.

3. Enter the description for each menu item in the cell directly below the menu item. You can enter labels or string formulas as menu item descriptions. The description of each menu item cannot exceed the width of the screen, or an error will occur.

4. Immediately below the menu item descriptions (that is, starting in the third row of the menu menu range) enter the macro instructions that 1-2-3 performs if you select that menu item. Or, enter a {BRANCH} or {subroutine} command that directs 1-2-3 to a set of macro instructions.

5. Use /Range Name Create to assign a range name to the first menu item in your macro menu.

After you select an item from a macro menu that {MENU BRANCH} activated, macro control branches to the associated macro instructions in the third row of the macro menu. Because this is a branch, macro control does not return to the original macro location when 1-2-3 completes the macro menu instructions.

After you select an item from a macro menu that {MENU CALL} activated, 1-2-3 performs the associated macro instructions as a subroutine; when 1-2-3 completes the instructions, macro control returns to the statement in the original macro that follows {MENU CALL}.
Note

Pressing \texttt{ESC} when a macro menu appears in the control panel cancels the \texttt{[MENUBRANCH]} or \texttt{[MENUCALL]} command that activated the menu. Macro control returns to the location from which \texttt{[MENUBRANCH]} or \texttt{[MENUCALL]} command was issued, and the macro continues at the instruction that follows the \texttt{[MENUBRANCH]} or \texttt{[MENUCALL]} command. Once you choose a menu item, you must either complete the macro or press \texttt{CRTL+BREAK} to exit the macro.

Examples. The following macro displays the macro menu that starts in cell \texttt{MACROMENU}. When you select one of the menu items, 1-2-3 branches to the macro instructions associated with that item. 1-2-3 performs the \texttt{(BEEP)} command only if you press \texttt{ESC} instead of selecting a menu item.

\begin{verbatim}
[MENUBRANCH MACROMENU]
(BEEP)
\end{verbatim}

The following macro displays the macro menu that starts in cell \texttt{MACROMENU}. When you select one of the menu items, 1-2-3 performs a subroutine call to the macro instructions associated with that menu item. When it completes those instructions, 1-2-3 saves the revised file, and then the macro ends. If you press \texttt{ESC} instead of selecting a menu item, 1-2-3 saves the file and the macro ends.

\begin{verbatim}
[MENUCALL MACROMENU]
/B&-7
\end{verbatim}

\textbf{(ONERROR)}

\begin{verbatim}
[ONERROR branch-location [message-location]] traps and handles errors that occur while a macro is running.
\end{verbatim}

\textbf{Note}

\begin{verbatim}
[ONERROR] does not trap macro syntax errors (typing errors in macro instructions that prevent 1-2-3 from interpreting the instructions). When 1-2-3 encounters a syntax error, it ends the macro and displays an error message that describes the error.
\end{verbatim}

15-44 Macros
Normally, if an error occurs while a macro is running, 1-2-3 displays an error message, changes the mode indicator to ERROR, and exits the macro. However, if an [ONERROR] command is in effect when the error occurs, 1-2-3 returns to READY mode and branches to branch-location for further macro instructions instead of ending the macro. If you include the optional message-location argument, 1-2-3 records the error message (in most cases, excluding the press HELP (H) portion of the message) in message-location.

An [ONERROR] command remains in effect until (1) an error occurs (each [ONERROR] command can handle only one error), (2) it is superseded by a subsequent [ONERROR] command, or (3) the macro ends. Use [ONERROR] at any point in which there is a possibility of an error.

In addition, [ONERROR] means the subroutine stack. If the error occurs in a subroutine, 1-2-3 does not return to the location from which the subroutine call was issued after completing the instructions at the [ONERROR] branch-location.

**Note**

Pressing **CTRL**-[BREAK] causes a 1-2-3 error. Therefore, if you press **CTRL**-[BREAK] while an [ONERROR] command is in effect, the command will trap that error rather than the one you want it to trap. You may want to disable **CTRL**-[BREAK] with [BREAKOFF] if you are using [ONERROR] to trap a specific error.

Example: In the following example, macro \A prompts you for a file name and enters the name in cell FNAM. It then attempts to retrieve the file whose name you specified (using a subroutine call to cell FNAM). If an error occurs during file retrieval, 1-2-3 enters the associated error message in cell ERREMSG and branches to location FILEERR, which contains a routine that causes 1-2-3 to beep, display the contents of ERRMSG, and let you attempt to retrieve another file. (In this example, the • (bullet) represents one space.)
(OPEN)  

(OPEN file-name,access-type) opens a text file for read-only processing, write-only processing, or for read-and write processing, depending on the type of access you specify. You must open a file with \{OPEN\} before you can use any of the other file-manipulation commands.

Only one text file can be open at a time. If a text file is open when 1-2-3 performs an \{OPEN\} command, 1-2-3 automatically closes that text file before opening the new one.

If 1-2-3 succeeds in opening the specified file, it goes directly to the next cell in the macro, skipping any further instructions in the same cell as the \{OPEN\} command. If 1-2-3 does not succeed in opening the file (that is, the \{OPEN\} command fails), it continues to the next macro instruction in the same cell as \{OPEN\}.

File-name is the full name (including the extension) of a text file. File-name can also be the range name or cell address containing the full file name. Unless the text file is in the current directory, you must specify the path as part of file-name and enclose the argument in quotation marks. All of the following are examples of valid file-name specifications:

\{PASTDUE.PRN\}  
"A\:PASTDUE.PRN"  
"\:\ACCOUNTS\PASTDUE.PRN"  
"\:\BUSINESS\ACCOUNTS\PASTDUE.PRN"
Access-type is one of the four characters R, W, M, or A (in uppercase or lowercase letters), or a range name or cell address that contains one of those characters. The character specifies the type of access you have to the file once it is opened:

- **R** (read access) opens an existing file for reading only, placing the byte pointer at the beginning of the file. You can use [READ], [READLN], [GETPOS], and [SETPOS] but not [WRITE] and [WRITELN] with a file opened with read access.
- **W** (write access) opens a new file for reading and writing. You can use [READ], [READLN], [GETPOS], [SETPOS], [WRITE], and [WRITELN] with a file opened with write access.

**Caution**

If you open an existing file with write access, 1-2-3 erases the current contents of the file when it opens the file. To open an existing file for writing and retain the existing file contents, use modify or
append access.

- **M** (modify access) opens an existing file for reading and writing, placing the byte pointer at the beginning of the file. You can use [READ], [READLN], [GETPOS], [SETPOS], [WRITE], and [WRITELN] with a file opened with modify access.
- **A** (append access) opens an existing file for reading and writing, placing the byte pointer at the end of the file. You can use [READ], [READLN], [GETPOS], [SETPOS], [WRITE], and [WRITELN] with a file opened with append access.

When opening a new file (a file that does not yet exist in the specified directory), you can use write access only. If you try to open a new file with read, modify, or append access, the [OPEN] command will fail.

If a text file is open when a macro ends, 1-2-3 does not automatically close the text file. You must include a [CLOSE] command in the macro to close the file.
Examples. In the following macro, if a file named PASTDUE.FRN exists in the current directory, 1-2-3 opens the file with read access, enters the first line of the file in cell FULLNAME, and closes the file. If a file named PASTDUE.FRN does not exist in the current directory, 1-2-3 branches to PLANB for further instructions.

```
{OPEN PASTDUE.FRN} (BRANCH PLANB)
{READ FULLNAME}
{CLOSE}
```

In the following macro, if a file named PASTDUE.FRN exists in the current directory, 1-2-3 opens the file, writes over the first five bytes in the file with the string Hello, and closes the file. If a file named PASTDUE.FRN does not exist in the current directory, 1-2-3 branches to PLANB for further instructions.

```
{OPEN PASTDUE.FRN.m} (BRANCH PLANB)
{WRITE "Hello"}
{CLOSE}
```

**[PANELOFF] and [PANELON]**

[PANELOFF] freezes the control panel and status line until 1-2-3 encounters a [PANELON] command or the macro ends. If you include the optional clear argument, 1-2-3 clears the control panel and status line before freezing them. Use [PANELOFF] in interactive macros to suppress activity in the control panel and status line that might be distracting to users. [PANELON] unfreezes the control panel and status line.

**Note**

- [PANELOFF] suppresses control panel activity that results only from keystroke instructions. The advanced macro commands that cause changes in the control panel—[MENUBRANCH], [MENUCALL], [GETLABEL], [GETNUMMEM], [WAIT], and [INDICATE]—override a [PANELOFF] condition.
Example. The following macro frames the control panel so you don’t see the prompts and means that normally appear during the /Range Erase command:

(PANSELFF)
/ndata.Range
(PANELON)

[PUT]

[PUT location, column-offset, row-offset, entry] enters a number or left-aligned label in a cell within location. [PUT] is a variant of (LET). In a [LET] command, you specify the target cell by its name or address. In a [PUT] command, you identify the target cell by its row-and-column position within a range.

Location can be a range of any size, as long as it contains the cell in which you are entering data.

Column-offset and row-offset are numbers that identify the column and row position of the data-entry cell within location. The first column and row of the range have the offset number 0, the second column and row have the offset number 1, the third column and row have the offset number 2, and so on. If the data-entry cell is in the third column and fifth row of location, for example, column-offset, row-offset is 2,4.

Entry can be a number, literal string, formula, or reference to a cell that contains a number, label, or formula. If entry is a string formula, precede it with a + (plus).

Examples. The following examples assume range COSTS occupies the range A1:D5 and that each * (bullet) represents one space.

This macro copies the contents of cell MONTH to cell C1. If cell MONTH contains a formula, 1-2-3 copies the current value of the formula to cell C1.

{PUT COSTS2,0.MONTH}^`

The following macro takes the contents of cell MONTH (a label for a month), adds the year 1991 to it, and copies it to cell C1.

{PUT COSTS2,0.+MONTH: M991}^`
{QUIT}

{QUIT} ends a macro immediately, returning keyboard control to the user. Any instructions that follow a {QUIT} command in a macro are never completed. Even if you use {QUIT} in a subroutine, the command ends the entire macro, not just the subroutine.

Example: In the following excerpt from a macro, if cell YEAR has the value 1999, the macro ends. Otherwise, 1-2-3 continues to the next cell for further macro instructions.

{IF \text{YEAR} = 1999} \{\text{QUIT}\}

{READ}

{READ \text{byte-count}\text{, location}} starts at the current byte pointer position in the open text file, copies the specified number of bytes (\text{byte-count}) to \text{location}, and advances the byte pointer \text{byte-count} bytes.

\text{byte-count} can be a number, numeric formula, or reference to a cell that contains a number or numeric formula whose value is from 1 to 240. If the value of \text{byte-count} is greater than the number of bytes remaining in the file, 1-2-3 copies all of the remaining bytes to \text{location}. Using a negative number or a number greater than 240 as \text{byte-count} is equivalent to using 240.

{READ} copies the carriage return and line feed at the end of text lines. If you don't want to copy the carriage return and line feed, use \{\text{READEN}\}.

You must open a text file with \{OPEN\} before you use {READ}.

If 1-2-3 encounters a null byte in the specified file, it goes directly to the next cell in the macro, skipping any further instructions in the same cell as the {READ} command. If the text file is not open, 1-2-3 ignores the {READ} command and continues to the next instruction in the same cell as the {READ} command.

Example: The following example assumes the open text file contains these two lines:

\begin{verbatim}
Total Sales
for the Year Ending 1995
\end{verbatim}

and that the byte pointer is at the T in Total (position 0).

15-50 Macros
The following macro enters the left-aligned label Total $S_9$ (the first eight bytes in the file) in cell CHAR5 and advances the byte pointer to the position right (the 1 in Sales).

\{READ 8,CHAR5\}

The following macro enters in cell CHARBS a 13-character left-aligned label that starts with the T in Total and ends with the e in for, and advances the byte pointer to the e in for. The twelfth and thirteenth characters in the label represent the carriage return and line feed at the end of the first line.

\{READ 15,CHARBS\}

\textbf{(READLN)}

\textbf{(READLN feature)} starts at the current byte pointer position in the open text file, copies the remainder of the current line to location, and advances the byte pointer to the beginning of the next line in the file.

With \{READLN\}, 1-2-3 does not copy the end-of-line sequence (carriage return and line feed) to the worksheet. To copy these to the worksheet, use \{READ\}.

You must open a text file with \{OPEN\} before you use \{READLN\}.

If 1-2-3 succeeds in reading the specified file, it goes directly to the next cell in the macro, skipping any further instructions in the same cell as the \{READLN\} command. If the text file is not open, 1-2-3 ignores the \{READLN\} command and continues to the next instruction in the same cell as the \{READLN\} command.

\textbf{Examples}. The following examples assume the open text file contains these two lines:

\texttt{Total Sales For the Year Ending 1990}

and that the byte pointer is on the S in Sales (position 6).

The following macro enters the left-aligned label Sales in cell FRIST and the left-aligned label for the Year Ending 1990 in cell SECOND.

\{READLN FRIST\}

\{READLN SECOND\}

\textbf{Macros} 15-51
The following macro writes the left-aligned label Sales in cell LINE, immediately writes over it with the left-aligned label for the Year Ending 1996, and enters 39 in cell POS (the current position of the byte pointer, which is the beginning of the next line of the file). The (BEEP) command in the second line of the macro is never executed because the (READLN) command succeeded and 1-2-3 skipped immediately to the next cell.

(READLN LINE)
(READLN LINE) (BEEP)
(GETPOS POS)

(RECALC) and (RECALCCOL)

(RECALC location,[condition],[iteration]) recalculates the values in location, proceeding row by row. Use (RECALC) to recalculate formulas located below and to the left of cells on which they depend.

(RECALCCOL location,[condition],[iteration]) recalculates the values in location, proceeding column by column. Use (RECALCCOL) to recalculate formulas located above and to the right of cells on which they depend.

The optional condition argument tells 1-2-3 to repeat the recalculation until condition is true. The optional iteration argument tells 1-2-3 to perform the specified number of recalculation passes. You need to include both optional arguments together—a 1-2-3 repeats the recalculation until condition is true or until it has performed the specified number of recalculation passes, whichever happens first.

Condition is typically a logical formula or reference to a cell containing a logical formula, but it can be any formula, number, literal string, or cell reference. 1-2-3 evaluates any condition that does not equal zero as true and any condition that equals zero as false. Blank cells, strings, and ERR and NA values all equal zero when used as condition. Iterations can be a number, numeric formula, or reference to a cell that contains a number or numeric formula. You cannot use the iteration argument without the condition argument.
When 1-2-3 recalculates a range with (RECALC) or (RECALCCOL), it does not update formulas outside the range. To ensure that all your formulas are up-to-date at the end of a macro that uses (RECALC) or (RECALCCOL), include a (CALC) instruction in the macro, change worksheet recalculation to Automatic, or pass CALC (FD) when the macro ends.

Examples. Assume the following macro changes a value in cell D4, and the formula in cell A8 depends on cell D4. Both of these cells are in a range named RANGE1. (Because recalculation proceeds row by row, 1-2-3 recalculates cell D4 before cell A8, and the result is accurate.)

(RECALC RANGE1)

The following macro continuously recalculates range PAYMENT, column by column, until the value in cell VAL falls below 150 or the number of recalculations passes equals 50.

(RECALCCOL PAYMENT, VAL<100,50)

(RESTART)

(RESTART) is used in subroutines to clear the subroutine stack. When 1-2-3 encounters a (RESTART) command, it continues to the end of the current subroutine, but instead of returning to the original macro location, after it completes the subroutine, the macro ends.

Example. In this example, the subroutine command (CKS) called the subroutine. In this accept from a macro, if cell CKST contains the label not ok or a string formula that evaluates to not ok, the macro ends after 1-2-3 completes the remainder of subroutine CKS. If cell CKST contains any other label, macro control returns to the location from which the subroutine call CKS was issued after 1-2-3 completes the remainder of the subroutine.
(RETURN) affects flow of control in subroutines. In a subroutine called by \texttt{SUBROUTINE} or \texttt{MENUCALL}, (RETURN) immediately returns macro control from the subroutine to the location from which the \texttt{SUBROUTINE} or \texttt{MENUCALL} command was issued. In a subroutine called by a \texttt{FOR} command, (RETURN) ends the current iteration of the subroutine and immediately starts the next iteration.

When used in the main body of macros, instructions other than in a subroutine, (RETURN) is equivalent to (QUIT); it ends the macro immediately.

\textbf{Note} \hspace{2cm} (RETURN) is optional in a subroutine. If a macro encounters a blank cell at the end of a subroutine, it interprets this as a (RETURN).

\textbf{Example:} In this example, the subroutine \texttt{SAVE} is called with the \texttt{SUBROUTINE} command. Subroutine \texttt{SAVE} prompts you to type a letter. If you type Y or N, 1-2-3 returns immediately to the location from which the subroutine call (SAVE) was issued. If you type Y or N, 1-2-3 saves the current version of the file and then returns to the location from which the subroutine call (SAVE) was issued. If you type any other character, 1-2-3 repeats subroutine \texttt{SAVE} from the beginning.

\begin{verbatim}
SAVE
  (GETLABEL "Do you want to save (Y/N)",INPUT)
  (IF INPUT="y") (RETURN)
  (IF INPUT="n") (RETURN)
  (BRC SAVE)
\end{verbatim}

\hspace{1cm} 15-54 Macros
(SETPOS)

(SETPOS offset-number) positions the byte pointer in the open text file offset-number bytes from the first byte in the file. After executing a (SETPOS) command, 1-2-3 goes directly to the next cell in the macro, skipping any further instructions in the same cell as the (SETPOS) command.

Offset-number can be a number, numeric formula, or reference to a cell that contains a number or numeric formula. The argument specifies the position of the byte pointer relative to the first byte in the file, which is at position 0. Using a negative offset-number is the same as using 0.

You must open a text file with (OPEN) before you use (SETPOS).

If 1-2-3 succeeds with the (SETPOS) command, it goes to the instructions in the next cell, skipping any further instructions in the same cell as (SETPOS). If no text file is open, however, 1-2-3 ignores the (SETPOS) command and continues to the next macro instruction in the same cell as (SETPOS).

Examples. For all of these examples, assume the open text file consists of the following sentence (created with a (WRITE) command): This is a report on the state of macros. The file is 40 bytes long.

This macro moves the byte pointer to the first r in This report:

(SETPOS 19)

This macro moves the byte pointer to the T in This:

(SETPOS 4)

This macro enters the value 40 in cell COUNT, then sets the byte pointer immediately after the period at the end of the sentence:

(FILESIZE COUNT)

(SETPOS COUNT)

The following macro enters the nine-character string “the state” in cell RECODED. If no text file was open, the macro would branch to location CLOSED.

(SETPOS 80) (BRANCH CLOSED)

(READ $RECORD)
(SYSTEM) command is not available in the HR 91.A version of Lotus 1-2-3. Macros that use the (SYSTEM) command will be incompatible.

(WAIT)

(WAIT time-number) suspends macro execution and displays WAIT as the mode indicator until the time specified by time-number. When the specified time arrives, 1-2-3 removes the WAIT indicator and continues the macro.

Time-number can be a number, numeric formula, or reference to a cell that contains a number or numeric formula. The number must represent a future moment in time. If the number represents a nonexistent time or a time that has already passed, 1-2-3 ignores the (WAIT) command and continues in the next macro instruction. In most cases you will use date and time functions to specify time-number. See the examples below.

During a (WAIT) command, only keystrokes 1-2-3 responds to in CTRL-BREAK. If you press CTRL-BREAK during a (WAIT) command, 1-2-3 immediately stops running the macro (unless you used (BREAKOFF) earlier in the macro to disable use of CTRL-BREAK).

(WAIT) overrides a (PAUSEOFF) command, but not an (INDICATE) command.

Note: 1-2-3 uses the system date and time settings to keep track of time. Be sure these settings are correct before you use (WAIT).

Examples. The following macro suspends macro execution for 10 seconds.

(WAIT @NOW+@TIME(0.0,10))

The following macro suspends macro execution for the amount of time specified by the @TIMEVALUE formula.

(WAIT @NOW+@TIMEVALUE(INTERVAL))
[WINDOWSOFF] and [WINDOWSON]

[WINDOWSOFF] freezes the worksheet area of the screen, including worksheet borders, during macro execution. It also suppresses the display of settings sheets if you previously used a [WINDOWSON] command to turn on settings sheets during macro execution. The area remains frozen until 1-2-3 encounters a [WINDOWSON] command or the macro ends. The [WINDOWSOFF] in noninteractive parts of a macro to suppress the flashing in the worksheet area and to speed up macro execution significantly.


By default, settings sheets do not appear while a macro is running. To display settings sheets in a macro, use [WINDOWSON]. If you’ve used [WINDOWSOFF] to turn off the display of the worksheet area, use [WINDOWSON] twice: once to redisplay the worksheet and the second time to redisplay settings sheets.

Unless you’ve used [WINDOWSOFF] to turn off the display of the worksheet area, you can also use [WINDOW] (which simulates WINDOW (F3)) to turn settings sheets on or off, but only while in MENU mode. If you have used [WINDOWSOFF], you must use [WINDOWSON] to redisplay the worksheet area before you can redisplay settings sheets.

[WINDOWSOFF] and [WINDOWSON] are often used in conjunction with [PANELOFF] and [PANELON]. [PANELOFF] freezes the control panel and status line, and [PANELON] unfreezes the control panel and status line.

Example: The following excerpt from a macro freezes the worksheet area of the screen during a noninteractive part of a macro and suppresses the display of any settings sheets. The macro then unfreezes the worksheet area so that when the user moves the cell pointer around the worksheet during the (?) command, the cell-pointer movements will be visible. After the (?) command, the macro refreezes the worksheet area and continues.

Macro 15-57
{WINDOWOFF}

{WINDOWSON}

{?~-

{WINDOWOFF}

{WRITE}

{WRITE string} copies string to the open text file, starting at the current byte pointer position. {WRITE} works only if a text file was opened with write, append, or modify access (see {OPEN}).

String can be a literal string, string formula, or reference to a cell that contains a label or string formula.

1-2-3 evaluates string and converts the result from LICS codes (the codes 1-2-3 Release 1.2 uses to represent characters) to the codes the operating system uses to represent characters. It then copies the converted result to the file, starting at the current position of the byte pointer, and advances the byte pointer to the position just beyond the last character written. If necessary, 1-2-3 extends the length of the file to accommodate the incoming string. A subsequent {WRITE} or {WRITELN} command begins writing where this command stopped, unless you change the position of the byte pointer with a {SETPOS} command.

Note

To use {WRITE} to write values or formulas that evaluate to values, use {STRING} to convert the value to a string, for example,

{WRITE STRING(NUMBER.0)}.

If 1-2-3 succeeds in writing to a file, it goes to the instructions in the next cell, skipping any further instructions in the same cell as {WRITE}. If, however, no text file is open, or if the open file was opened with read access, 1-2-3 ignores the {WRITE} command and goes to the next macro instruction in the same cell as {WRITE}.
Examples. The following macro writes the character string
OneTwoThree to the open text file. If so text file is open, or if the file
was opened with read access, the macro branches to location FAILED
for further instructions.

\texttt{\{WRITE \text{ "One"}\}} \texttt{\{BRANCH FAILED\}}
\texttt{\{WRITE \text{ "Two"}\}}
\texttt{\{WRITE \text{ "Three"}\}}

The following macro writes the character string One Two Three to the
open text file (assuming the file was opened with write, append, or
modify access). In the macro, each \texttt{\&} represents one space.

\texttt{\{WRITE \text{ +\char"0"\&"One"\&\char"0"\&"Two"\&\char"0"\&"Three"\}}

\texttt{\{WRITELN \}}

\texttt{\{WRITELN string\}} works the same way \texttt{\{WRITE\}} does, except that
it adds an end-of-line sequence (a carriage return and line feed) to the
string it writes to the file.

Note that \texttt{\{WRITELN\}} works only if a text file was opened with
write, append, or modify access (see \texttt{\{OPEN\}}).

\begin{footnotesize}
\begin{itemize}
\item To use \texttt{\{WRITELN\}} to write values or formulas
that evaluate to values, use \texttt{\#STRING} to
convert the value to a string, for example,
\texttt{\{WRITELN \#STRING(NUMBER,0))\}}.
\end{itemize}
\end{footnotesize}

If 1-2-3 succeeds in writing to a file, it goes to the instructions in
the next cell, skipping any further instructions in the same cell as
\texttt{\{WRITELN\}}. If, however, no text file is open, or if the open file was
opened with read access, 1-2-3 ignores the \texttt{\{WRITELN\}} command and
goes to the next macro instruction in the same cell as \texttt{\{WRITELN\}}.

Example. The following macro writes three separate lines to the open
text file. If no text file is open, or if the text file was opened with read
access, the macro branches to location FAILED.

\texttt{\{WRITELN \text{ "One"}\}} \texttt{\{BRANCH FAILED\}}
\texttt{\{WRITELN \text{ "Two"}\}}
\texttt{\{WRITELN \text{ "Three"}\}}
1-2-3 Templates

The cash-flow and statistics templates are designed to provide the capability found in many advanced financial calculators, but in a convenient worksheet format. This chapter is for users who are already familiar with 1-2-3 features and terminology.

Each template is a 1-2-3 worksheet that is ready to accept specific data because formulas, macros, labels, and cell formats have been set up for you. You can experiment with each template by entering data and seeing the results.

It’s easy to use these templates:
2. Retrieve the template.
3. Enter the appropriate data.
4. Invoke the macros.
5. Save your worksheet, if desired.

The .CFLOW and .STAT templates are read-only files. To save a modified template, specify a different file name.

Note

These templates contain formulas and range names that, if altered, will cause the template to give incorrect results. Please use the provided macros (rather than the 1-2-3 commands) to edit data and calculate results.
Tips:

- The top of the worksheet shows which macros are available for that template. To run a macro, hold down ALT and the first letter of the macro name. (For example, to invoke the Cash Flows macro, press ALT C.)
- To save your new worksheet:
  1. Select /File Save
  2. Type the name of your new worksheet.
  3. Press ENTER
- To print a copy of your worksheet, use 1-2-3 select /Print Printer
- You can end 1-2-3 by pressing EXiT and selecting Quit. When 1-2-3 asks you to confirm your selection, select Yes.

Cash Flow Analysis

Cash flows are used to analyze "flows" of money received or money paid out at regular intervals. Once you've entered the cash flows, you can calculate the following:

- Calculate the total and internal rate of return of the cash flows.
- Calculate the net present value, net uniform series, and net future value for a specified periodic interest rate.
- Plot a graph of NPV versus IR.

To use the cash-flow template:

1. Retrieve the _CFLOW template: Press F2, select /File Retrieve, type _CFLOW, and press ENTER. (Press ALT B, then Y to erase the Help message.)
2. Enter your data into the cash-flow list in Column B beginning at cell B44. Remember, money received is entered as positive; money paid out is entered as negative.
3. Press ALT F and the first letter of the macro you wish to invoke (see the following table).
4. After you input data in response to a prompt, press ENTER.
The top of the display shows the names of available macros you can invoke (step 3 above):

<table>
<thead>
<tr>
<th>Macro</th>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash-Flows</td>
<td>ALT-G</td>
<td>Displays cash-flow data.</td>
</tr>
<tr>
<td>Size</td>
<td>ALT-D</td>
<td>Prompts for the last item number in your range (&lt; 8160) and numbers the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>cash flows accordingly, beginning at cell B44. If you do not specify a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>number (or type something other than a number) and press ENTER, this macro</td>
</tr>
<tr>
<td></td>
<td></td>
<td>numbers the cash flows (beginning with B44) until the first blank cell is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>encountered.</td>
</tr>
<tr>
<td>Erase</td>
<td>ALT-B</td>
<td>Erases all cash flows in column B if you type Y or YES at the prompt.</td>
</tr>
<tr>
<td>Delete</td>
<td>ALT-D</td>
<td>Deletes the specified number of cash flows, starting at the cell pointer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and going downward. If you do not specify a number (or type something other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>than a number) and press ENTER, this macro deletes one cash flow.</td>
</tr>
<tr>
<td>Insert</td>
<td>ALT-D</td>
<td>Allows you to insert a specified number of cash flows, starting at the cell</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pointer and going downward. If you do not specify a number (or type something</td>
</tr>
<tr>
<td></td>
<td></td>
<td>other than a number) and press ENTER, this macro inserts one 0 cash flow.</td>
</tr>
<tr>
<td>Group</td>
<td>ALT-B</td>
<td>Allows you to insert a group of consecutive, equal cash-flow amounts,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>starting at the cell pointer position and going downward. (The macro will not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>insert the group, it writes over any previous flows in the range.)</td>
</tr>
<tr>
<td>NPV/IRR</td>
<td>ALT-D</td>
<td>Computes NPV, NUS, NFV, Total, and IRR.</td>
</tr>
<tr>
<td>Macro</td>
<td>Keys</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>Bar</td>
<td>ALT-B</td>
<td>Displays a bar graph of the cash flows. Press ESC to clear the graph and return to the cash-flow screen.</td>
</tr>
<tr>
<td>Plot</td>
<td>ALT-D</td>
<td>Plots on the screen NPV versus % values of I%. The macro prompts for starting I% and the increment between values. Press ESC to clear the graph and return to the NPV screen.</td>
</tr>
</tbody>
</table>

All the calculations and graphs operate on the range of cash flows beginning with cell B4 and extending downward until the first blank cell is encountered. (So, if a cash flow amount is 0, remember to enter the number 0 rather than leaving it blank.) Labels that are included in the range are treated as a 0 cash-flow amount.

The cash flow data is numbered in column A. Initially, the list is numbered from 0 to 60 (if AutoExecute Macros is set to Yes). The macro Name allows you to extend the numbering to end at any specified number up to 8140. Numbering the cash flows is optional; the calculations do not require it.
The **NPV/IRR macro**

The NPV/IRR macro performs these calculations:

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV</td>
<td>Calculates net present value: the present value of a series of cash flows plus the initial cost of the investment, discounted for a specified periodic interest rate.</td>
</tr>
<tr>
<td>NUS</td>
<td>Calculates the net uniform series: the dollar amount of regular, equal cash flows having a present value equivalent to the net-present value.</td>
</tr>
<tr>
<td>NFV</td>
<td>Calculates net future value of a series of cash flows by finding the future value of the net present value.</td>
</tr>
<tr>
<td>Total</td>
<td>Calculates the sum of the cash flows.</td>
</tr>
<tr>
<td>IRR</td>
<td>Calculates the internal rate of return: the interest rate at which the net present value of the cash flows equals 0. (HP 95X calculates the periodic rate of return. To calculate the annual return, multiply the periodic rate by the number of periods per year.)</td>
</tr>
</tbody>
</table>

N is the number of the cash flows in the range being computed. For example, if your cash flow range starts at 0 and ends at 60 then \( N = 61 \).

1% is the periodic interest rate, expressed as a percentage.

NPV, NUS, and NFV depend on the periodic interest rate 1%. The default rate is 10%. After executing the macro, the cell pointer is on 1%. To change the rate, simply type the new 1% rate, and press \( \text{ENTER} \).

This macro also computes IRR, which may depend on Guess. The default Guess is 10; to change the guess, move the cell pointer to Guess, type in your new guess, and press \( \text{ENTER} \).
Example: Calculating IRR%, NPV, NUS, and NFV of an investment.

Part 2. An investor makes an initial investment of $80,000 and expects returns over the next eight years as illustrated below.

Calculate the total of the cash flows and the internal rate of return of the investment. Also calculate NPV, NUS, and NFV, assuming an annual interest rate of 8%.

Keys:  

<table>
<thead>
<tr>
<th>KEYS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>shift F1</td>
<td>Displays the CFLOW data screen</td>
</tr>
<tr>
<td>alt + y enter</td>
<td>Clears the list</td>
</tr>
<tr>
<td>-20000</td>
<td>Enters the initial cash flow—cash flow (0)</td>
</tr>
<tr>
<td>5000</td>
<td>Enters cash flow (1)</td>
</tr>
<tr>
<td>alt + g</td>
<td>Enters cash flow (2)</td>
</tr>
<tr>
<td>enter</td>
<td>Enters the number of consecutive times it occurs</td>
</tr>
<tr>
<td>4000</td>
<td>Enters cash flow (3)</td>
</tr>
<tr>
<td>111500</td>
<td>Enters the final cash flow</td>
</tr>
</tbody>
</table>

16.6 1-2-3 Templates
8.3 ENGLISH

Displays the cash-flow bar diagram.

Closes graph, returns to cash-flow screen.
Displays NPV table.

Stores the periodic rate and displays results.

\[
\begin{align*}
\text{NPV} &= 1266.5205796 \\
\text{HUS} &= 224.57745371 \\
\text{NPV} &= 2492.1007965 \\
\text{TOTAL} &= 63000 \\
N &= 9 \\
\text{IRR} &= 8.7534988492 \\
\% &= 8.5 \\
\text{Guess} &= 10
\end{align*}
\]

Part 2. Assuming the same interest rate, recalculate your answers if cash flow #7 is reduced from $4,000 to $1,000.

Key:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2)</td>
<td>Displays cash flow data.</td>
</tr>
<tr>
<td>(7)</td>
<td>Moves the pointer to cash flow 7.</td>
</tr>
<tr>
<td>(0)</td>
<td>Changes cash flow 7 to $1,000.</td>
</tr>
</tbody>
</table>

1000 (EDIT/REV)

Displays NPV table with the new answers.

\[
\begin{align*}
\text{NPV} &= -429.42047275 \\
\text{HUS} &= -75.9785999 \\
\text{NPV} &= -822.8939146 \\
\text{TOTAL} &= 60000 \\
N &= 9 \\
\text{IRR} &= 8.4195179502 \\
\% &= 8.5 \\
\text{Guess} &= 10
\end{align*}
\]

1-2-3 Templates 16-7
Statistics

The HP 95LX statistics template makes one or two-variable statistical calculations as easy as 1,2,3. As you enter data, the column totals are updated in the display, so this template is useful for simply adding columns of numbers—or balancing your checkbook.

To use the statistics template:

1. Retrieve the STAT template. Press [F2], select File Retrieve, type CT\STAT and press ENTER.
2. Enter your data beginning in row 44: use either Column B or C for one-variable statistics; use both columns for two-variable statistics.
3. To run a macro, press [ALT] and the first letter of the macro you wish to invoke. The top of the display shows the names of available macros.

<table>
<thead>
<tr>
<th>Macro</th>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>XY-DATA</td>
<td>ALT EX</td>
<td>Displays statistics data.</td>
</tr>
<tr>
<td>Size</td>
<td>ALT 5</td>
<td>Prompts for the last item number in your data range (&lt; 816) and numbers the data accordingly, beginning at cell B14. If you do not specify a number (or type something other than a number) and press [ENTER], the macro numbers the data pairs (beginning at cell B44) until a blank cell is encountered.</td>
</tr>
<tr>
<td>Erase</td>
<td>ALT E</td>
<td>Erase all statistics data if you type 5 or 55 and press [EXIT] at the prompt.</td>
</tr>
<tr>
<td>Macro</td>
<td>Keys</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>Delete</td>
<td>ALT + ⬤</td>
<td>Deletes the specified number of data pairs, starting at the cell pointer and going downward. If you do not specify a number (or type something other than a number) and press ENTER, one data pair is deleted. If you have entered data pairs, you cannot delete items in one column without affecting the other column.</td>
</tr>
<tr>
<td>Insert</td>
<td>ALT + ⬤</td>
<td>Allows you to insert a specified number of blank rows, starting at the cell pointer and going downward. If you do not specify a number (or type something other than a number) and press ENTER, the macro will insert one blank row.</td>
</tr>
<tr>
<td>Group</td>
<td>ALT + ⬤</td>
<td>Allows you to enter a group of consecutive, equal data pairs, starting at the cell pointer position and going downward. In one-variable statistics, you may use either column B or C. (The macro will not insert the group; it will not overwrite any data in the range.)</td>
</tr>
<tr>
<td>AVG, ...</td>
<td>ALT + ⬤</td>
<td>Displays N, the number of items, calculates and displays Totals, Average, Population Standard Deviation and Sample Standard Deviation; displays the Minimum and Maximum; calculates and displays Range of the data in columns B and C. (If the number of items is not what you expected, you may have some labels in the data range.)</td>
</tr>
<tr>
<td>Macro</td>
<td>Keys</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>Regression</td>
<td>Alt-B</td>
<td>Calculates the Y-intercept, Standard Error of Y Estimate, R Squared (the square of the correlation coefficient), Number of Observations, Slope, and Standard Error of the Coefficient. Also calculates Y Predicted Value (the predicted value of Y given a value of X). To change the value of X, type the new value in the X Value cell and press Enter.</td>
</tr>
<tr>
<td>Plot</td>
<td>Alt-D</td>
<td>Plots on the screen a scatter diagram of the XY data, and draws the linear regression line. Press Esc to close the table and return to the XY-Data screen.</td>
</tr>
</tbody>
</table>

All calculations except linear regression and plotting operate on a single range of data starting in row 44 and extending downward to row 8167. Blank cells are not included in the calculations, however, cells containing labels are treated as zero data and are ignored in the calculations. So, avoid storing labels in the range.

Linear regression and plotting operate on two ranges. The X range starts with cell A1 and extends downward until the first blank cell is encountered. The Y range starts with cell C41 and also extends downward until the first blank cell is encountered. If the two ranges are not the same length, linear regression and plotting will error.

16-10 1-2-3 Template
Example: Compute the average sales, standard deviation, and so on, for the following staff of salespersons:

<table>
<thead>
<tr>
<th>Salesperson</th>
<th>Hours/Week</th>
<th>Sales/Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>$17,000</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>$25,000</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>$20,000</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>$21,000</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>$28,000</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>$29,000</td>
</tr>
<tr>
<td>7</td>
<td>35</td>
<td>$15,000</td>
</tr>
</tbody>
</table>

**Keys:**
- **F4** /File Retrieve
- **F3** STAT ENTER
- **ALT** Y ENTER

- **32** Enter hours worked for the first salesperson.
- **40 45 40** Enter hours worked for the next three employees.
- **38 50 35** Enter hours worked for the last employee.
- **HOME** Move cursor to top of second data-entry column.
- **14800 23860** Enter sales for first three employees.
- **20600 3** Enter remaining sales.

**Description:**
- **Displays the STAT data screen.**
- **Closes data screen.**
- **Enters hours worked for the first salesperson.**
- **Enters hours worked for the next three employees.**
- **Enters hours worked for the last employee.**
- **Moves cursor to top of second data-entry column.**
- **Enters sales for first three employees.**
- **Enters remaining sales.**
Displays AVG, ... screen and all calculated results.

<table>
<thead>
<tr>
<th>N</th>
<th>Y</th>
<th>Totals</th>
<th>152000</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>21714.285714</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>4862.599914</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.590570567</td>
<td>4028.599756</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0277197793</td>
<td>15000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN</td>
<td>50</td>
<td>20000</td>
<td></td>
</tr>
<tr>
<td>15000</td>
<td>15000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Keys:

<table>
<thead>
<tr>
<th>ALT-B</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL-B</td>
<td>Displays the Regression screen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4f</th>
<th>ENTER</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter X value</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Intercept | -7093.6597352 |
| Pred Err of Y Est | 2296.0733477 |
| R Squared | 8.0169445149 |
| No. of Observations | 7 |
| Slope | 720.18945624 |
| Pred Err of Coef. | 159.59978650 |
| Y Predicted Value | 27475.738664 |
| X Value | 48 |
Example: Weighted Mean. You can calculate weighted mean using the Group macro. For example, let's say that on your last vacation you bought gas at four stations as follows: 15 gallons at $1.20 per gallon, 7 gallons at $1.34 per gallon, 10 gallons at $1.30 per gallon, and 17 gallons at $1.48 per gallon. What is the weighted mean? (Remember to press \texttt{ENTER} twice after entering the X values.)

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{AlS A Y ENTER}</td>
<td>Displays STAT1 data screen.</td>
</tr>
<tr>
<td>\texttt{AL8 1.20 ENTER}</td>
<td>Enters first gasoline data.</td>
</tr>
<tr>
<td>\texttt{AL9 15 ENTER}</td>
<td></td>
</tr>
<tr>
<td>\texttt{AL8 1.34 ENTER}</td>
<td>Enters second gasoline data.</td>
</tr>
<tr>
<td>\texttt{AL9 7 ENTER}</td>
<td></td>
</tr>
<tr>
<td>\texttt{AL8 1.30 ENTER}</td>
<td>Enters third gasoline data.</td>
</tr>
<tr>
<td>\texttt{AL9 10 ENTER}</td>
<td></td>
</tr>
<tr>
<td>\texttt{AL8 1.48 ENTER}</td>
<td>Enters forth gasoline data.</td>
</tr>
<tr>
<td>\texttt{AL9 17 ENTER}</td>
<td></td>
</tr>
</tbody>
</table>

Displays AVG, ... screen and all calculated results. The AVG calculation now reflects the weighted mean. The F.STD and S.STD reflect the weighted standard deviations.

\[ \begin{array}{c|c|c}
\hline
\text{N} & 49 & 6 \\
\hline
\text{Totals} & 66.44 & 0 \\
\hline
\text{AVG} & 1.329180673 & ERR \\
\hline
\text{F. STD} & 0.0939804228 & ERR \\
\hline
\text{S. STD} & 0.0949974892 & ERR \\
\hline
\text{MIN} & 1.20 & ERR \\
\hline
\text{MAX} & 1.48 & ERR \\
\hline
\text{RANGE} & 0.28 & ERR \\
\hline
\end{array} \]

(The error message appears because no Y values were entered.)
Part 3

The Personal Information Manager
The Appointment Book helps you organize your time by enabling you to:

- Enter appointments with optional alarms.
- Enter repeating appointments: weekly, monthly, or yearly.
- Create to-do lists.
- Attach a note to any appointment or to-do item.
- Display current time in many world cities.
- Time different events with the stopwatch and countdown timer.
Press (2) to open the Appointment Book. If you have not yet set the current date and time, do so using the Date Current and Time Current commands in the Setup utility.

To close the Appointment Book, select (MEN) Quit or open another application. For help, press (F1) anytime. To cancel an action, screen, or menu, press (ESC) one or more times. If pressing (MEN) causes a beep, press (ESC) and try again.

**Note**

Before you leave the Appointment Book, save your appointment book (see "Saving an Appointment Book" later in this chapter). Otherwise, the Appointment Book copy and the disk copy (if any) may not match. Later operations on that disk file from the File (printing, viewing, transferring to a PC, etc.) would be performed on an out-of-date copy.

### Entering Appointments

The Appointment Book display and alarms are based on the system time and date. Before you enter an appointment, make sure the system time and system date are set correctly. For information about setting time and date and their formats, see "Setting the Date and Time" in chapter 21.

**Example: Entering Your First Appointment.** You want to enter an appointment with an alarm for a one-hour project status meeting at 9:00 AM, Friday, June 5, 1992.

1. Press (2) to open the Appointment Book.
2. Select (MEN) View Daily.
3. Press (ESC) (2). The prompt (left, above the double line) shows today’s date.
5. Move the highlight to the 9:00 AM position using the arrow keys.
6. Type Project status meeting and press [ALT] A. A heavy bracket, the duration bar (see the figure below), appears to the left of the appointment time showing that this appointment lasts for one hour.

7. Press [ENTER] to display the edit daily screen for your appointment.

8. Move the highlight to the alarm field using [ ] and press [SICHEB] to display ene61e. The alarm will sound 5 minutes before your appointment.

9. Press [DONE] [ ] to save your appointment and return to the daily view shown in the following figure. A musical-note alarm symbol appears to the left of the appointment showing that the repeating appointment alarm is set.

This figure also shows a 2:00 PM appointment. The symbols indicate the meeting:
- Has an alarm (musical note).
- Is a repeating appointment (black dot).
- Has a note attached (black note pad symbol).
- Is scheduled to last between 1 and 2 hours (the duration bar does not point to an end time).

The current appointment day (also called current day) is unique to the Appointment Book. The current appointment day is defined by the date of the most recently displayed daily view. After completing the example above, the current day would be June 5, 1987 as shown in the figure below.
Entering Concurrent Appointments

The Appointment Book allows you to enter more than one appointment for a single time period. This permits you to enter two concurrent meetings. You could then decide on the day of the meetings which had priority.

Entering Dates and Times

The years covered by the Appointment Book are 1900 through 2099. All years may be specified with four digits, but 1980 through 1999 may also be specified by 80 through 99, and 2000 through 2099 may be specified by 00 through 99. To specify a year less than 1960 or greater than 2079, you must use four digits.

Dates and times must be entered using the same general form (for instance, month, day, year; 12- or 24-hour clock) shown in the upper right corner of any Appointment Book screen. But you have a wide choice of characters to separate day, month, and year and hours and minutes.
The format used to display date and time is set in the Setup Utility. See "Setting the Date and Time" in chapter 21. Regardless of the format chosen in the Setup Utility, you can use the following characters in the Appointment Book to separate month, day, and year: - (hyphen), / (slash), (space), T (color), . (period), and _ (comma). Also, you need not type a leading zero (4/2/03 works just as well as 04/02/03).

All the characters listed above to separate month, day, and year also can be used to separate hours, minutes, and seconds. Additional time separations are h, m, and . To type an e. g. hour (like 3:00 PM), you can leave off the zero. And you need only type a or p. rather than am or pm. So 2:00 pm can be typed as Sp.

**Entering a One-Time-Only Appointment**

Choose one of the two procedures that follow based on the appointment you want to enter. Here is how to make your choice:

- **Use the simpler procedure** "To enter an appointment into the daily view" if your appointment starts at a time displayed in the daily appointments view. Your new HP 93LX shows intervals—timeline intervals—one hour. You can change this interval to 30 or 15 minutes using [ ] Settings Timeline (see "To specify the timeline interval shown on the daily view" later in this chapter). The duration bar (see the previous figure) will be automatically set to indicate an appointment duration of one timeline interval.

You can also set an alarm for your appointment using this simpler procedure.

- **Use the more versatile procedure** "To enter an appointment into the insert daily screen" if your appointment fits one of these descriptions:
  - 0 It starts at a time not displayed on the daily view, or
  - 0 It's concurrent with an existing appointment, or
  - 0 You want to specify an appointment duration other than that given by the timeline interval.

The table below lists the editing keys available in the appointment, insert, todo, and note screens. Use these keys as you follow the procedures. For more typing aids see "Typing Tools" at the end of this chapter.

---

The Appointment Book 17-5
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⌘</td>
<td>Moves one character to the left.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves one character to the right.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves up to the previous line or entry.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves down to the next line or entry.</td>
</tr>
<tr>
<td>⌘</td>
<td>Backspace—moves left one space, erasing previous character.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves the cursor 5 spaces in a note.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves left to the beginning of the previous word.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves right to the beginning of the next word.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves to the last character of the current line, or (appointment and to-do screens only) to the first field in the display.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves to last character in the line or, in edit mode, to last field in the display.</td>
</tr>
<tr>
<td>⌘</td>
<td>(Press ⌘ and  simultaneously.) Move to the top of the display or to the beginning of the note.</td>
</tr>
<tr>
<td>⌘</td>
<td>(Press ⌘,  and  simultaneously.) Move to the top of the display or to the beginning of the note.</td>
</tr>
<tr>
<td>⌘</td>
<td>Deletes note text to the end of the line.</td>
</tr>
<tr>
<td>⌘</td>
<td>Deletes current character.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves to the next line or field (except in appointment screens).</td>
</tr>
<tr>
<td>⌘</td>
<td>Ends editing the current field and restores its previous contents, or exits the screen.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves to the next day, week, or month (appointment views and to-do screens) or to the last line of the note.</td>
</tr>
<tr>
<td>⌘</td>
<td>Moves to the previous day, week, or month (appointment views and to-do screens) or to the last line of the note.</td>
</tr>
</tbody>
</table>

17-6 The Appointment Book
To enter an appointment into the daily view:

1. Press [Day] (F10), if necessary, to display the daily appointments view.
2. Press [Date] (F3). The date displayed is today’s date.
3. Type the date of your appointment if different from today’s date (see the earlier “Entering Dates and Times”).
4. Press [ENTER] to display a daily view for the date of your appointment.
5. Move the highlight to the starting time of your appointment. The daily view displays all hours from 12:00 AM (midnight) to 11:00 PM. Use [A] (DOWN) and [B] (UP) to move the highlight and scroll the display. (By using [Menu] Settings Timeline, you can choose a timeline interval of 60, 30 or 15 minutes.)
6. Type your appointment’s name (up to 27 characters) and press [ENTER].

To edit your entry either before or after pressing [ENTER], use the editing keys in the previous table. If you’ve already pressed [ENTER], first highlight your entry, then your first editing keystroke (an arrow key, letter key, etc.) will automatically open edit mode. Press [ENTER] after editing.

If you do not want to set an alarm for this appointment, your entry is complete.

7. To set an alarm:
   a. Highlight your appointment (if not already highlighted). Then press [ENTER] to display the edit daily screen for this appointment.
   b. Press [A] twice (fewer keystrokes than pressing [F] to move the highlight to the alarm field.
   c. Press [Spaces] if necessary, to select a time, then press [ENTER] to move the highlight to the baseline field.
   d. Accept the offered time interval or type any number between 9 and 30 to specify the number of minutes between alarms and appointment.
   e. Press [ENTER] to set the baseline.
   f. Press [Repeat] (F13) to save your alarm and return to the daily appointments view, or press [ESC] to reject the changes and return to the daily view.

The Appointment Book 17-7
To enter an appointment into the insert daily screen:

See the earlier "Entering Dates and Times" to help you complete this procedure.

1. Press (F6) if necessary, to display the daily appointments view.
2. Press Insert key to display the insert daily screen.
3. Type your appointment's name (up to 25 characters) and press enter.
4. To edit your entry either before or after pressing (Enter), use the editing keys in the previous table. If you've already pressed (Enter), first highlight your entry, then your first editing keystroke (an arrow key, letter key, etc.) will automatically open edit mode. Press (Enter) after editing.
5. Accept the offered date or type a new date for your appointment (see the earlier "Entering Dates and Times"), then press (Enter) to highlight the start time field.
6. Type your appointment's start time. Press (Enter) to highlight the end time field.
7. Type your appointment's end time if it's different from that shown. In any case, press (Enter) to enter that time and to highlight the alarm field. (The paragraphs directly below this procedure describes how you can bypass this end time step in many cases.)
8. Press (F6) if necessary, to select disable or enable, then press (Enter) to move the highlight to the deadline field.
9. Accept the offered time interval or type any number between 0 and 30 to specify the number of minutes between alarm and appointment.
10. Press (Enter) to set the deadline.

Do one of the following:
- Press (Space) to save your appointment and to return to the daily appointments view.
- Press Insert key to save your appointment and to display a new, blank insert daily screen.
- Press (ESC) to reject the changes and return to the daily appointments view.

Here's how you can make entering many appointments in the insert screen easier. Say the times displayed on your daily view include 2:00 PM and 3:00 PM, reflecting the default timeline interval of one hour.

17-8 The Appointment Block
You're scheduling a meeting that starts at 2:30 PM and ends at 3:30 PM. In the insert screen, you enter 2:30 PM as the start time and see 9:40 AM, for instance, as the displayed end time. Since the length of your meeting is the timeline interval (one hour), you need not enter the end time. When the end time is highlighted, press (9), not ENTER (8). For, if you don't want to enter an alarm, press 2:30 PM (7). The Appointment Book will enter 3:30 PM for you. While the end time is on the insert screen, it will not change immediately; the duration bar in the daily view will show an appointment that extends beyond 3:00 PM. Also, if you press ENTER from the daily view (with your 2:30 appointment highlighted), you'll see an end time of 3:30 PM on the edit daily screen.

**Entering Repeating Appointments**

You can enter a repeating appointment as one that repeats weekly, monthly by position (first Monday, third Thursday, etc.), monthly by date, or yearly. The appointment you enter not only appears in the repeating view you choose, but also in the daily views specified by the data you enter in the repeating appointment view.

Also, every daily view entry of your repeating appointment is identified by a small dot, the same size as the dots that make a colon (:). A larger solid rectangle—a note pad symbol—indicates that the appointment has a note.

For example, say you want to enter the meeting days for your monthly meeting of the Carole Baker Gourmet Cooking and Star Trek Tape Watching Society (Baker Cook-Trek). The group meets every second Tuesday at 11:30 AM and adjourns at 2:30 PM. You plan to enter this appointment for the next 12 months. You'd enter the meeting in the insert monthly position screen using the procedure "To enter a monthly repeating appointment by position" later in this chapter. When this appointment was entered, it would appear not only in the monthly position view, but also in the daily view for every second Tuesday for each of the next 12 months.

**To enter a weekly repeating appointment:**

See the earlier “Entering Dates and Times” to help you complete this procedure.
1. Select View Weekly-Repeat to display the weekly appointments screen.
2. Press Insert (Ins) to display the insert week screen.
3. Type the name of your appointment in the entry field.
4. Press Enter to enter your appointment name and move the highlight to the weekday field.
5. Press Spacebar ( ) or , if necessary, to move forward or back through the weekdays to display the day of your appointment.
6. Press Enter to set the day and move the highlight to the start time field.
7. Type the start time and press Enter. Your highlight moves to the end time field.
8. If a one-hour duration (as the interval specified by (Menu) Settings Timeline) is acceptable, press ( ) to move to the start date field. Otherwise, type an end time and press Enter.
9. Accept the offered choice for start date or type another choice, then press Enter. Your highlight is now in the end date field. If the date you enter in the start date field does not match the day you entered in the weekday field (step 6 above), the first appointment will be scheduled for the specified weekday following the specified start date.
10. Accept the offered choice for end date or type another choice.
11. Your highlight is now in the alarm field.
12. Press Spacebar, if necessary, to select disable or on-alarm, then press Enter to move the highlight to the endtime field.
13. Accept the offered time interval or type any number between 0 and 30 to specify the number of minutes between alarm and appointment.
14. Press Enter to set the endtime.

Do one of the following:
- Press [Ins] to save your appointment and to return to the previous screen.
- Press Insert (Ins) to save your appointment and to display a new, blank insert weekly screen.
- Press Del to reject the changes and return to the previous screen.

To enter a monthly repeating appointment by position:

Besides entering a monthly repeating appointment by position (first Monday, third Wednesday, etc.), you can also enter a monthly appointment by date as described later.

17-10 The Appointment Book
See the earlier “Entering Dates and Times” to help you complete this procedure.

1. Select **MENU** View Monthly-Repeat Position to display the monthly position view.

2. Press **INSERT** to display the insert monthly position screen.

3. Type the name of your appointment in the apt field.

4. Press **ENTER** to enter your appointment name and move the highlight to the week field.

5. Press **Spacebar**, **A**, or **B** if necessary, one or more times to reach the week (1st, 2nd, etc.) of your appointment.

6. Press **ENTER** to set the week and move the highlight to the weekday field.

7. Press **Spacebar**, **A**, or **B**, if necessary, one or more times to display the day of your appointment.

8. Press **ENTER** to set the day and move to the start time field.

9. Type the start time and press **ENTER**. Your highlight moves to the end time field.

10. If a one-hour duration (or the interval specified by **Menu** Settings Timeline) is acceptable, press **V** to move to the start date field. Otherwise, type an end time and press **ENTER**.

11. Accept the offered choice for start date or type another choice, then press **ENTER**. Your highlight is now in the end date field. If the date you enter in the start date field does not match the day you entered in the weekday field (step 8 above), the first appointment will be scheduled for the specified weekday following the specified start date.

12. Accept the offered choice for end date or type another choice. Your highlight is now in the alarm field.

13. Press **Spacebar** if necessary, to select disable or enable.

14. Press **ENTER** to move the highlight to the start time field. Accept the offerd time interval or type any number between 0 and 30 to specify the number of minutes between alarm and appointment.

15. Press **ENTER** to set the alarm time.

16. Do one of the following:
   - Press **Resume** to save your appointment and to return to the previous screen.
   - Press **Interrupt** to save your appointment and to display a new, blank insert monthly position screen.
   - Press **ESC** to reject the changes and return to the previous screen.

The Appointment Book 17-11
To enter a monthly repeating appointment by date:

See the earlier “Entering Dates and Times” to help you complete this procedure.

1. Select [Menu] View Monthly-Repeat Date to display the monthly date appointment view.
2. Press [Insert] (F3) to display the insert monthly date screen.
3. Type the name of your appointment in the app field.
4. Press [Enter] to enter your appointment name and move the highlight to the day field.
5. Type a number from 1 to 31 and press [Enter] to move the highlight to the start time field.
6. Type the start time and press [Enter]. Your highlight moves to the end time field.
7. If a one-hour duration for the interval specified by [Menu] Settings Timeline is acceptable, press [F1] to move to the start date field. Otherwise, type an end time and press [Enter].
8. For each of the start data and end data fields, accept the offered choice or type another choice, then press [Enter]. Your highlight is now in the alarm field.
9. Press [Enter] if necessary to select disable or enable.
10. Press [Enter] to move the highlight to the reminder field. Accept the offered time interval or type any number between 0 and 30 to specify that number of minutes between alarm and appointment.
11. Press [Enter] to set the reminder.
12. Do one of the following:
   • Press [Done] (F5) to save your appointment and to return to the previous screen.
   • Press [Insert] (F3) to save your appointment and to display a new, blank insert monthly date screen.
   • Press [ESC] to reject the changes and return to the previous screen.

To enter a yearly repeating appointment:

See the earlier “Entering Dates and Times” to help you complete this procedure.

1. Select [Menu] View Yearly-Repeat to display the yearly view.
2. Press [Insert] (F3) to display the insert yearly screen.
3. Type the name of your appointment in the app field.

17-12 The Appointment Book
4. Press [ENTER] to enter your appointment name and move the highlight to the month field.
5. Press [cursor] 1 or 2, if necessary, one or more times to display the month of your appointment.
6. Press [ENTER] to set the month and move the highlight to the day field.
7. Type a number from 1 to 31 and press [ENTER] to move the highlight to the start time field.
8. Type the start time and press [ENTER]. Your highlight moves to the end time field.
9. If a one-hour duration (or the interval specified by [MENU] Settings / Timeline) is acceptable, press [v] to move to the start date field. Otherwise, type an end time and press [ENTER].
10. For each of the start date and end date fields, accept the offered choice or type another choice, then press [ENTER]. Your highlight is now in the alarm field.
11. Press [cursor] if necessary, to select disable or enable.
12. Press [enter] to move the highlight to the deadline field. Accept the offered time interval or type any number between 0 and 30 to specify that number of minutes between alarm and appointment.
13. Press [EXIT] to set the deadline.
14. Do one of the following:
   - Press [Done] [F1] to save your appointment and to return to the previous screen.
   - Press [Up/ESC] [F2] to save your appointment and to display a new, blank insert monthly date screen.
   - Press [ESC] to reject the changes and return to the previous screen.

**To enter an appointment that repeats irregularly:**

This procedure is explained as an example. It leads you step by step through the use of the copy and paste functions of the Clipboard. All the Clipboard functions are described later in "Using the Clipboard with Appointments and Notes."

You've just learned that your employer, Beeton's Deep Fried Pizza, has scheduled a series of four meetings over the next several weeks to discuss next year's budget. The dates and times are:

- October 8, 9:30 AM, 1992
- October 13, 10:00 AM, 1992
- October 15, 9:00 AM, 1992
October 21, 1:00 PM, 1992.

1. From the daily view, press [Enter].
2. Type 10/21/93 and press [Enter].
3. Highlight the 9:00 AM appointment field and type FY 93 budget. Press [Enter].
4. Press [Enter] to display the edit screen for this appointment.
5. Press [F4] 4 times to highlight the alarm field.
6. Press [Space] to display available. You accept the displayed 5 minute deadline.
7. Press [F5] to complete the entry of this appointment and return to the daily view.
8. Press [F5] to copy to the clipboard this highlighted appointment name with its alarm.
10. Highlight the 10:00 AM appointment field and press [F5] to enter the copied appointment name with its alarm. A copy of the appointment (name and alarm) is still on the clipboard. (If you entered the appointment at the wrong time or date, highlight the appointment, press [Cut], [F3], and try again. The appointment is still on the clipboard.)
11. Follow the same routine to paste the appointment name into the proper appointment fields for October 13 and 14.

Using Appointment Notes

You can add a note (one screen long) to any one-time-only or repeating appointment. You cannot enter a note for a time period for which no appointment is scheduled. When a note is added to an appointment, a solid rectangle mark like a note pad (•) is placed to the left of the appointment starting time.

To add a note:

1. Select [View], then select the appointment view containing the appointment you want to augment with a note. If it's a repeating appointment, select the view (Weekly, Monthly, Position, Monthly Date, or Yearly) in which you entered the appointment.
2. Highlight the appointment to which you will add a note.
3. Press ‘Note’ ( ) to display the 40 character by 11 line note screen. The related appointment name is displayed on the second line of the screen.
4. Type your note using the editing keys described in the earlier table.
5. Do one of the following:
   - Press ‘Done’ ( ) to save your note and return to the previous screen. A * mark to the left of the appointment time will show that the appointment has a note.
   - Press ( ) to reject the note and return to the previous screen.

To view a note:
1. Highlight the appointment associated with a note in any view in which the appointment appears.
2. Press ‘Note’ ( ) to display the note screen with its note.
3. Press ( ) to return to the related appointment view.

To edit a note:
1. View the note you want to edit by following the above procedure.
2. Edit the note using the editing keys described in the earlier table.
   “Keys Active in Appointments, Insert, Note, and To-Do Screens.”
3. Press ‘Done’ ( ) to save your edited note and return to the previous view. To discard your edits, preserve the original note, and return to the previous view, press ( )

Using the Clipboard with Appointments and Notes

The Clipboard is available in all appointment views except calendar. It’s also available in notes and in to-do lists. The Clipboard is not available in insert or edit screens, in world-time, in the stopwatch, or in the timer. The use of the Clipboard in to-do lists (and associated notes) is discussed later in this chapter.

Copy, cut, and paste functions access a storage area called the Clipboard. The use of these functions in view screens is summarised in the following table. To move text, first cut it, then paste it in the new location. After a paste, a copy of the appointment or selected note text remains in the Clipboard (until another cut or copy...
operation replaces it), allowing multiple placements. For instance, this allows placing the same appointment into different time fields and in different views, as shown in the previous example.

When a highlighted appointment in any view is copied or cut to the Clipboard, any associated alarm or note is also copied. All this information can be pasted into any available time period in a daily view only.

**Note**

Although repeating appointments can be copied or cut, you cannot paste data into a repeating view.

---

You can paste an appointment into a note screen, into another appointment or note location, or into another application, such as the Memo Editor. The appointment time, name, and related note, if any, are pasted to the new location. However, any alarm information in the Clipboard can be pasted only to an appointment location. Selected note text that is copied or cut can also be pasted into another application. See “To select text in a note field” below.

If Clipboard text that is not an appointment is inadvertently pasted over an appointment, the text will overwrite the appointment. (The pasted text would be limited to that which would fit in the field—27 characters.)

If an appointment (or to-do item) is pasted into a to-do view, it will be entered as a new to-do item. (If the pasted item was not an appointment or to-do item, it would overwrite any highlighted to-do item.)

**To select text in a note field**:

1. Position the cursor at the beginning of the text you want to select.
2. Press **fn**-[left arrow] (F3).
3. Move the cursor to highlight and define the selected text.

The text can now be copied or cut into the Clipboard.

The table below describes Clipboard operations with appointments and their notes. A later table “Interaction Between Clipboard Function Keys and To-Do Lists and Notes” further describes Clipboard operations.

---

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<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COPY (F3)</strong></td>
<td>Copies from any view a highlighted appointment plus any note and alarm and puts it into the Clipboard. Also copies marked text into the Clipboard.</td>
</tr>
<tr>
<td><strong>CUT (F3)</strong></td>
<td>Removes from any view a highlighted appointment plus any note and alarm and puts it into the Clipboard. Also cuts marked note text and puts it into the Clipboard.</td>
</tr>
<tr>
<td><strong>PASTE (F3)</strong></td>
<td>Copies appointment plus any note and alarm from the Clipboard and pastes it into the highlighted appointment field in any daily view. If the field already has an appointment, the pasted appointment is placed in a concurrent appointment box. Nothing is lost. Also copies selected note text from the Clipboard into any note screen at the cursor’s position.</td>
</tr>
<tr>
<td><strong>MARK (F3)</strong></td>
<td>Locates the beginning of marked text in a note at the cursor position. Moving the cursor then selects (highlights) text (marked text) for copying or cutting.</td>
</tr>
</tbody>
</table>
Formatting the Daily View

You can specify the timeline interval and the first hour displayed on the daily view through the settings menu. This first hour is the hour displayed before you scroll the display using  and  (HOME), and . The timeline choices are shown below:

<table>
<thead>
<tr>
<th>Choice</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appts-Only</td>
<td>Displays only scheduled appointments with their start times.</td>
</tr>
<tr>
<td>15-Min</td>
<td>Displays 15-minute increments.</td>
</tr>
<tr>
<td>30-Min</td>
<td>Displays 30-minute increments.</td>
</tr>
<tr>
<td>60-Min</td>
<td>Displays 60-minute increments.</td>
</tr>
</tbody>
</table>

To specify the first hour displayed on the daily view:

This first hour is the hour displayed before you scroll the display using  and . This first hour is also displayed when you press (UP) or (DOWN) from a daily view.

1. Select  Settings to display the Appointment Book Settings screen.
2. Select First-Hour.
3. Type the time and press Enter. When you display the daily view, this hour will the earliest hour displayed. Use  (UP),  (HOME), and (END) to display any time from midnight to 11:00 PM.

To specify the timeline interval shown on the daily view:

1. Select  Settings to display the Appointment Book Settings screen.
2. Select Timeline.
3. Select Appts-Only, 15-Min, 30-Min, or 60-Min to display corresponding times.

When Appts-Only is specified, you must use an insert screen to enter an appointment. If you do not specify an end time, an appointment duration of 1 hour is set.

When 15-Min, 30-Min, or 60-Min is specified, you may enter an appointment in the daily view screen or in an insert screen. If you
Using Alarms

You can set an alarm, consisting of a sound and a message, for any one-time-only or repeating appointment. To see how to set an alarm while entering an appointment, see the section “Entering Appointments” near the beginning of this chapter. Unless you change it, an alarm is set to go off 5 minutes before the appointment time. When the alarm turns on, the alarm sounds periodically for 10 seconds or until ESC is pressed, and the message remains until ESC is pressed. If no key is pressed in the next five minutes, the VP 95 LX turns itself off to conserve power, but an uncanceled message will reappear when the computer is turned back on.

To change an individual alarm:

1. Highlight the appointment whose alarm you want to change. Be sure to highlight the appointment in the view where the appointment was entered. Select VIEW, view, then select Daily, Weekly-Repeat, Monthly-Repeat Date, Monthly-Repeat Position, or Yearly-Repeat. In the daily view, use Go to (G) to specify the correct date.

2. Press ENTER to display the edit dialog screen.

3. Highlight the alarm field and press (ESC), if necessary, to select enable or disable.

4. Highlight the deadline field. Either accept the displayed default time interval or type any number between 0 and 30 to specify a 0 to 30 minute interval.

5. Press (DEL) to replace your original appointment with the edited version.

To change the default time interval (deadline) between alarm and appointment:

The default deadline will apply to all new appointments that you enter. For example, once you change the deadline, the insert appointment screen will display the newly specified deadline.

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Note

This procedure does not affect the leadtime values for existing appointment alarms.

1. SelectMENU Settings to display the Appointment Book Settings screen. This screen shows the present default value for Leadtime.
2. Select Leadtime.
3. Type a new default leadtime from 0 to 30 minutes.

To enable and disable the alarm sound:
The sound of all alarms in both the appointment book and in the watch feature can be enabled or disabled in the settings alarm screen. This affects only the sound, not the message. The message will still display at the specified time interval (leadtime) before the appointment time.
You might want to disable all alarms if you're in a meeting, for instance.

To control the alarm sound for all alarms:
1. SelectMENU Settings Alarm.
2. Do one of the following:
   • Select Enable to allow all alarms to sound.
   • Select Disable to turn off the sound of all alarms.

To turn off an alarm after it turns on:
1. Read the message first because turning off the alarm removes the message.
2. Press [ESC] to turn off the sound (and to remove the message).
Otherwise, the alarm will turn off in 10 seconds and the message will remain until you press [ESC].

17-20 The Appointment Book
Using the Calendar

The calendar, one of whose arrays is shown below, contains a calendar for every month from January 1980 through December 2099. To display the calendar, press [ESC] from any appointment view or select (MENU) View Calendar. Once the calendar is displayed, you can easily change the display to any other month in two ways:

1. To display nearby months, press [UP] and [DN] one or more times.
2. To display more distant months, it might be faster to use [GOT] as described in the procedure below.

To display any month in the calendar:

1. Press [ESC] from any appointment view or select (MENU) View Calendar to display the calendar.
2. Press [GOT] to display the month you’ve selected. The day you specified will be highlighted.

The calendar view provides this special information (see the figure below):

1. A day with appointments: identified by an underline.
2. The current appointment day: identified by > <.
3. Corner position: identified by a block cursor.

The Appointment Book 17.21
Keys Active in Calendar View

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>←</td>
<td>Moves to the previous day and scrolls the calendar as necessary.</td>
</tr>
<tr>
<td>→</td>
<td>Moves to the next day and scrolls the calendar as necessary.</td>
</tr>
<tr>
<td>↑</td>
<td>Moves up to the previous week and scrolls the calendar as necessary.</td>
</tr>
<tr>
<td>↓</td>
<td>Moves down to the next week and scrolls the calendar as necessary.</td>
</tr>
<tr>
<td>EXIT</td>
<td>Displays the daily view for the highlighted date.</td>
</tr>
<tr>
<td>END</td>
<td>Moves to the last displayed date.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves to the first displayed date.</td>
</tr>
<tr>
<td>UP</td>
<td>Scrolls forward 4 weeks.</td>
</tr>
<tr>
<td>DOWN</td>
<td>Scrolls backward 4 weeks.</td>
</tr>
</tbody>
</table>
Viewing Appointments

You can display a daily view showing the current day's appointments by pressing [Day] (F3) from any other view. (The current day is the day last displayed in the daily view and is identified in the calendar by > <.) When viewing a daily view, you can view (or enter) an appointment for any hour from midnight (12:00 AM) to 11:59 PM by scrolling the screen with A, V, HOME, and END.

You can choose the daily view's date by using the calendar or by typing the date you want. Procedures for each method follow:

Choosing a Current Appointment Day by Using the Calendar

1. Press TAB from any view or select [DIARY] View Calendar to display the calendar.
2. Move the cursor to the date you seek. You can scroll the calendar using the keys described in the table above, or use Go to (F3), as described earlier in "To display any month in the calendar."
3. Press ENTER to display that date in the daily view. This defines a new current day.

Choosing a Current Appointment Day by Typing the Date

1. If you're in a repeating view (weekly, monthly, yearly) or in the calendar, press [Day] (F3) to display the daily view for the current day.
2. Press Go to (F3) from the daily view.
3. Type the date you choose in place of the offered date. You must use the same order (like month, day, year) but you can use different separators (see "Entering Dates and Times" near the beginning of this chapter).
4. Press ENTER to display that date in the daily view. This defines a new current day.
Finding Appointment Book Text

The Find command (F1: (F2)) can be executed from a daily appointments or daily to-do screen (see the later section "Using To-Do Lists"). It searches all daily appointments and daily note screens for specified text within plus or minus two years from the current day. If the text is found, you'll see displayed the daily appointments screen that contains the text, or whose note screen contains the text (in that case, press (Note: (F2)) to see the text). The search initiated by Find is case insensitive (entering "text" will find both "Text" and "text"). You can search forward (toward last date) and backward (toward earlier dates). Once a match is found, you can continue the search in the same direction, or you can change the direction of search at any time.

To search all dates, conduct a forward (next) search repeatedly until a message reports that no match is found. Then conduct a backward (previous) search until no match is found.

1. Press Day: (F3) from any repeating appointment view to display the current daily view.
2. Press F1: (F2) to display the Find prompt.
3. Type the text you want to find, 39 characters maximum.
4. Press Next: (F2) to search for the next occurrence of this text. If the text is found, the daily view or to-do screen containing that text will be displayed.
5. Press Prev: (F3) to complete the search. (You can press Prev: (F3) first, followed by Next: (F2).)
6. To search for other occurrences of the text, repeat steps 4, 5, and 6.
Rescheduling, Changing, and Canceling
Appointments and Notes

Example: Changing the Date of an Appointment Using the Edit Screen. You have a one-time-only appointment with note and alarm presently scheduled for 9:00 AM, October 15, 1991. You want to change it to November 5, 1991. Today's date is September 19, 1991. Here are the steps you can perform to do this. (This is a read-only example—no need to press keys.)

1. Press [ESC] to display the calendar.
2. Press [PS ON] then use the arrow keys to highlight October 15.
3. Press [ENTER] to display the daily view for October 15.
4. Highlight the 9:00 AM appointment.
5. Press [ENTER] to display the edit screen for this appointment.
6. Highlight the date field and type 11/5/91, then press [HOME].
   Your appointment, together with its note and alarm, is rescheduled.

The six procedures that follow apply to daily, weekly, monthly, and yearly appointments. When making changes, use the keys described in the table "Keys Active in Appointments, Insert, Note, and To-Do Screen" earlier in this chapter. For other typing aids, see "Typing "tools" at the end of this chapter.

To change only an appointment name:
1. Display the view in which the appointment was entered (daily, weekly, monthly date, monthly position, yearly).
2. Highlight the appointment you want to change.
3. Do one of the following:
   - Type a new name. As you begin, the old name is deleted and a single-character cursor appears.
   - Press [2] to enter edit mode. The old name remains and a single-character cursor appears. Make your changes.
4. Press [ENTER] to save your new or edited name.

To make other changes to an appointment:
1. Display the view in which the appointment was entered (daily, weekly, monthly date, monthly position, yearly).
2. Highlight the appointment you want to change.
3. Press [ENTER] to display the edit screen.
4. Move the cursor to the field you want to change.
5. Either type your change or, if the field is surrounded by a box, press \texttt{Delete} or \texttt{Insert} to display other choices.
6. Press \texttt{Enter} to enter the change and move the highlight to the next field.
7. Repeat steps 4, 5, and 6 until you've made all your changes.
8. Press \texttt{F10} or \texttt{F12} to save the new version of your appointment, including any note or alarm.

To 

reschedule a one-time-only appointment:

1. Highlight the appointment in the daily view.
2. Press \texttt{Cut} (\texttt{F2}) to move the appointment into the Clipboard.
3. Highlight the new location of the appointment.
4. Press \texttt{Paste} (\texttt{F2}) to reschedule the appointment.

To cancel a one-time-only appointment:

1. Highlight the appointment in the daily view.
2. Press \texttt{Cut} (\texttt{F2}) to cancel the appointment.

To reschedule or cancel one day of a repeating appointment:

1. Highlight the appointment in the daily view.
2. Press \texttt{Enter} to display the edit day screen.
3. Enter a concurrent "appointment" whose name is a message informing you that the appointment is canceled or rescheduled.
4. To reschedule, enter a one-time-only appointment for the rescheduled day and time.

The original repeating appointment will still display. If you want to disable any alarm, you must do so in the edit screen of the repeating view in which the appointment was entered.

To cancel all days of a repeating appointment:

1. Display the view in which the appointment was made (Weekly, Month Date, Month Position, Yearly).
2. Highlight the appointment.
3. Press \texttt{Cut} (\texttt{F2}). All occurrences of the appointment are deleted.
To change or delete a note:

You can change an appointment note in any view. If it’s a note for a repeating appointment, the change will appear in all occurrences of the repeating appointment.

To change a note:
1. Highlight the appointment whose note you want to change.
2. Press Note (F4).
3. Type your changes.
4. Press Done (F2) to save your changes.

To delete a note:
1. Highlight the appointment whose note you want to delete.
2. Press Note (F4).
3. Press Mark (F5) then press (F3) and (D) together to move the cursor to the last character in your note. The entire note is highlighted.
4. Press Cut (F3).
5. Press Done (F2) to delete the note.

To remove all appointments and to-do items before a chosen date:

The Remove command erases all appointments and to-do items before a date you specify. (To-do items are described below.) You might want to do this to release disk space for other uses if your appointment book is large.

Note

Once Remove is executed, the appointments are gone and cannot be recovered, so make sure the date you specify is the date you want.

1. Select (Menu) Remove.
2. Either accept the offered date, or type a new date and press Enter.
3. Do one of the following:
   - Type y to remove all appointments before the specified date.
   - Type n to cancel the operation.

The Appointment Book 17-27
Using To-Do Lists

You can create a prioritized to-do list and check off an item as it's completed. You can specify that an item not completed on the day it's due be automatically deleted from future lists. Or you can specify that such an item continue to be listed day after day until it is completed (checked off) or deleted. To-do items can be entered on a daily basis only. For instance, you cannot have weekly to-do items.

A to-do screen is similar to a daily view, except no times are involved. Instead, to-do items are prioritized.

Use "To Do / Day" (RE) to switch between a daily view and the to-do screen of the same date.

Entering a To-Do Item

1. From a daily view, press "To Do" (RE) to display the to-do list.
2. Move, if necessary, to the date of your to-do item by using "Goto" (FR) or the (PGUP) (PGDN) keys.
3. Press "Insert" (RE) to display the insert to-do screen. The highlight is in the item field.
4. Type your to-do item (27 characters maximum) using the editing keys described in the earlier table "Keys Active in Appointments, Insert, Note, and To-Do Screens." For more typing aids, see "Typing Tools" at the end of this chapter.
5. Press "ENTER" to move to the priority field.
6. Press "Downarrow" (1) or (2) to cycle forward through the available priorities, 1-9. Select the priority of your item.
7. Press "ENTER" to move to the carry forward option field. If carry forward is enabled, this to-do item will appear on to-do lists for future days until it is checked off or deleted as explained later. If carry forward is disabled, this to-do item will appear only on this screen; that is, only on the date it is scheduled to be done.
8. Press "Downarrow" to cycle between Yes and No. Select your choice.
9. Press "ENTER" to move to the last field, date. Accept the displayed date or type a new date, then press "ENTER."
10. Do one of the following:
   - Press "Done" (RE) to save the item and return to the to-do list.
   - Press "Ins at End" (RE) to save the item and display a new, blank insert to-do screen.
Press [ESC] to cancel the item and return to the to-do list.

**Editing a To-Do Item**

1. Highlight the to-do item to edit.
2. Do one of the following:
   - If only the name needs changing, type the changes and press [ENTER] to save the changes. You’ve completed this procedure.
   - Otherwise, press [ENTER] to display the edit to-do screen, then continue with the following steps.
3. Move the highlight to the field or fields to change.
4. Make the desired changes.
5. Do one of the following:
   - Press [DONE] ([F3]) to save the item and return to the to-do list.
   - Press [ESC] to cancel the changes and return to the previous screen.

**Adding or Changing a Note to a To-Do Item**

You can add or change notes to to-do items just as you can to appointments.

1. Highlight the to-do item whose note you want to create or change.
2. Press [NOTE] ([F3]) to display the note screen.
3. Type your note or make your changes to the existing note.
4. Do one of the following:
   - Press [DONE] ([F3]) to save the note and return to the previous screen.
   - Press [ESC] to cancel the changes and return to the previous screen.

**Checking Off or Deleting a Completed To-Do Item**

When you complete a to-do item, you can put a check mark in front of the item or delete it. Once an item is checked, it will not appear on previous or future to-do screens.

1. Display the to-do screen containing the item to be checked off or deleted.
2. Do one of the following:
To check the item, highlight the item and press [Proceed] to put a check (✓) in front of the item. To toggle on and off, press [Proceed].

To delete the item, highlight the item and press [Cut] (F2).

Displaying Past-Due To-Do Items

You can control whether or not past-due items continue to appear on later to-do lists. This control is exercised by choosing whether the carry-forward command is enabled (leaves carry over to later lists) or disabled. There are two ways to exercise this control:

- Select Yes or No in the carry-forward field of each to-do item's insert or edit screen as explained earlier in "Entering a To-Do Item." In this way, the carry-forward state of each item can be controlled individually.
- Select Enable or Disable after selecting Settings Carry-Foreward. In this way, the default carry-forward state of all future to-do items are set.

To change the default carry-forward state of future to-do items:

This procedure does not affect the carry-forward states of existing to-do items.

1. Select [Menu] Settings to display the Appointment Book Settings screen. This screen shows the present default Carry Forward state, either Enable or Disable.
2. Select Carry-Foreward.
3. Do one of the following:
   - Select Enable. The default value of Carry forward in the insert to-do screens is set to YES.
   - Select Disable. The default value of Carry forward in the insert to-do screens is set to NO.

Using the Clipboard with To-Do Screens and Notes

The use of these functions in to-do screens is summarized in the following table. To move a to-do item, first cut it, then paste it in the new location. After a paste, a copy of the to-do item and any note remains in the Clipboard, allowing multiple placements.
Paste is available in the daily view and todo screens only. If you paste a to-do item into either screen, the Clipboard contents are entered as a new item. The amount of Clipboard text that is pasted depends on the capacity of the field into which it's pasted. Existing text is not overwritten.

You can paste a to-do item and any note (but not its priority) into a todo screen, or into another application, such as the Memo Editor. The to-do item and related note, if any, are pasted into the new location. Selected note text that is copied or cut can also be pasted into another application.

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Copy (F2)</strong></td>
<td>Copies from todo screen a highlighted todo item with any note and pastes it into the Clipboard. Also copies selected note text (press <em>Mark</em> (F3), move cursor) into the Clipboard.</td>
</tr>
<tr>
<td><strong>Cut (F3)</strong></td>
<td>Removes from any todo screen a highlighted todo item and any note and puts it into the Clipboard. Also cuts selected note text and puts it into the Clipboard.</td>
</tr>
<tr>
<td><strong>Paste (F3)</strong></td>
<td>Copies todo item and any note from the Clipboard and pastes it into a highlighted todo field in any todo screen. If the field already contains a todo item, the pasted item is inserted immediately below the existing item and adopts its priority. Nothing is lost. Also copies selected note text from the Clipboard into any note screen at the cursor's position.</td>
</tr>
<tr>
<td><strong>Mark (F3)</strong></td>
<td>Locates the beginning of marked text at the cursor position. Moving the cursor then selects (highlights) text (marked text) for copying or cutting.</td>
</tr>
</tbody>
</table>

The Appointment Book 17-31
Saving an Appointment Book

To avoid losing any unsaved appointments, you must save your appointment book in a file before executing a command, such as [MENU] Quit or [MENU] File Open, that can cause your appointments to be lost. Reasons to execute [MENU] Quit include releasing memory occupied by an open Appointment Book application and executing MS-DOS commands (see "Executing MS-DOS Commands" in chapter 20).

Before you execute a command that could cause loss of appointment book information, the Appointment Book gives you an opportunity to save before executing the command. You may select [MENU] File Save to save your appointment book at any time.

Follow these procedures to save your appointment book for later use in the Appointment Book application. (To save appointments and to-do items for use in another HP 95LX application or in an application outside of the HP 95LX, see "Writing Selected Appointments to an ASCII File" later in this chapter.)

To save an appointment book in a new file:
1. Select [MENU] File Save. You'll see displayed C:\_DIT\*\.ABK with perhaps some file names also displayed.
2. Type a file name (8 characters maximum). File names are case insensitive (A = a). Your first character will replace *. If you type no extension, .ABK will be supplied to identify your file as an appointment book.

To save an appointment book in an existing file:
This procedure assumes you earlier selected [MENU] File Open to open an existing appointment book. After changing it, you follow this procedure to save it in the same file.
- Select [MENU] File Save. You'll see displayed C:\_DIT\filename .ABK, where filename is the existing name of your appointment book file.
- Press [ENTER] to save your file under its existing name.
Opening an Appointment Book

When you open the Appointment Book application, the last appointment book (if any) you saved will be opened automatically. To open another appointment book, use one of the procedures below:

To open an existing appointment book file:

1. Save your current appointment book (if you want to) by following one of the procedures in the earlier section “Saving an Appointment Book.”
3. Highlight the displayed name of the file you want to open and press [ENTER]. If the file you want to open is not displayed, see the procedure below, “To display all file names.”

To display all file names:

After executing [MENU] File Save, [MENU] File Open, or any other file related command, follow this procedure to display all file names in the HP 900LX's C: and A: directories. If necessary, press [ESC] to display the [C:\, D:\, E:\,..., NW prompt.

- To display files in the [D:\AT] directory, type [D:\] and press [ENTER].
- To display all subdirectories and files in the [C:\] directory with the .ATB extension, highlight ...\ and press [ENTER].
- To display all files and subdirectories in the root directory of the hard disk, press [A] (backspace) repeatedly to erase all but [C:\, type [D:\], then press [ENTER].
- To display all files and subdirectories in the root directory of a plug-in card, press [A] (backspace) to erase the entire line, type [D:\, then press [ENTER].
- To display all files in any subdirectory, highlight the subdirectory name (for instance, [D:\PPTS\]), then press [ENTER].

To start another separate appointment book:

1. Save your current appointment book (if you want to) by following one of the procedures in the earlier section “Saving an Appointment Book.”
2. Select **File** menu. If you decide, as step 1 above, not to save your appointment book, you'll see **save changes? (Y/N)**. Press **Y** to lose your appointment book. An empty daily view is displayed.

**Printing Appointments and To-Do Items**

To configure your printer, see “The Printer Configuration Settings” in chapter 21.

The Print Printer command initiates a series of automatically displayed prompts. The responses to those prompts are explained below:

1. Turn on your printer.
2. Select **Print** Printer.
3. Either select Apps to print a set of appointments, or select Todos to print a set of to-do lists.
4. Do one of the following:
   - Select Print Notes to print all associated notes with the appointments or to-do items.
   - Select Without Notes to print only appointments or to-do items and omit notes.
5. Type the date where you want your printout to begin, then press **ENTER**.
6. Type the date where you want your printout to end, then press **ENTER**.
7. Either select One-Day Per Page to print one screen on each page, or select Many-Days Per Page to print continuously on each page. Your printout begins.
Writing Selected Appointments to an ASCII File

Use the Print File procedure below to save appointment book information in an ASCII file when you intend to use that information in another application, either inside or outside the HP 91 LX. See File Save (see “Saving an Appointment Book” earlier in this chapter) when you intend to use that information within the Appointment Book application.

Print File initiates a series of prompts. The responses to these prompts are explained below:

1. Select MENU Print File.
2. Either select Appx to save in a file a set of appointments or select Todos to save in a file a set of to-do lists.
3. Do one of the following:
   ▪ Select Print-Notes to save all associated notes with the appointments or to-do items.
   ▪ Select Without-Notes to save only appointments or to-do items and omit notes.
4. Type the date of the first appointment or to-do item you want saved, then press ENTER.
5. Type the date of the last appointment or to-do item you want saved, then press ENTER.
6. Do one of the following:
   ▪ Select One-Day-Per-Page to include instructions in the file that will cause a future printing to print one screen on each page.
   ▪ Select Many-Days-Per-Page to include instructions in the file that will cause a future printing to print continuously on each page.
7. Do one of the following:
   ▪ Type your choice of file name, plus path and/or extension if you choose, then press ENTER. If you omit an extension, the .TXT extension will be added automatically. Your appointments or to-do items are saved.
   ▪ Highlight a file. To replace the existing file contents, press ENTER. Your appointments or to-do items are saved.
Displaying Current Time in World Cities

The Appointment Book world-time feature allows you to view on one screen the current time and date in any world city and in your local city. You initially choose your local city from a large supplied list of cities and then any world city from the same list. Also, you can add up to eight cities to this list.

Press [MODE 1] from any Appointment Book view or to-do screen to display the watch screen, your window to the world-time feature. This screen is shown below. Press [MODE 1] or [EXIT] to return to the previous Appointment Book screen. Press [RECALL] one or more times to stop any action and return to the previous state. Press [HELP] for assistance.

A brief introductory example is followed by procedures describing in general terms how to select your local and World Cities. Then a keystroke example leads you step by step through the process.

Example: Using the World-Time Feature. You’ve just arrived in Moscow for a business trip. Since you’ll be in Moscow for a week, you’ve made Moscow time your system (clock) time. This means the Moscow appointments you enter into the Appointment Book will be based on Moscow time. You’ve also made Moscow your Local City so the times in other world cities will be relative to Moscow (Local City) time. Since you’ll be communicating with your home office in Atlanta frequently, you’ve made Atlanta your World City.

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It's now 4:15 PM. You need to call your home office in Atlanta, but want to make sure the home office is open. Before you turn your HP 95LX off, you were viewing your watch screen. Here is the one keystroke you perform to check on Atlanta time:

ON

You see that Atlanta time is 5:15 AM. You place your call and complete your business successfully.

Since the watch screen was the last screen displayed when you turned your HP 95LX off, it's the first one you see when you turn it on.

Starting to Use the World-Time Feature

Before you can find the time in other cities, you must define a reference time the world-time feature can use. That reference time is the time in your Local City, the city whose name is displayed on the watch screen. To choose your Local City, follow these steps:

Choosing a Local City from the City List

1. Press WATCH (F3) to display the watch screen if it's not already displayed. The figure above shows the watch screen.
2. Move the cursor to highlight the Local City field. Use 4 and 9.
3. Press CITY (F2) to display the alphabetical city list. The name of the current (highlighted) city displays at the top of the screen with its current, date, and time.
4. Search for a city in your time zone to use as your Local City:
   a. Type the first letter of your city. The first city starting with that letter is highlighted. This letter search is case-insensitive—typing a or A will find the first city starting with a.
   b. Type the second letter of your city. The first city starting with those two letters is highlighted.
   c. Continue spelling your city's name on the keyboard until your city is highlighted. (You can search for your city in other ways. See "Searching for a City" below.)
5. Press ENTER to end the search for your city.
6. If daylight savings time is in effect, press DST (F3). Three things happen:
   - One hour is added to your city's time displayed on the first line.
   - One hour is added to the difference between the time in Greenwich (London), England (Greenwich Mean Time—GMT)

The Appointment Book 17-37
and your local time. This time difference is displayed at the right end of the highlight in the GMT of fast comma.

- DST (daylight savings time) is displayed at the far right of the highlighted city's entry.

7. Press [DATE] to display the watch screen. This places the selected city, today's date, and the current time in the appropriate Local City fields. If local City time is different from system time, a prompt is displayed asking if you want to change the HP 55LX's system time covering all applications to equal Local City time. (System time, that is, clock time, is displayed at the upper-right of most HP 55LX screens.) In most cases you'll want to answer yes (press 2) to that prompt.

8. Respond with either y if you want the HP 55LX's clock changed, or n if you do not want to change the HP 55LX's clock setting.

Searching for a City

There are several reasons to search for a city:

- To display the local date and time in that city.
- To choose a city as your Local City.
- To choose a city in your World City.
- To change the daylight savings-time status of a city. (Note that you can change the daylight savings-time status of your Local and World Cities from the watch screen.)
- To view rapidly all the cities in a certain country.

Here are three ways to search for the city list for a city:

To search for a city by scrolling:

Use the keys described in this table to search for a city.
### Highlight Moving Keys Active in the City Screen

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;</td>
<td>Moves up one line.</td>
</tr>
<tr>
<td>%</td>
<td>Moves down one line.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves to the first entry in the displayed screen.</td>
</tr>
<tr>
<td>END</td>
<td>Moves to the last entry in the displayed screen.</td>
</tr>
<tr>
<td>DEL</td>
<td>Moves up to the next screen.</td>
</tr>
<tr>
<td>INS</td>
<td>Moves down to the next screen.</td>
</tr>
<tr>
<td>CTRL+HOME</td>
<td>Moves to the first entry in the list.</td>
</tr>
<tr>
<td>CTRL+END</td>
<td>Moves to the last entry in the list.</td>
</tr>
</tbody>
</table>

### To search for a city by typing its first letter:

1. Press **City** (F7).
2. Type the first letter (upper- or lowercase) of the city you seek. To type letters not on the keyboard, see "Typing Characters Not on the Keyboard" at the end of this chapter. The highlight moves to the first city in the list that starts with that letter.
3. Type the second letter of the city you seek. The highlight moves to the first city in the list that starts with those two letters.
4. Continue typing letters until the city you seek is highlighted.
5. Press **Enter** to complete the search.

### To search for a city by searching for text:

This method of searching the city list is primarily useful if you want to view rapidly only cities in a certain country.

**Note**
The search will search for text only within fields, not across fields. For instance, it will find "Acapulco" or "Mexico," but not "Acapulco Mexico." Also it will not search for time intervals in the column labelled "Offset."
Choosing a World City from the City List

This procedure selects the World City to be displayed on the watch screen. This city can be your initial World City for your new HP 90LX or a replacement.

1. Highlight the World City field in the watch screen.
2. Press City (F3) to display the city list.
3. Highlight the city you want as your World City. See "Searching for a City" earlier in this chapter.
4. Press (F1) to enter your chosen city into the World City field of the watch screen. The watch screen is displayed and your new world city is highlighted.

Example: Starting the World-Time Feature. In her work, Betsey Harrington often telephones Tokyo from Cambridge, Massachusetts. She's tired of trying to figure Tokyo time in her head.

To remove the confusion about Tokyo time, she decides to use her world-time feature for the first time to make Tokyo her World City. But she knows she must first set her HP 90LX’s system clock and define her Local City. After using "Setting the Date and Time" in chapter 31 to set the HP 90LX’s clock to Boston's Eastern Standard Time, she performs the following steps to define her Local and World Cities.

This example assumes Betsey has never used the watch feature before. You can follow these steps to enter choices for your initial Local and World Cities.

17-40 The Appointment Book
Keys:

\( \text{Starts the Appointment Book.} \)

\( \text{Starts the watch} \) \( \text{accessory and displays the watch screen.} \)

\( \text{Highlights the Local City field.} \)

\( \text{Displays the city list. Betty is ready to select her local city. She wants to select Boston, Massachusetts} \) \( \text{since both Cambridge and Boston are in the same time zone and follow the same daylight savings time schedule.} \)

\( \text{Now Betty will search the city list for Boston by starting to spell "Boston" on the keyboard. (She could use either lower-} \) \( \text{or uppercase letters.)} \)

\( \text{Types b, The first city starting with b, Baghdad, is highlighted.} \)

\( \text{Types c, The first city starting with bc, Bogota, is highlighted.} \)

\( \text{Types s, The first city starting with bos, Boston, is highlighted.} \)

\( \text{Ends the search.} \)

\( \text{Selects Boston as her Local City and displays the watch screen.} \)

The Appointment Book 17-41
Her watch screen now looks like this:

Keys:

- **T**: Highlight "World City" in the watch screen.
- **CITY**: Displays the city list.
- **[ ]** to **[ ]**: Types a and 0 to highlight Tokyo, then ends the search.
- **ENT**: Selects Tokyo as her World City and displays the watch screen, which now looks like this:

---

'7-42 The Appointment Book
Now that Battery has selected Boston and Tokyo as her local and world cities, she can see by glancing at the watch screen the current time in both cities. She can also easily display the current time in any of the cities in the city list. All she needs to do is highlight that city in the list and see the time on the first line of the screen.

**Adding a City to the City List**

By using this procedure repeatedly, you may add up to eight cities to the list. Since you can add duplicate cities, check the city list first to avoid an unwanted duplication.

1. Press `City` (24) from the watch screen (either Local City or World City must be highlighted for the `City` function key to appear).
2. Press `Import` (23) to display the insert city screen.
3. Type the city name, then press `Enter` (36). To type letters not on the keyboard, see "Typing Characters Not on the Keyboard" later in this chapter.
4. Type the country name, then press `Enter`.
5. Press `1` to highlight the system time field. (You could, instead, enter a GMT offset, but it's generally easier to determine a system time offset to enter than a Greenwich Mean Time offset.)
6. Type the time difference: local time minus system time (system time is that displayed in the upper-right corner of your screen).
7. Press `Enter`. The GMT is automatically entered based on the city's system time.
8. Press `Done` (15). The city list is displayed with the name of your added city highlighted. An asterisk (*) to the left of the city name indicates it as user-defined.

**Example: Adding a City to the City List as a New Local City.**

Pressing keys in this example will give the results shown if you've just finished the previous example, or if the following are both true:

- The current Local City in your HP 95LX is now Boston or another Eastern Standard Time zone city.
- Your system time—the time displayed in the upper-right corner of your screen—is the same as your current Local City time.

Helen Assisted has just moved from Boston to Pullman, Washington. She wants to change her Local City to her new home town, but finds that Pullman is not in the city list. She could use Seattle as her Local City instead.

The Appointments Book 17-43
City (it's in the same time zone as Pullman), but wants Pullman to display on her watch screen. The following steps show how she adds Pullman to the city list, then makes Pullman her new Local City. She starts from an Appointment Book screen.

**Keys:**

**Watch**
- Displays the watch screen.

**City**
- Displays the city list.

**Enter**
- Displays the insert city screen.

**Pullman**
- Types and enters her new local city's name. The country field is highlighted.

**United States**
- Types and enters the country's name. The Offset, GMT field is highlighted.

**v**
- Moves the highlight to the offset, system time field.

**-1**

**Done**
- Adds Pullman to the city list. The city list is displayed and Pullman is highlighted.

---

### City Offset Table

<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pingtung</td>
<td>North Korea</td>
<td>+0800</td>
</tr>
<tr>
<td>Quito</td>
<td>Ecuador</td>
<td>+0500</td>
</tr>
<tr>
<td>Regina</td>
<td>Canada</td>
<td>-0600</td>
</tr>
<tr>
<td>Reykjavik</td>
<td>Iceland</td>
<td>-0100</td>
</tr>
<tr>
<td>Rio De Janeiro</td>
<td>Brazil</td>
<td>-0311</td>
</tr>
<tr>
<td>Riyadh</td>
<td>Saudi Arabia</td>
<td>-0300</td>
</tr>
<tr>
<td>Richmond</td>
<td>Virginia</td>
<td>-0500</td>
</tr>
<tr>
<td>Saint John</td>
<td>Canada</td>
<td>-0400</td>
</tr>
</tbody>
</table>

---

17.44 The Appointment Book
Changign Daylight Savings Time for Your Local City

You need to tell the world-time feature when daylight savings time starts or stops in your Local City.

To make a one-hour daylight savings time change:

1. Highlight the Local City on the watch screen.
2. Press DST. A prompt asks if you want to change the HP 95LX's clock to the displayed new time.
3. Type y to make the change. Two displayed times (and dates if necessary) on the watch screen change. These are system time in the upper right corner and Local City time.

Example: Changing the HP 95LX's Clock to Daylight Savings Time. Daylight savings time has come to Pullman, Washington. To change HP 95LX's clock to reflect this time change, Helen Ansted performs the following steps, starting from an Appointment Book screen:

Keys: Description:
Watch Displays the watch screen.
1/2/3 Highlights Helen's home city, Pullman.
DST A prompt offers to change the HP 95LX's clock.
y The HP 95LX's system clock and Local City time is now set for daylight savings time.

The Appointment Book 17:45
Viewing a City's Current Date and Time

The watch screen shows the current time for your Local City and your World City. To view the current time in any city in the city list:

1. Highlight the Local City or World City field to display the City label.
2. Press CITY [(] to display the city list.
3. Search the list for the city you seek. See the earlier section “Searching for a City.”
4. Highlight the city you seek. That city's current date and time will be displayed on the first line of your screen.

Changing Your Local City

1. Highlight the Local City field in the watch screen.
2. Press CITY [)] to display the city list.
3. Search for a city in the proper time zone to use as your new Local City. See “Searching for a City” earlier in this chapter.
4. Press ENTER to change your Local City.
5. If the new city time is different from the old, you're asked if you want to change the system date and time for all applications throughout the HP-81LA. Either press y to change the system date and time or press n to leave system date and time unchanged.

Deleting a City You’ve Entered

Only cities you’ve entered into the city list (marked with *) can be deleted.

1. Highlight the Local City or World City field to display the City label.
2. Press CITY [)] to display the city list.
3. Highlight the city you want to delete.
4. Press DEL ([])
5. Either press y to delete the city or press z to cancel the delete operation.
Editing a City's Listing

Only cities you've entered into the city list can be changed. Since you cannot type in the city list, to change a listing:

1. Delete the listing following the procedure directly above
2. Re-enter the listing with the changes you want. See the earlier section "Adding a City to the City List."

Using the Stopwatch and Countdown Timer

Using the Stopwatch

1. To start the stopwatch, display the watch screen, highlight "Stopwatch", then press [Start]. It continues to run after you leave the Appointment Book and while the HP 95LX is turned off. When it reaches 24 hours, it resets to zero and continues to run.
2. To stop it, press [Stop].
3. To reset and stop it, or to reset it after pressing [Stop], press [Reset].

Using the Countdown Timer

You can use the countdown timer to sound an alarm at a specified time interval within the next 24 hours and to display a note. If you don't specify a note, the HP 95LX will display The timer has expired.

To start the Timer and write an optional note:

2. Press 1 to move the highlight to the Timer field.
3. Type the time interval between now and the time you want the alarm to sound. For example, enter 3 hours as 3 and 5 minutes as @3:05, @@5, etc. The minimum time interval is 1 minute, the maximum 24 hours.
4. Do one of the following:
Move the highlight to the note field, type a note, and press START (ES) to begin the countdown.

Press START (ES) to begin the countdown without typing a note.

The Timer continues to run after you leave the Appointment Book and while the HP 95LX is turned off.

To turn off the alarm before it turns on:
Press STOP (PB).

To turn off the alarm after it turns on:
Press ESC to stop the alarm and clear the note.

To respond to an expired alarm:
The alarm sounds for 10 seconds, and the note displays for 5 minutes. At that time, the HP 95LX’s display turns off.
1. Press ON to turn the HP 95LX on if you found it turned off.
2. Press ESC to clear the note, turn off the alarm, and display the Timer screen.

To see the time interval since the alarm went off:
The Remaining field shows the time interval (maximum – 21 hours) since the alarm sounded.

To control the alarm sound:

Note

Settings Alarm affects the alarm in both the watch and appointment book.

1. Press ESC or Set (SE) to display an appointment book screen.
2. Select SETS Alarm.
3. Select either Enable (alarm will sound) or Disable (alarm will not sound).

17.48 The Appointment Book
Typing Tools

Using User Keys
Any of the ten function keys (F1 through F10) can be assigned a sequential group of keystrokes which can then be executed ("pressed") by pressing (F10) simultaneously with that function key. This is one way a segment of text or a commonly executed command can be stored and used as needed. For more information, see "Creating and Using User Keys" in chapter 21.

Typing Characters Not on the Keyboard
The compose function is used to create international characters and other characters you cannot enter directly from the keyboard. A particular special character is created by pressing (COMPOUND) followed by one or two specific alphanumeric keys. For information on compose sequences, see appendix F, "Lotus International Character Set."
The Phone Book enables you to enter names, phone numbers, and other information (such as addresses), which are alphabetized by name automatically.

- You can search for phone numbers and other information in several ways.
- You can create and use multiple phone books.
- You can save and print selected records or entire phone books.

To open the Phone Book, press ( ). To leave the Phone Book, select (MENU) Quit. To display a help screen, press (Help: (F1)). If pressing (MENU) produces no menu, press (ESC) and try again.

Names and phone numbers are displayed as single-line entries in an index screen (see the figure below). Additional information like an address (plus the name and phone number) are displayed in a card screen (see the second figure). Each index entry has a separate card screen associated with it, and together they make up one record. To move between index and card screens, press Card: (F2) or Enter from an index screen and Index: (F1) or ESC from a card screen.
Starting a New Phone Book

1. Press [2] to start the Phone Book and display an index screen.
   - If this index screen contains no entries, your new phone book has
     started.
   - If the index screen contains phone book entries, save your current
     phone book, if you want to, by performing one of the procedures in
     the later section “Saving a Phone Book.”
   - If you do not want to save your current phone book, select
     (MENU) File New and press N when you see the message “Save
     changes? (Y/N).” Your new phone book has started.

Note

Before you leave the Phone Book, save your file (see “Saving Phone Book Records” later in this chapter). Otherwise, the Phone Book copy and the disk copy (if any) may not match. Later operations or that disk file from the File (printing, viewing, transferring to a PC, etc.) would be performed on an out-of-date copy.
Example: Opening, Using, and Leaving the Phone Book. In this example, you'll add three name and phone number records to your new phone book, add an address to one record, and delete one record. Then you'll leave the Phone Book application.

**Keys:**
- **Insert**
- **Clear**
- **(555) 865-1234**
- **406 Eln St.**
- **NY 11111**

**Description:**
- **Insert**
  - Starts the Phone Book application and displays an empty index screen.
  - Displays the insert card screen.
- **Clear**
  - Enters the name. Erase any errors with the backspace key (Clear). The highlight moves to the number field.
- **(555) 865-1234**
  - Enters Jack's phone number. The highlight moves down to the address field.
- **406 Eln St.**
  - Enter Jack's address. Use Clear and Insert to make any corrections.
- **NY 11111**
  - Enter Jack's address. Use Clear and Insert to make any corrections.

Your screen should look like this:

```
Insert card: Enter the address
Name: Peters, Jack
Number: (555) 865-1234
Address: 406 Eln St.
Gotham City, NY 11111
```

The Phone Book 18-3
Your screen should now look like this

Keys: Insert

**Description:**
Displays the insert card screen. You're now ready to add the second name to your phone book.

Sayam’s Diaper Service
(555) 759-2345

**Description:**
Enter the diaper service's name and phone number into the insert screen. The prompt invites you to add an address.

**Description:**
Saves your second name and displays an empty insert card screen.
Entrys Mary's name and phone number into the insert card screen. You decide not to add Mary's address.

Displays the index screen.

Your screen should now look like the first figure in this chapter.

Now you'll delete the record for Shyan's Diaper Service.

Moves the cursor down two lines to highlight "Shyan's Diaper Service."

Deletes the highlighted record from your phone book.

Quits the Phone Book. You're asked if you wish to save the current phone book.

You decide to quit without saving. To save a phone book, see "Saving A Phone Book" later in this chapter.

Resumes the Phone Book application.

To enter a record into the phone book:

See the following table for descriptions of editing and cursor-moving keys you can use when entering records and using your phone book. Also, see "Typing Tools" later in this chapter for more editing information.

1. Press \( \text{MEM} \) if necessary, to open the Phone Book.
2. Press \( \text{ENT} \) to display an insert card screen.
3. Type a name, last name first, and press \( \text{ENT} \).
4. Type a phone number and press \( \text{ENT} \).
5. Type optional information in the address field, such as an address. Lines wrap automatically.
6. Do one of the following:
- Press **[F2]** to enter the record into the phone book and return to the index screen.
- Press **[F4]** to enter the record into the phone book and display a blank insert card screen.
- Press **[ESC]** to return to the index screen without entering the card text you've just typed.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;</td>
<td>Moves left one character.</td>
</tr>
<tr>
<td>&gt;</td>
<td>Moves right one character.</td>
</tr>
<tr>
<td>↑</td>
<td>Moves up one line within a field or up to the previous field.</td>
</tr>
<tr>
<td>↓</td>
<td>Moves down one line within a field or down to the next field.</td>
</tr>
<tr>
<td>0</td>
<td>Moves left one space, deleting as it moves.</td>
</tr>
<tr>
<td>DEL</td>
<td>Deletes the character.</td>
</tr>
<tr>
<td>[CLR] [ENTER]</td>
<td>Deletes to the end of the line.</td>
</tr>
<tr>
<td>[INS]</td>
<td>Moves to first character in previous word.</td>
</tr>
<tr>
<td>[DEL]</td>
<td>Moves to first character in next word.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves to the beginning of the line.</td>
</tr>
<tr>
<td>END</td>
<td>Moves to the end of the line.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Adds a carriage return and moves to the next line in a multi-line field, or completes an entry and moves to the next field.</td>
</tr>
<tr>
<td>1</td>
<td>Moves down to the next field.</td>
</tr>
<tr>
<td>PG UP</td>
<td>Moves to the previous card screen.</td>
</tr>
<tr>
<td>PG DN</td>
<td>Moves to the next card screen.</td>
</tr>
<tr>
<td>END</td>
<td>Ends editing the current field and restores its previous contents, or returns to the index.</td>
</tr>
</tbody>
</table>

To delete a record from the phone book:

In the index screen, highlight the record you wish to delete and press **[Del]**.
Saving A Phone Book

To avoid losing any unsaved phone book records, you must save your phone book in a file before executing a command, such as [FIND] Quit or [MENU] File Open, that can cause your records to be lost. Resets to execute [MENU] Quit include releasing memory occupied by an open Phone Book application and executing MS-DOS commands (see "Executing MS-DOS Commands" in chapter 20).

Before you execute a command that could cause loss of phone book information, the Phone Book gives you an opportunity to save before executing the command. You may select [MENU] File Save to save your phone book at any time.

Follow these procedures to save your phone book for later use in the Phone Book application. Phone books are saved as ASCII files. (To save phone book records for use in another WP 90XL application or outside the WP 90XL, see "Writing Phone Book Records to an ASCII File" later in this chapter.)

To save a phone book in a new file:

1. Select [MENU] File Save. You'll see displayed \_OS\&.*PBK.
2. Type a file name (8 characters maximum). File names are case insensitive (A = a). Your first character will replace *. If you do not type an extension, .PBK will be supplied to identify your file as a phone book.

To save a phone book in an existing file:

This procedure assumes you earlier selected [MENU] File Open to open an existing phone book. After changing it, you follow this procedure to save it in the same file.

- Select [MENU] File Save. You'll see displayed \_OS\& file name. PBK where file name is the existing name of your phone book file.
- Press [ENTER] to save your file under its existing name.
Using a Phone Book

Finding information
Finding information means finding the record that contains that information. To find that record, search for any information on that record. For instance, you can find a company’s fax number by searching for its phone number. Knowing a person’s name allows you to find his phone number. If you’ve forgotten a company’s name and knew only that it’s located in Tulsa, look at the Tulsa cards and you’ll probably recognize the company.

There are three ways to find phone book information:

* by scrolling,
* by searching alphabetically (find one card containing Smith by searching for s, then s, then i, etc.),
* by searching for text (find one card containing Smith or all cards containing Tulsa).

To search by scrolling:
You can scroll through index screens for a name or phone number by using the following keys.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Moves highlight up one line.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Moves highlight down one line.</strong></td>
</tr>
<tr>
<td>BACK</td>
<td><strong>Moves highlight to the first record in the index.</strong></td>
</tr>
<tr>
<td>FIND</td>
<td><strong>Moves highlight to the last record in the index.</strong></td>
</tr>
<tr>
<td>PG UP</td>
<td><strong>Moves highlight up one page.</strong></td>
</tr>
<tr>
<td>PG DN</td>
<td><strong>Moves highlight down one page.</strong></td>
</tr>
</tbody>
</table>

18-8 The Phone Book
To search the index screen alphabetically:

The alphabetic search routine described here is case insensitive. You can find "Brown" by searching for "brown" or "Brown," for instance.

1. Press Index (F3), if necessary, to display the index screen.
2. Type the first letter of the name associated with the information you seek. (You can press Goto (F3) first, then type the letter.) The first name in the phone book starting with that letter is highlighted in the index screen.
3. Type the second letter of the name. The first name starting with those two letters is highlighted.
4. Repeat these steps as necessary.
5. Press Enter to complete the search. If the information you want appears only in the card screen, press Enter to display the card screen.

To search for one or more occurrences of a specified text:

1. Press Find (F7) from either a card or an index screen.
2. Type the text you seek, 30 characters maximum. The search is case insensitive, so you can use all lowercase letters if you want.
3. Press Enter, Prev (F5), or Next (F7) to begin searching the entire phone book.

Enter and Next start the search at the next record and search towards the end of the phone book. Prev starts at the previous record and searches towards the beginning. Regardless of search direction, the search continues until a match is found or until the entire phone book is searched. Wildcard characters (*) are not recognized (for information about wildcard characters, see appendix B).

**Note**

If the search began from an index view, and if the search is successful, the record containing the text will be highlighted in the index view. You may have to press Card (F6) to see the text you seek.

After a successful search, press Find (F7), then press Enter, Prev (F5), or Next (F7) again to search for the next occurrence of your text.

The Phone Book 16-9
To search for all occurrences of a specified text:

1. Press [F4] (Search) from an index screen.
2. Type the text (20 characters maximum) you’re searching for. The search is case insensitive.
3. Press [ENTER]. The search begins with the first record. All records whose cards contain that text, if any, are displayed as a temporary list in an index screen.
4. Save none or all of these records, if you want, by using [F9] (Save) as described in “To create a smaller phone book from an existing phone book” later in this chapter.
5. Press [F1] (View), then [ENTER] to display the entire phone book again.

If a new record is added using the insert screen while the temporary list created with [F4] is displayed, that record will be added to the phone book that was searched to produce this collection. This new record will be displayed in this temporary index list only if it contains the search text.

Editing a Phone Book Record

You can change any information in a record by displaying its card screen (press [ENTER] or [ESC] from the index screen), then making your changes with the help of the keys described in the earlier table “Editing and Cursor-Moving Keys Active in the Card Screen.”

Working with Multiple Phone Books

You can create another phone book related to an existing phone book. You can also create a new phone book that contains a selection of records from an existing phone book. Two phone books might be useful, for instance, where one contains records of friends and relatives and another is devoted to companies and people important to your work.
To start another separate phone book:
1. Save your current phone book (if you want to) by following one of the procedures in the earlier section "Saving A Phone Book."

To open an existing phone book file:
When you open the Phone Book application, the last phone book (if any) you saved will be opened automatically. To open another phone book, use this procedure:
1. Save your current phone book (if you want to) by following one of the procedures in the earlier section "Saving a Phone Book."
2. Select [MENU] File Open. If you decided, in step 1 above, not to save your phone book, you'll see Replace file without saving? (Y/N). Press Y to lose your phone book or your recent changes.
3. Highlight the displayed name of the file you want to open and press [ENTER]. If the file you want to open is not displayed, see the procedure below, "To display all file names."

To display all file names:
After executing [MENU] File Save, [MENU] File Open, or any other file related command, follow this procedure to display all file names in the BP 9600's C: and A: directories.
- To display files in the .DATA directory, type *.s and press [ENTER].
- To display all subdirectories and files in the C:\ directory with the .PBK extension, highlight \*\* and press [ENTER].
- To display all files and subdirectories in the root directory of the RAM disk, press [BACKSPACE] repeatedly to erase all but C:\, type *.s, then press [ENTER].
- To display all files in the root directory of a plug-in card, press [BACKSPACE] to erase the entire line, type \*\* or \*\*, then press [ENTER].
- To display all files in any subdirectory, highlight the subdirectory name (for instance, BOOKS\), then press [ENTER].
To create a smaller phone book from an existing phone book:

1. Highlight the index entry of a record you want to save. See the earlier section “To Search by Scrolling” for highlight moving keys.
2. Press F3 ([F3]) to identify the record as one you want to include in the new phone book. (To untag a highlighted record, press F3 ([F3]) again.) The tagged file is identified by a small diamond in the left margin.
3. Repeat the steps above to tag any other records you want saved in the same new phone book. (To untag all tagged records, press Alt F3 ([Alt]+[F3]).)
4. Select [MENU] File Exit. You’ll see displayed C:\_DATA +. PBK with perhaps some file names also displayed.
5. Do one of the following:
   - Type a file name (8 characters maximum). File names are case sensitive (A = a). Your first character will replace $, if you do not type an extension. .PBK will be supplied to identify your file as a phone book. Then press Enter.
   - Highlight one of the displayed file names (if any) and press Enter. The contents of that file will be replaced with your phone book. If the file name you want is not displayed, see the earlier procedure, “To display all file names.”

Printing Phone Book Records

You can print one, none, or all phone book records (index entries or card screens) on your configured printer. For information about configuring a printer for use with the EP 931X, see “The Printer Configuration Settings” in chapter 21.

Before printing, ensure that your printer is turned on.

To print one record:

1. Highlight the index screen entry of the record you want to print.
2. Select [MENU] Print Printer.
3. Do one of the following:
   - Select One Index to print the highlighted record’s index entry.
   - Select One Card to print the highlighted record in card format.
To print several records:
1. Highlight and tag (press [Tag]) each index-screen entry whose record you want to print.
2. Select [Print] Print Printer.
3. Do one of the following:
   - Select Tagged Index to print all tagged index-screen entries.
   - Select Tagged Card to print the tagged records in card format.

The All command used to print a phone book is not affected by tagged items or by the Only command ([Glue] [Print]).

To print a phone book:
1. Display an index screen of the phone book you want to print.
2. Select [Print] Print Printer.
3. Do one of the following:
   - Select All Index to print all phone book index entries.
   - Select All Card to print all phone book card screens.

Writing Phone Book Records to an ASCII File

You can save one, some, or all phone book records (index entries or card screens) in an ASCII file using Print File. You can save your complete phone book using File Save.

Use one of the following Print File procedures when you intend to use one or more phone book records in another application, either inside or outside the HP 917X. Use File Save (see “Saving Phone Book Records” earlier in this chapter) when you intend to use the phone book within the Phone Book application.

To write one record to an ASCII File:
1. Highlight the index-screen entry of the record you want to write to a file.
2. Select [Print] Print File.
3. Do one of the following:
   - Select One Index to write the record in index format to a file.
   - Select One Card to write the record in card format to a file.
4. Do one of the following:
   a. Type a file name (8 characters maximum). You can use either upper- or lowercase letters. Your first character will replace . If you type no extension, .TXT will be supplied to identify your file as a Phone Book file. Then press (ENTER).
   b. Highlight a displayed file name and press (ENTER).
   c. Display another file name (see the procedure earlier in this chapter, "To display all the names"). Highlight a file name, then press (ENTER).

To write several records to an ASCII File:

1. Highlight and tag (press (TAQ) (Gi)) each index-screen entry whose record you want to write.
2. Select (PRINT) Print File.
3. Do one of the following:
   a. Select Tagged Index to write to a file all tagged records in index format.
   b. Select Tagged Card to write to a file all tagged records in card format.
4. Do one of the following:
   a. Type a file name (8 characters maximum). You can use either upper- or lowercase letters. Your first character will replace . If you type no extension, .TXT will be supplied to identify your file as a Phone Book file. Then press (ENTER).
   b. Highlight a displayed file name and press (ENTER).
   c. Display another file name (see the procedure earlier in this chapter, "To display all the names"). Highlight a file name, then press (ENTER).

To write a phone book to an ASCII File:

The All command used in this procedure is not affected by tagged items or by the (GIRV) command.

1. Display an index screen of the phone book you want to write to a file.
2. Select (PRINT) Print File.
3. Do one of the following:
   a. Select All Index to write to a file all records in index format.
   b. Select All Card to write to a file all records in card format.
4. Do one of the following:
- Type a file name (8 characters maximum). You can use either upper- or lowercase letters. Your first character will replace *. If you type no extension, .TXT will be supplied to identify your file as a Phone Book file. Then press ENTER.
- Highlight a displayed file name and press ENTER.
- Display another file name (see the procedure earlier in this chapter, "To display all file names"), highlight a file name, then press ENTER.

## Typing Tools

### Using the Clipboard in the Phone Book

The keys you use to copy, move, and delete phone book records are shown in this table. (A record consists of all the information on a card.) The Clipboard is the special storage location used by the keys described in the following table. A phone book entry can be pasted into a memo or into notes of either to-do items or appointments.

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPY (F2)</td>
<td>Copies the highlighted record to the Clipboard.</td>
</tr>
<tr>
<td>CUT (F3)</td>
<td>Removes the highlighted record and stores it in the Clipboard.</td>
</tr>
<tr>
<td>PASTE (F4)</td>
<td>Inserts Clipboard contents in the current phone book. The record will be placed in the proper sort order.</td>
</tr>
</tbody>
</table>

The Phone Book 16-15
Using User Keys

Any of the ten function keys (F1 through F10) can be assigned a sequential group of keystrokes which can then be executed ("pressed") by pressing (CHAR) simultaneously with that function key. This is one way to execute often used commands and/or insert segments of text, such as an address, where needed. For more information, see "Creating and Using User Keys" in chapter 21.

Typing Characters Not on the Keyboard

The compose function is used to create international characters and other characters you cannot enter directly from the keyboard. A particular special character is created by pressing (CHAR) (CTRL) (F1) followed by one or two specific alphanumeric keys. For information on compose sequences, see appendix F.
The Memo Editor enables you to write or edit memos, letters, and other documents. It also enables you to print documents and save them on disk.

To open the Memo Editor, press (F8). To cancel commands, press (ESC) one or more times. For help, press (HELP) anytime. To exit the Memo Editor, select (QUIT) Quit. If pressing (ESC) causes a beep, press (ESC) and try again.

Note

Before you leave the Memo Editor, save your document (see "Saving a Document" later in this chapter). Otherwise, the Memo Editor copy and the disk copy (if any) may not match. Later operations on that disk file from the File (printing, viewing, transferring to a PC, etc.) would be performed on an out-of-date copy.
Starting a New Document

Press <Enter> to start the Memo Editor. If the screen contains text, and you wish to save it, see "Saving a Document" later in this chapter. Then select [MENU] File New to display a blank memo screen. Type your document, using the resources described in "Writing Tools" later in this chapter.

When you start typing, the modified-since-last-saved indicator (*) displays at the left end of the second line (just above the double line), either by itself or following the document's file name.

Example: Writing a Memo. In this example, you'll type a memo, then make a correction.

1. Press <Enter> to start the Memo Editor.
2. If the screen contains text, follow the instructions in the above section, "Starting a New Document."
3. Press <ESC> (press <Esc>), if necessary, to put the Editor into insert mode. Insert mode is indicated by Ins displayed in the middle of the second line on your screen. Ins toggles between insert and overwrite (Over) modes.
4. Type the following note to Jason: To correct errors and move around the screen, use [A] [V] [D] [T], [N], and [B] (backspace). As you type, lines wrap automatically, so you need to press [Enter] only when you end a line before wrapping occurs (for instance, to start a new paragraph or to insert a blank line). When you press [Enter], a line termination mark (©) is displayed. This mark does not appear in printed memos.

Jason:

Our group has been invited to go skydiving with Hawkeye Henschel or mountain climbing with Stan ("because it’s there") Blasnow. Both activities would start the same day. Give me a call and let me know what activity you’d prefer.

Marc

5. Replace "the same day" with "next May 20" by performing the following steps:
   a. Use [A] [V] [B], and [C] to position the cursor on the t of the.
c. Move the cursor to the y of day to highlight the text to be removed.
d. Press [Cut] (3).
c. Type "next May 20" to complete the correction.

Your screen should now look like the figure below.

To delete this example, select [Menu] File New and type k in response to the prompt. To save it, see "Saving a document" later in this chapter.

Opening a Document File

To open a new document file:
1. Save your current document (if you want to) by following one of the procedures in the following section "Saving A Document."
2. Select [Menu] File New. If you decided, at step 1 above, not to save your document, you'll see Save changes? (Y/N). Press N to lose your document or your recent changes. An empty menu screen is displayed.
To open an existing document file:
1. Save your current document (if you want to) by following one of the procedures in the section below, "Saving a Document."
2. Select [MENU] File Open. If you decided, in step 1 above, not to save your document, you'll see Replace file without saving? (Y/N). Press Y to lose your document or your recent changes.
3. Highlight the displayed name of the file you want to open and press [ENTER]. If the file you want to open is not displayed, see the procedure below, "To display all file names."

To display all file names:

After executing [MENU] File Open, [MENU] File Save, or any other file related command, follow this procedure to display all file names in the HP 95LX's C: and A: directories.

- To display files in the .25T directory, type *.* and press [ENTER].
- To display all subdirectories and files in the C: directory with the .TXT extension, highlight .. and press [ENTER].
- To display all files in the root directory of the RAM disk, press [ (backspace) repeatedly to erase all but .., type .., then press [ENTER].
- To display all files in the root directory of a plug-in card, press [ (backspace) to erase the entire line, type .., then press [ENTER].
- To display all files in any subdirectory, highlight the subdirectory name (for instance, MEMOS\), then press [ENTER].

Saving a Document

To avoid losing any unsaved document or document changes, you must save it in a file before executing a command, such as [MENU] Quit or [MENU] File Open, that can cause your document or changes to be lost. Reasons to execute [MENU] Quit include releasing temporary occupied by an open Memo Editor application and executing MS-DOS commands (see "Executing MS-DOS Commands" in chapter 26).

Before you execute a command that could cause loss of all or part of a document, the Memo Editor gives you an opportunity to save before
executing the command. You may select **FILE** File Save to save your document at any time.

Follow these procedures to save an ASCII file all or part of a document for later use in the Memo Editor. (To save a document for use in an application outside of the HP-GLX, see "Writing a Document to an ASCII File" later in this chapter.)

**To save an entire document in a new file:**

1. Select **FILE** File Save. You'll see displayed C:\_DRT\-, TXT with perhaps some file names also displayed.
2. Type a file name (8 characters maximum). File names are case insensitive (A = a). Your first character will replace _. If you do not type an extension, .TXT will be supplied to identify your file as a memo editor document.
3. Press **ENTER** to save your document.

**To save part of a document in a new file:**

1. Move the cursor to the beginning of the part you want to save.
2. Press **MARK** (F3). The mark indicator (brk) displays on the second line.
3. Move the cursor to expand the highlight to cover all the text you want to save.
4. Follow either the procedure above, "To save an entire document in a new file" or the procedure below, "To save all or part of a document in an existing file." The save operation clears the highlight from the marked text.

**To save all or part of a document in an existing file:**

This procedure assumes you selected **FILE** File Open to open an existing document. After revising it, follow this procedure to save it in the same file.

- Select **FILE** File Save to save your file (or the marked portion of your file—see "To save part of a document in a new file" above). You'll see displayed C:\_DRT\_ filename .TXT where filename is the existing name of your file.
- Press **ENTER** to save your file under its existing name.
## Writing Tools

### Editing Keys

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ctrl</strong> C</td>
<td>Moves left one character.</td>
</tr>
<tr>
<td><strong>Ctrl</strong> D</td>
<td>Moves right one character.</td>
</tr>
<tr>
<td><strong>A</strong></td>
<td>Moves up one line.</td>
</tr>
<tr>
<td><strong>Y</strong></td>
<td>Moves down one line.</td>
</tr>
<tr>
<td><strong>Backspace</strong></td>
<td>Backspace—moves left one space deleting the previous character.</td>
</tr>
<tr>
<td><strong>Ctrl</strong> P</td>
<td>Moves to the beginning of the previous word.</td>
</tr>
<tr>
<td><strong>Ctrl</strong> J</td>
<td>Moves to the beginning of the next word.</td>
</tr>
<tr>
<td><strong>Home</strong></td>
<td>Moves to the beginning of the current line.</td>
</tr>
<tr>
<td><strong>Ctrl</strong> H</td>
<td>Moves to the end of the current line.</td>
</tr>
<tr>
<td><strong>Ctrl</strong> E</td>
<td>Moves to the end of the file.</td>
</tr>
<tr>
<td><strong>Del</strong></td>
<td>Deletes the current character.</td>
</tr>
<tr>
<td><strong>Ins</strong></td>
<td>Inserts a carriage-return to end the current line and moves to the first column of the next line.</td>
</tr>
<tr>
<td><strong>End</strong></td>
<td>Toggles between insert and overwrite modes.</td>
</tr>
<tr>
<td><strong>Page Up</strong></td>
<td>Moves up one page.</td>
</tr>
<tr>
<td><strong>Page Down</strong></td>
<td>Moves down one page.</td>
</tr>
<tr>
<td><strong>Insert</strong></td>
<td>Inserts a tab character (insert mode) or replaces the current character with a tab character (overwrite mode), then moves text right to the next tab stop.</td>
</tr>
</tbody>
</table>

---

13.6 The Memo Editor
Inserting/Overwriting Characters

The [ ] key toggles between insert and overwrite modes. The status indicators Inc and Over displayed at the center of the second line on your screen indicate which mode is active.

In insert mode, the next character typed will be inserted before the current cursor position. In overwrite mode, the next character typed will be typed at the current cursor position, overwriting any character at that position.

Setting Tabs

You can set tabs at intervals from 1 to 90 characters. When you quit the Memo Editor, the tab setting is preserved, even if the current file is not saved.

1. Select [MENU] Settings Tabs. The current tab setting displays in the prompt and in the memo settings sheet.
2. To change from the default interval of 5, type an interval between 1 and 90, then press [ENTER]. A tab marker, spaced at the interval you set, appears on the double-line border separating the second and fourth lines on the screen (the double line border is the third line). The memo settings sheet is also updated.

Setting the Screen’s Right Margin

Your HP 96LX is delivered with the right margin (the wrap margin for the screen) set at 40 characters, the width of your screen. You can adjust the right margin between 40 and 260 characters to accommodate files transferred to the HP 96LX from a personal computer or other source. The right margin set with this procedure affects printing only when marked text is printed. See “Printing a Document” near the end of this chapter. To display characters beyond 40 characters when the right margin is greater than 40, scroll to the right (move characters to the left) by using [ ] and [ ]. To scroll to the left, use [ ] and [ ].

When you quit the Memo Editor, the right margin setting is preserved, even if the current file is not saved.
To specify the screen's right margin:

1. Select Options > Settings > Wrap. The current right margin displays in the prompt and in the menu settings sheet.
2. Type a number from 40 to 290, then press Enter. The prompt and settings sheet show the new right margin.

The number of characters in a line includes trailing spaces and tabs. So you might see a word moved to the next line even though the last character of that word does not exceed the margin you set.

Highlighting Text:

Various operations (copying, moving, and deleting text) using part of a document) require text to be highlighted. To highlight text:

1. Move the cursor to the first character of the text to be highlighted.
2. Press Mark (F2) to anchor the start of the highlight. The mark indicator (M) displays on the second line of your screen.
3. Move the cursor to expand the highlight to cover all the text you want to save.

Copying, Moving, and Deleting Text

The text rearranging keys are shown in this table.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy (F2)</td>
<td>Copies highlighted text to the Clipboard.</td>
</tr>
<tr>
<td>Cut (F2)</td>
<td>Removes highlighted text from the screen and stores it in the Clipboard.</td>
</tr>
<tr>
<td>Paste (F2)</td>
<td>Inserts text from the Clipboard at the current cursor position, and moves existing text to the right.</td>
</tr>
<tr>
<td>Mark (F2)</td>
<td>Toggles text-marking on and off.</td>
</tr>
</tbody>
</table>

A move operation consists of a cut followed by a paste. A copy operation consists of a copy followed by a paste. A cut or copy operation stores the highlighted text in the Clipboard, a special storage location. Since a paste operation pastes a copy of the

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Clipboard contents to your chosen destination, that text can be pasted repeatedly to various HP 95LX applications and locations.

To move or copy text to another location in the same file:

1. Highlight the text to be moved or copied. Set “Highlighting Text” earlier in this chapter.
2. Press [Copy] if you are copying text, or press [Cut] if you are moving text. Tabs are stored as the Clipboard as tab characters, not as stop settings. The copy or cut operation turns off mark mode.
3. Move the cursor to the location in your document where you want the selected text placed.
4. Press [Paste] (F3). Tab characters are spaced according to the tab stops on the destination screen.

To delete text:

1. Highlight the text to be deleted.
2. Press [Cut] (F3).

Combining Files

You can insert into the Memo Editor the entire text from any ASCII file using the following procedure given sufficient HP 95LX memory. This text is inserted even if the Memo Editor is in overwrite mode.

If you want to insert text from an ASCII text file located in another HP 95LX or in a PC, copy that file into the HP 95LX’s Filer application first. See “Using the Filer for Computer to Computer Communication” in chapter 20.

To insert text from another file:

1. Position the cursor in your present document at the position you want the text inserted.
2. Select [FILE] File Insert to display all files with the extension .TXT in the current directory.
3. Do one of the following:
   a. To insert all the text from one of the displayed files, highlight the file name and press [ENTER].
To insert all the text from another ASCII file, display other file names (see the earlier procedure: "To display all file names"), highlight the ASCII file you want, then press [ENTER].

Searching for Text
You can search for any text in your current document.

1. Press [Find] (F7).
2. Type the text you want to find. The search is case insensitive—you can use all lower case letters if you want.
3. Press [Next] (F7) or [Previous] (F7) to search towards the end or beginning of your file.
   The search does not wrap between the beginning and end of your document. So if you start your search from somewhere in the middle of your document, search is both directions.
4. To search for another position of the text following a successful search, press [Find]. (F7), then start at step 3.

Using User Keys
Any of the ten function keys (F1 through F10) can be assigned a sequential group of keystrokes which can then be executed ("pressed") by pressing (Ctrl) simultaneously with that function key. This is one way commands and segments of text can be stored and used where needed. For more information, see "Creating and Using User Keys" in chapter 21.

Typing Characters Not on the Keyboard
The compose function is used to create international characters and other characters you cannot enter directly from the keyboard. A particular special character is created by pressing [Compose] ([Esc] [F1]) followed by one or two alphanumeric keys. For information on compose sequences, see appendix 1.
Printing a Document

For information about configuring your printer, see "The Printer Configuration Settings" in chapter 21.

You can print an entire document or a highlighted portion of that document.

Before printing, you may:

- Insert page breaks into your document.
- Set the right, left, top, and bottom margins and the page length of your printout.

To insert a page break:

When a document is printed, a page break causes a page advance to the top of the next page.

1. Position the cursor at the location in your document you want a page break to occur.
2. Press F3 (PGUP) to place a page break and a page-break symbol at that location.

To set print margins and page length:

Note

When marked text is printed to a file or a printer, the Memo Editor does not use the print margin or page length settings. The right margin is given by the screen's right margin setting (Settings Wrap). This allows printing marked text from various applications on one page.

1. Select the Print Options menu. The screen shows both the Print Options menu and the print settings show with the current settings for left, right, top, and bottom margins and for page length.
2. Select the menu options.

The Memo Editor
A page break command in your document (see the earlier “To insert a page break”) causes the printer to advance immediately to the top of the next page, where printing continues.

To print a document:

1. If you want to print a portion of your document, highlight (mark) that portion (see “Highlighting Text” earlier in this chapter). Refer to the previous Note under “To set print margins and page length.”
2. Turn on your printer.
3. Select [Print] Print Printer. Your configured printer will print your entire document or the position you selected.

Writing a Document to an ASCII File

You can save all or part of a document to a file by selecting either Print File or File Save.

Use Print File when you intend to use the document in another application, either inside or outside the HP 91LX. Print Options settings are used for margins and page length. Hard carriage returns are inserted at the end of each line, and tabs are expanded to spaces.

Use File Save (see “Saving a Document” earlier in this chapter) when you intend to use the document within Memo Editor. The Print Options settings described above are not used when the file is saved. No hard carriage returns are inserted, and tab characters are maintained.
To save a document for use in another application:

1. If you want to save a portion of your document, highlight (mark) that portion (see "Highlighting Text" earlier in this chapter). Refer to the previous note under "To set print margins and page length."

2. If you want to save an entire document, make your choice of print options. See the previous procedure "To set print margins and page length."

3. Select [Menu] Print File. You'll see displayed C: \Unter\*, .TXT with perhaps some file names also displayed.

4. Do one of the following:
   - Type a file name (8 characters maximum). You can use either upper- or lowercase letters. Your first character will replace *. If you type no extension, .TXT will be supplied to identify your file as a Memo Editor file. Then press [Enter].
   - Highlight a displayed file name and press [Enter].
   - Display another file name (see the procedure earlier in this chapter, "To display all file names"), highlight a file name, then press [Enter].

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The Filer enables you to:

- Manage files and directories.
- Transfer files and directories between the 4P 86LX and a PC using the Connectivity Pack.
- Run ROM and plug-in RAM based programs.
- Execute MS-DOS commands.
Starting and Leaving the Filer

To start the Filer, press (F). The display will list the subdirectories and files contained in the root directory. The following figure shows the directory structure one level down from the root directory. It shows one subdirectory and several files contained in the directory C:324. (Your display may show a different file structure.) The terms used in this figure are explained in the following pages.

To quit the Filer, select (QUIT) Quit. (Quitting the Filer when it's not in use, rather than just leaving it by starting another application, helps extend HP 90LX battery life.) For help, press (HELP) (H) at any time. To cancel most operations before you press (ENTER), press (ESC) one or more times.

An important feature of the Filer is its split-screen display. You can view two directories at the same time on your HP 90LX. See "Using the Split Screen" several pages ahead. You can also view the same time directories on an HP 90LX and a PC (using the Connectivity Pack connection) or two different HP 90LXs (using the infrared connection). See "Using the Filer for Computer to Computer Communications" towards the end of this chapter. If such a Connectivity Pack connection is made (including the installation of the software into the PC), the PC can show the same type of split screen display and can use the Filer to manage its own files.

20:2 The Filer
This two-directory display makes file transfer between two directories much easier. You can highlight the file to transfer in one split-screen window and display the destination directory in the other window, then press a single function key to complete the transfer. No typing of path and file name is necessary.

**File Names** The Filer uses MS-DOS file names and directory paths. For information on these, see appendix B.

**Prompts** When a Filer prompt offers you a directory path and file name, you can accept all of the offering or change part or all of it. To erase part of an offered directory path or file name, use DEL (backspace). To erase the entire offering, press ESC.

---

**Working with Files**

When the Filer is started, a listing of the current directory's files is displayed as shown above. The directory path identifies the current directory whose files and subdirectories are currently displayed. The current file is the highlighted file. In the figure above, the directory path is C:\_dat\, the current directory is _dat and the current file is JASON.TXT.

**Viewing Files in a Directory**

Use F1, F2, F3, F4, F5, and ESC to move through the directory's list of files.

**Viewing the Contents of a File**

To specify a file:

You can view the contents of a file in two ways:

- Highlight the file in the directory and press ENTER.
Press \texttt{GOT} (\texttt{CE}), type the file's path and name (including extension), then press \texttt{ENTER}.

Press \texttt{ESC} to return to the directory screen.

If the file's name can be quickly displayed on your screen, highlighting that name could be the easiest way to specify the file. Otherwise, if you know the file's path and name, it might be easier to type them after pressing \texttt{GOT} (\texttt{CE}). Using \texttt{GOT} (\texttt{CE}) might be even more desirable for often-used files if a user key were assigned that file's path and name. Then pressing that user key would display the name and path, making typing unnecessary. See "Using User Keys" at the end of this chapter.

To control line wrapping:

If a line in your viewed file is longer than the width of the HP 95LX's screen, only the first 40 characters of that line are normally displayed. You cannot scroll those off-screen characters onto the display, but you can turn line wrapping to make the entire line visible.

To control line wrapping in a displayed file:

1. Select \texttt{MENU} Options Wrap.
2. Do one of the following:
   - Select Yes to enable line wrapping.
   - Select No to disable line wrapping.

### Selecting Files for File Operations

Most file operations (copy, move, delete, and print) can be performed on single files and on several files at once. To select one file for an operation, highlight the file. To select several files for a single operation, tag the files (see the table below). To tag a file, highlight it and press \texttt{TAG} (\texttt{DIAG}). The tagged file is identified by a small diamond in the left margin.

When a file operation begins, the HP 95LX first looks for one or more tagged files to act upon. If it finds none, it then selects the single highlighted file. To avoid the problems left-over tags could create, the HP 95LX automatically erases any and all tags after any file.
operation. So before you begin any file operation, all files should be tag-free. If you want to be certain that no tags remain, press UNIT TAG (ALT F) to erase any remaining tags before you select your file or files.

### File Tagging Keys

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag (F)</td>
<td>Tags or untags the highlighted file.</td>
</tr>
<tr>
<td>Up (ALT U)</td>
<td>Tags the highlighted file and all preceding files in the current directory.</td>
</tr>
<tr>
<td>Down (ALT D)</td>
<td>Tags the highlighted file and all subsequent files in the current directory.</td>
</tr>
<tr>
<td>elt (ALT E)</td>
<td>Tags all files in the current directory.</td>
</tr>
<tr>
<td>Untag (ALT E)</td>
<td>Removes tags from all files in the current directory.</td>
</tr>
</tbody>
</table>

### Copying, Moving, and Deleting Files

See "Using the Split Screen" later in this chapter for information about file operations using the split screen.

#### Caution

The HP 99XL allows you to delete entire directories, including all subdirectories and files, but only if Options Dirs Yes is selected. When you receive your new HP 99XL, Options Dirs No is selected, which prevents any operations on directories. Before performing copy, move, and delete operations on files, a safe (but not necessary) choice is to select Options Dirs Yes (unless it's already chosen). When Options Dirs No is active, DIR is displayed in the center of the second line of your directory, as shown in the earlier figure.

#### Note

In all operations, if the prompt field contains characters, C (ESC) will clear the field. If the field is empty, C (ESC) will cancel the operation.

---

*The File* 20-F
To copy or move a single file:

1. Highlight the file.
2. Press **COPY** (^C) or **MOVE** (^M).
3. Type the destination path (and file name, if different from the current file name).
4. Press **ENTER** to copy or move the file.

---

**Note**

You can stop a copy, move, or delete operation in progress involving several files. To stop an operation, press **CTR-BREAK** (press at the same time the **CTRL** and **BREAK** keys). After pressing **CTRL-BREAK** some individual file operations may have been completed. Unless the number of files is large, you must act quickly to stop the operation before it's finished.

---

To copy or move several files:

1. Use the keys in the earlier table, “File-Tagging Keys,” to tag the files you want to copy or move.
2. Press **COPY** (^C) or **MOVE** (^M).
3. Type a destination directory path.
4. Press **ENTER** to copy or move the files.

---

To delete a single file:

1. Highlight the file.
2. Press **DELETE** (^D).
3. Select Yes to delete the file, or select No to cancel the delete operation.

---

To delete several files:

1. Use the keys in the previous table, “File-Tagging Keys,” to tag the files you want to delete.
2. Press **DELETE** (^D).
3. Select Yes to delete the files, or select No to cancel the delete operation.
Renaming a File

You can rename a single file as a separate operation or as part of a single-file copy or move operation described above. During the copy or move procedure, you may type a new name following the destination path you type.

This procedure renames a file as a separate operation:

1. Highlight the file.
2. Press F1 (NAME).
3. Type a new file name.
4. Press F7 (ENTER) to rename the file.

---

Working with Directories

Viewing the Current Directory

To display information about the current directory:

1. Press MENU.
2. Select Directory Status to display the status screen.
3. Press ESC to return to the previous screen.

The directory status screen displays the following information about the active directory: the number of subdirectories under the currently displayed directory, the number of files, the number of bytes in the directory, the bytes remaining on disk, and the volume label. If there are over 100 files in the directory, this information covers only the first 100 files.

If your directory contains more than 100 files, an incomplete listing indicator appears above the directory listing. You can view all files in a directory regardless of the number of files it contains by selecting MENU System, then executing appropriate MS-DOS commands. Note that Filer copy, move, and delete operations on a directory affect all files in that directory, even those beyond this 100-file limit.

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To choose the order files are listed in directories:

A directory always lists its subdirectories first, followed by its files. The HP 90SLX offers four ways to list files. When you select your new HP 90SLX, files are listed alphabetically by file name, but you can choose any of the other three listing methods. The ordering scheme selected applies to all directory listings, those displayed in a single screen and in a split-screen, both local and remote. The procedure below defines these schemes and describes how to select each one.

1. Press [MENU].
2. Select File-Sort followed by the selection of one of the following menu commands:
   - Select Date/Time to sort according to the file-creation date and, secondarily, by file-creation time. Most recent files are listed first.
   - Select Extension to sort alphabetically according to the file's extension. Files with no extensions are listed first.
   - Select Size to sort according to the file size, in descending order.
   - Select Filename to sort alphabetically by file name.

Changing the Current Directory

To reach a higher level directory by scrolling:

There are two ways to move up the "inverted tree" directory structure towards the root directory:

Do one of the following:
- Press [ESC] to move up one level. Continue to press [ESC] if necessary, to reach the directory you seek.
- Press [A] as needed to highlight View Up 1, the directory tree navigator. Then press [ENTER] to reach the next higher level directory. Continue to highlight View Up 1 and press [ENTER] as needed to reach the directory you seek.

To reach a lower level directory by scrolling:

1. Highlight the subdirectory you seek.
2. Press [ENTER] to make that subdirectory the current directory.
3. Repeat these steps as needed to display the directory you seek.

20-1 The Filer
To reach another directory by name:

You can reach any directory within the HP 91LA, including the root directory A\ of the plug-in RAM card. You can also, by using the Connectivity Pack, reach any directory in the remote PC, including the root directory in any drive (A\, B\, C\, D\, etc.).

1. Press \[\text{Go to (FD)}\].
2. Type the path of the directory you seek.
3. Press \[\text{ENTER}\] to display that directory.

Creating a New Directory

When you create a new directory, the current directory continues to display.

To create a new subdirectory:

1. Display the directory to which the new subdirectory will belong.
2. Select \[\text{Menu}\] Directory Create.
3. (Optional) Move the cursor to the end of the displayed path.
4. Type a directory name and press \[\text{ENTER}\]. The current directory continues to display, and now shows the new subdirectory.

To create a new directory at another level:

1. Select \[\text{Menu}\] Directory Create.
2. Change the offered path as desired, then type a directory name.
3. Press \[\text{ENTER}\] to create the new directory.

Copying, Moving, and Deleting Directories

If you want to copy or move directories using the split screen, see "Using the Split Screen" later in this chapter for information.

Note

When an operation is performed on a directory, all of its contents, including subdirectories and the files within them, are copied, moved or deleted.
You can stop a copy, move, or delete operation in progress involving directories. To stop an operation, press (CTRL + BREAK) (press at the same time the CTRL and (break) keys). After pressing (CTRL + BREAK), some individual operations may have been completed. Unless the number of files involved in the directory operation is large, you must act quickly to stop the operation before it’s finished.

To copy or move a directory and its contents:

1. Press (MENU).
2. Select Options Dire Yes.
3. Highlight the directory or tag several directories you want to copy or move.
4. Press COPY (F2) or MOVE (F3).
5. Type a directory path.
6. Press (ENTER) to copy or move the directory or directories.
7. Select Options Dire No to protect against a future unwanted directory operation.

To delete a subdirectory and its contents:

1. Press (MENU).
2. Select Options Dire Yes.
3. Highlight the directory or tag the directories you want to delete.
4. Press DELETE (F4).
5. Either select Yes to delete the directory or directories (including contents), or select No to cancel the operation.
6. Select Options Dire No to protect against a future unwanted directory operation.
Using the Split Screen

The File’s split screen display simplifies copying and moving files and other directory management tasks, whether performing operations within the HP 95LX, between two HP 95LXs, or between an HP 95LX and a PC linked together with the Connectivity Pack or by a modem.

To toggle between a single- and split-screen display, press Shift/F11 (F7).

To understand the use of the split-screen display, review the following example. It shows a file copy operation between two directories within the HP 95LX. You can use a similar procedure to transfer files or directories between an HP 95LX and a PC or between two HP 95LXs. See “Using the File for Computer to Computer Communication” later in this chapter.

You may read this example without pressing keys, or press keys after matching on your HP 95LX the initial conditions listed below. (You may also press keys using your own choices for directory and file-to-copy.)

When this example begins, the following situation exists:

1. The HP 95LX screen you are viewing is a single screen and shows the root directory C:\.
2. You want to move the 1-2-3 worksheet C:\EXPENSES.WK1 to the directory C:\LOTUS.

Here are the main actions demonstrated by this example:

1. Display the destination directory it one window.
2. Highlight the file to copy in the other window.
3. Copy the file

Here are these actions described in more detail:

1. Split your screen (press Shift/F11 (F7)). Both screens display the current local HP 95LX root directory C:\, but only the left window contains the highlight bar. You see the subdirectory lotus.
2. Highlight the subdirectory lotus in the left window.
3. Display the lotus directory (press F10). This is the destination directory.
4. Move to the right window (press F7) and highlight the file EXPENSES.WK1. Now the file you want to copy is highlighted.
and the destination directory is displayed, as shown in the figure below.

5. Press [Ctrl] (E2) to display on the top two lines, Copy ‘expenses.wri’ to C:\lotus\expenses.wri.
6. Press [ENTER] to copy the file. In the left window, EXPENSES.WRI appears as a file in the C:\lotus directory.

No typing of file names or directory paths was necessary.

Running a Program from the Filer

You can run files with extensions .EXE, .BAT, or .COM from the Filer, provided no other applications except the Filer are open. Programs written for larger displays can be run satisfactorily on the HP 95LX. The section “Accessing MS-DOS” at the beginning of Appendix B describes cursor tracking, a special feature that allows the HP 95LX screen to become a window that never loses view of the full 80-character wide MS-DOS screen. This window will follow the cursor automatically, and you can move the window independently of the cursor by pressing [Left], [Right], [Up] and [Down]. You can disable the cursor-tracking feature by executing the MS-DOS command DISPC.AR, described in Appendix B.
Running a Program from a Plug-in RAM or ROM Card (Drive A)

1. Install the card. See "Inserting and Removing RAM Cards" in chapter 1.
2. Ensure that you have only the Filer application running, since otherwise you can’t run a program from a plug-in card.
3. Display the directory for drive A.
4. Highlight the executable file (extension .EXE, .BAT, or .COM) you want to run.
5. Press [Run] (F5) to run the application. If other applications are open, a message will inform you and state Cannot 1aunch file. In that case, press [ESC], close all other open applications, and repeat this step.
6. To return to the Filer, quit the program, then press any key.

Running a Program from the Internal RAM Disk (Drive C)

1. Ensure that you have only the Filer application running, since otherwise you can’t run a program from drive C.
2. Display the directory for drive C.
3. Highlight the executable file (extension .EXE, .BAT, or .COM) you want to run.
4. Press [Run] (F5) to run the application. If other applications are open, a message will inform you and state Cannot 1aunch file. In that case, press [ESC], close all other open applications, and repeat this step.
5. To return to the Filer, quit the program, then press any key.
Executing MS-DOS Commands

1. Ensure that you have only the File application running, since otherwise you can't access MS-DOS.
2. Select [Menu] system. You have now accessed MS-DOS.
3. Execute any HP 90LX MS-DOS internal command. You can also execute CHKDSK and FORMAT. For information on available commands, see Appendix B.
4. To return to the File, type exit at the DOS prompt, press ENTER, then press ENTER again (or any key) to continue.

Using the Filer for Computer to Computer Communication

Using the Filer, you can copy and move files and directories between two HP 90LXs or between an HP 90LX and a PC, delete files and directories in either computer, and perform in either computer the other file and directory operations described earlier in this chapter.

You can use the split screen—one half of the screen for each computer. For information on using the split screen, see "Using the Split Screen" earlier in this chapter.

You can also use two full screens for computer to computer communication. You switch between them by pressing the Local/Remote (F2) toggle.

The Local or Remote indicator tells whether the screen is displaying local directories (those in the computer you’re operating) or remote directories (those in the computer connected by infrared, cable, or modem to the computer you’re operating). In a single screen, this indicator is at the left end of the second display line (above the double line). In a split screen, each screen has its own Local or Remote indicator located at either end of the second line. Note that the computer you’re operating can be an HP 91LX or a PC.

Your split screen can show two local directories, one local and one remote, but you cannot show two remote directories.

If you are using a split screen for local/remote file operations and wish to perform file operations within the local directory structure.
without terminating the local-remote connection, press \[ F5 \] (FULL) to display a single screen, then press \[ F10 \] (LOCAL) if necessary, to display your local directory on a full screen. When you've finished your local directory operations, press \[ F7 \] (EXIT), then press \[ F4 \] (REMOTE) to view again your local/remote split screen.

**Note**
The Filer cannot run remote files; that is, you can only use \[ F3 \] (EXEC) to run executable files from a local directory. See the previous “Running a Program from the Filer.”

You can transfer one or more files or directories in either direction, local to remote or remote to local.

**Communicating Between the HP 95LX and a PC**

**Configuring the HP 95LX for Communication**

The Filer application, both the one included with each HP 95LX and the one included with the Connectivity Pack, defaults to certain configuration settings. These are shown in the figure below. Each time you start the Filer, these settings will be in effect.
Preparing the Hardware

Refer to the instructions supplied with your Connectivity Pack. You need to connect the Connectivity Pack cable (part of your HP 9101A Connectivity Pack accessory) to your HP 96LX and to the IBM-compatible PC. The connectors on the cable are designed to plug directly into the two computers. The Connectivity Pack software also must be installed on the PC. Connect your modem (if any) using its own instructions.

Making and Using the Connection

Use the default configuration settings for a direct HP 96LX to PC connection using the Connectivity Pack. Once the Connectivity Pack is installed, this one keystroke makes the connection:

Press Remote (F2) from the system you want to be your local system (the one you’ll operate). The remote Filer will display a message that it is in server mode. The local Filer will display a local directory in the local window and the current remote directory in the remote window.

For information about using your connection for file and directory operations, see “Using the Split Screen” earlier in this chapter.

Ending an HP 96LX Communication Session

Caution

The Quit command does disconnect the remote computer, but it:

1. Does not save your configuration file changes.
2. Does not hang up your phone after a modem communication session.

Before leaving the Filer, be sure to save any configuration file changes and, if you were using a modem, issue a hangup command. See the procedure below.

To turn the Connectivity Pack connection off:

1. Press Disconnect (Alt-F6) to turn off the Filer connection.
2. Press Hangup (Alt-F7) if you’ve used a modem.

20-16 The Filer
To create your own configuration file:

You must change configuration settings from those supplied if you want to communicate with a PC through a modem. Once these settings are established, you can save them in a configuration file. You can also create and save other configuration files for communication with other devices.

The procedure below tells you how to select configuration settings on your BP 961X and on your PC for a Connectivity Pack/PC connection, either by cable or phone. These same configuration settings must be active in both your BP 961X and the PC before communication can occur. Later procedures tell you how to save these settings in a file and how to choose a configuration file.

1. Press [MEN]
2. Select Remote-Set Config.
3. Select Interface 1 (Comm1).
4. Select Baud, then select by number (1-6) one of the displayed values.
5. Do the following if you plan to use a modem:
   a. Select Dial, then select Pulse or Tone.
   b. Select Dial again, then select Number.
   c. Type the phone number you'll dial using your modem. Use no other characters except space, numbers, left and right parentheses, comma, and hyphen. For instance, this is acceptable: (555) 123-4567.
6. Select Quit twice to leave the menu.

Remote-Set Config Interface and Baud Choices

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Selections Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>1 (Comm1), 2 (Comm2), 3 (Infrared) (communication port choices). Choosing Infrared automatically selects both the infrared port and the optimum Baud rate of 2400.</td>
</tr>
<tr>
<td>Baud</td>
<td>1 (300), 2 (1200), 3 (38400), 4 (4800), 5 (9600), 6 (19200), 7 (Direct).</td>
</tr>
</tbody>
</table>
Note
The baud choice (Direct) sets the HP 96LX's fastest transmission rate. However, the Direct rate may not work for all systems, and it cannot be used for modem connections.

To save a configuration file:
You can save your settings in a configuration file so you won't have to reset them each time you make a connection. To save them, use the procedure below:

1. Press [MENU].
2. Select Remote-Set Save. The screen shows C: \_DATA\*.FCF, and one or more file names may be displayed.
3. To specify a file name and save your configuration file, do one of the following:
   - Press [ENTER] to save your file under the name of the current (highlighted) configuration file.
   - Highlight a file name (use [A], [D], [S], and [W]) and press [ENTER].
   - Type a new file name, omitting the path (the path C: \_DATA\ will be supplied by the File) and press [ENTER]. The HP 96LX will supply the .FCF extension.

To choose and activate a configuration file:
Once you've saved a configuration file, follow these steps to use it in the future:

1. Press [MENU].
2. Select Remote-Set Use to display a list of configuration files.
3. Press [S], [W], [A], and [D] as necessary to highlight the name of the file you want.
4. Press [ENTER] to activate the configuration settings in the chosen file.

Note
Ensure that the same settings are active in both computers. Otherwise, no communication can occur.
Communicating Between two HP 95LXs

In both HP 95LXs:

1. Press <Menu>.
2. Select Remote Set. The current remote settings sheet is displayed.
3. Select Config Interface 3 (Infrared); that is, press C I 3. This not only selects the infrared port but also sets the baud rate to the optimum infrared communication value of 2000. All configuration settings are now set correctly. Select Quit/Quit to leave the menus.
4. Position the two HP 95LXs with their infrared ports directly opposite each other and separated by no more than 8 inches, as shown in the figure below. The infrared port is lined up with the third row of keys, counting from the top (the row with 3, 4, and 5).

5. Press <Enter> to establish the infrared connection.
6. From the local HP 95LX perform any desired file or directory operation between the two HP 95LXs as described in “Using the Split Screen” earlier in this chapter.
7. Press <Esc> (<Alt> <Esc>) to disconnect the infrared connection when you’re through communicating.

While you can always activate the infrared configuration by selecting <Remote Set> Config Interface 3 (Infrared), you can save this configuration file and then activate it as you would any other.
configuration file. See "To save a configuration file" and "To choose and activate a configuration file" earlier in this chapter.

Printing Files and Directories

For information about configuring your printer, see "The Printer Configuration Settings" in chapter 21.

You can print one or more files or directories using the Filer's Print command. For files created by other HP 95LX applications, such as the Memo Editor, that application's Print command offers more printing choices than does the Filer's command.

Follow these steps to print one or more files or directories:
1. Highlight a file or directory or tag the files or directories you want to print.
2. Turn on your printer.
3. Select (ADF) Print. The contents of each selected file or a listing of each selected directory will be printed.

Typing Tools

Using User Keys

Any of the ten function keys (F1 through F10) can be assigned a sequential group of keystrokes which can then be executed ("pressed") by pressing Ctrl simultaneously with that function key. This is one way a frequently used command or segments of text, such as a file's path and name, can be stored and inserted where needed. For more information, see "Creating and Using User Keys" in chapter 21.
Typing Characters Not on the Keyboard

The compose function is used to create international characters and other characters you cannot enter directly from the keyboard. A particular special character is created by pressing [COMPOUND] followed by one or two alphanumeric keys. For information on compose sequences, see appendix F.
The Setup utility establishes settings for the HP 90LX:

- Volume and screen contrast.
- Memory allocation.
- Date and time and their formats.
- Language and punctuation settings.
- Sorting order (collating sequence).
- Printer configuration.
- User keys.
- Your Business Card display (or other customized image).

The Setup utility also formats RAM cards.

Press [SETUP] on [CO] for the Setup menu. The display includes a list of many of the current Setup settings.

![Setup Utility Screen](image)

Note that the 'Help' (press [F1]) is always available.

Use [ESC] or Quit to exit a screen that you don't want to complete or use. To leave the Setup utility, use Quit from the main menu.

21-2 The Setup Utility
Specifying Volume, Contrast, and Memory

Select System for the System menu:

This settings sheet shows you the current settings for volume, display contrast, and allocation of memory (RAM).

Volume Control

To adjust the volume:
1. Select System Volume.
2. Press < or > to move the bar to decrease or increase the setting.
3. Press Enter to save the setting, ESC to not do.

Display Contrast

To adjust the contrast of the display:
1. Select System Contrast.
2. Press < or > to move the bar to decrease or increase the contrast.
3. Press Enter to save the setting, ESC to not do.
Memory Allocation

You can allocate the available random-access memory (RAM) between the operating system and the RAM disk (drive C). (See “Managing EP Memory” in chapter 1 to learn more about the memory.)

To adjust the allocation of RAM:

1. Close (QEMM) Quit any open applications other than Setup.
2. Select System Memory.
3. Press $ or $ to increase the proportion of memory allocated to system RAM or the RAM disk by 8KB increments. With each key press, the figures for System RAM and RAM disk change. (The position of the bar reflects the relative amounts of allocated RAM.)
4. When you have the allocation you want, press ENTER.
5. When you’re prompted to reboot the system, press ENTER again to reboot or press ESC to cancel the change. The change does not take effect until the system is rebooted.

Setting the Date and Time

Select Date or Time for the Date menu or Time menu:

<table>
<thead>
<tr>
<th>Format</th>
<th>Week</th>
<th>Start</th>
<th>Quit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Settings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Date: 02/01/91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date format: 4D MM/DD/YY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week start: Sunday</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

214 The Setup Utility
The Date and Time menus specify the current date or time and their formats for all applications except 1-2-3. (However, printing headers and footers in 1-2-3 is affected by the formats set here.) The Date menu also specifies the day (Sunday or Monday) that begins a week which is relevant for the Appointment Book.

**Date Settings**

The current date setting establishes the current date throughout the HP 9840X. The format setting, however, does not affect 1-2-3 except in the printing of headers and footers. (1-2-3 has its own commands for format settings.)

**To set the current date:**

1. Select Date Current.
2. Type in the date according to the current format shown on the screen. (You can drop leading zeros.)
3. Press [ENTER].

The date delimiters (punctuation between numbers) can be any one of these: hyphen, slash, space colon, period, or comma. The current date can be in any year from 1940 through 2099. You can specify years 1988 through 2079 by their last two digits—for example, 1992 can be entered as 92.

**To set the date format:**

1. Select Date Format.
2. Select the desired format from the menu. (Type the corresponding digit or use the arrow keys and [ENT].)
3. If you select option 4 or 5 (Long International or Short International), you receive four more options: A, B, C, D.

The following table shows the available format options, each including an example date of August 14, 1994.
## Date Formats

<table>
<thead>
<tr>
<th>Label</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DD-MM-YY</td>
<td>15-AUG-94</td>
</tr>
<tr>
<td>2</td>
<td>DD-MM</td>
<td>14-AUG</td>
</tr>
<tr>
<td>3</td>
<td>MMM-YY</td>
<td>AUG-94</td>
</tr>
<tr>
<td>4</td>
<td>Long Int/</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>MM/DD/YY</td>
<td>08/14/94</td>
</tr>
<tr>
<td>B</td>
<td>DD/MM/YY</td>
<td>14/08/94</td>
</tr>
<tr>
<td>C</td>
<td>DD:MM:YY</td>
<td>14:08:94</td>
</tr>
<tr>
<td>D</td>
<td>YY-MM-DD</td>
<td>94-08-14</td>
</tr>
<tr>
<td>5</td>
<td>Short Int/</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>MM/DD</td>
<td>08/14</td>
</tr>
<tr>
<td>B</td>
<td>DD/MM</td>
<td>14/08</td>
</tr>
<tr>
<td>C</td>
<td>DD:MM</td>
<td>14:08</td>
</tr>
<tr>
<td>D</td>
<td>MM:DD</td>
<td>8:14</td>
</tr>
</tbody>
</table>

These format options are the same as those available for 1-2-3.

### To specify the first day of the week (for the Appointment Book):

1. Select Date: Week Start.
2. Select Sunday or Monday using [3] and [2].
3. Press [ENTER].

### Time Settings

The current time setting establishes the current time throughout the HP 95LX. The format setting, however, does not affect 1-2-3. (1-2-3 has its own commands for format settings.)

### To set the current time:

1. Select Time Current.
2. Type in the time according to the current format shown on the screen.
3. Press [ENTER].

The time delimiters (punctuation between numerals) can be any one of these: hyphen, slash, space, colon, period, comma, or hyphen.

214 The Setup Utility
To set the time format:

1. Select Time Format.
2. Select the desired format from the menu. (Type the corresponding digit or use the arrow keys and press [ENTER].)
3. If you select option 3 or 4 (Long International or Short International), you receive four more options: A, B, C, D.

The following table shows the available format options, each including an example time of 2:03:07 pm.

<table>
<thead>
<tr>
<th>Label</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HH:MM:SS (AM/PM)</td>
<td>02:03:07 pm</td>
</tr>
<tr>
<td>2</td>
<td>HH:MM (AM/PM)</td>
<td>02:03 pm</td>
</tr>
<tr>
<td>3</td>
<td>Long Intl (24 hr)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>HH:MM:SS</td>
<td>14:03:07</td>
</tr>
<tr>
<td>B</td>
<td>HH:MM:SS</td>
<td>14:03:07</td>
</tr>
<tr>
<td>C</td>
<td>HH:MM:SS</td>
<td>14:03:07</td>
</tr>
<tr>
<td>D</td>
<td>HH:MMmmSSs</td>
<td>14:03:06:07</td>
</tr>
<tr>
<td>4</td>
<td>Short Intl (24 hr.)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>HH:MM</td>
<td>14:03</td>
</tr>
<tr>
<td>B</td>
<td>HH:MM</td>
<td>14:03</td>
</tr>
<tr>
<td>C</td>
<td>HH:MM</td>
<td>14:03</td>
</tr>
<tr>
<td>D</td>
<td>HH:MMmm</td>
<td>14:03:00</td>
</tr>
</tbody>
</table>

These format options are the same as those available for 1-2-3.

The Setup Utility 21-7
Setting the Punctuation and Language Conventions

Select international for the International menu:

This menu includes the current settings for punctuation, language, currency, sorting order, and keyboard mapping.

Note

In order for new punctuation, language, and currency settings to take effect is 1-2-3, you must quit 1-2-3 and then restart it. Also, the settings in any 123.CNF file present at startup take precedence over the settings made here.

Digit and Argument Separators

The Punctuation command specifies which symbols are used for the decimal point in numbers, the argument separator for functions and advanced macro commands, and the thousands separator in numbers.

The Punctuation setting establishes the symbols used by the Calculator and the default symbols used by 1-2-3.
To specify the symbols for the decimal point, argument separator, and thousands separator:

1. Select International Punctuation.
2. Select the desired set of symbols for decimal point, argument separator, and thousands separator from the menu. (Type the corresponding letter or use the arrow keys and ENTER.)

<table>
<thead>
<tr>
<th>Punctuation Symbols</th>
<th></th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Label</td>
<td>Combination</td>
<td>Decimal Point</td>
</tr>
<tr>
<td>A</td>
<td>..</td>
<td>2,3</td>
</tr>
<tr>
<td>B</td>
<td>..</td>
<td>2,3</td>
</tr>
<tr>
<td>C</td>
<td>..</td>
<td>2,3</td>
</tr>
<tr>
<td>D</td>
<td>..</td>
<td>2,3</td>
</tr>
<tr>
<td>E</td>
<td>space</td>
<td>2,3</td>
</tr>
<tr>
<td>F</td>
<td>space</td>
<td>2,3</td>
</tr>
<tr>
<td>G</td>
<td>space</td>
<td>2,3</td>
</tr>
<tr>
<td>H</td>
<td>space</td>
<td>2,3</td>
</tr>
</tbody>
</table>

These eight combinations are the same as those options given (and specifiable) in 1-2-3.

**Language, Keyboard, and Currency Settings**

To specify the language used for all text in the HP 95LX:

1. Close (MENU) Quit all applications other than Setup.
2. Select International Language.
3. Select the desired language from the menu. (Type the first letter or use the arrow keys and ENTER.) Note that the U.S.A. model of the HP 95LX offers English only.

The Setup Utility 21-9
To specify the keyboard for the HP 95LX character set:

1. Select International Keyboard.
2. Select the desired keyboard from the list. Your keyboard selection should match the physical keyboard your HP 95LX has. Note that the U.S.A. model of the HP 95LX offers English only.

By default, the Keyboard setting agrees with the Language setting. However, in some cases, you might want to use a keyboard layout for one language while using your applications in another language.

To specify the currency symbol:

1. Select International Currency.
2. Type the character (or Compose sequence) for the currency symbol. (For information on Compose sequences, see appendix E.)
3. Select Prefix or Suffix for the position of the symbol.
4. Press (Enter).

Specifying the Sorting Order

The Sort command specifies the sorting order—called the collating sequence—used in 1-2-3 by the Data Sort command. (Note that 1-2-3 sorts cells, labels, and values.)
<table>
<thead>
<tr>
<th>Categorizing Sequence</th>
<th>Sorting Order</th>
</tr>
</thead>
</table>
| Numbers-First         | 1. Blank cells.  
2. Labels beginning with numbers, in numerical order.  
3. Labels beginning with letters, in alphabetical order. Capitalization is ignored.  
4. Labels beginning with other characters.  
5. Values. |
2. Labels beginning with letters, in alphabetical order. Capitalization is ignored.  
3. Labels beginning with numbers, in numerical order.  
4. Labels beginning with other characters.  
5. Values. |
| ASCii                 | 1. Blank cells.  
2. All labels using their ASCII values. Uppercase letters precede lowercase letters.  
3. Values. |

To change the sorting order:

1. Select International Sort.
2. Select the desired sorting order from the menu. (Type the first letter or use the arrow keys and ENTER.)
The Printer Configuration Settings

Printer configuration files in the Setup utility control the printing of all information in all files of all applications. Selecting Printer displays the current printer configuration settings. Here are the default settings:

<table>
<thead>
<tr>
<th>Printer Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: Epson FX80</td>
</tr>
<tr>
<td>Interface: COM1</td>
</tr>
<tr>
<td>Baud: 9600</td>
</tr>
</tbody>
</table>

You can change these settings using the Config command, and then optionally save them in a file using the Save command. The Use command lets you make a file you previously saved the current configuration file.

To alter the printer configuration settings:

1. Select Printer Config.
2. Select Name, Interface, or Baud.
3. Select the desired option. (Type the corresponding digit or use the arrow keys and [ENTER].) For the Name of the printer, select a compatible type. Most printers are compatible with one of the three options shown. For a Kodak Deka printer, for instance, you need to set the option switches inside the printer for either the IBM or Epson driver, then select either IBM or Epson (as the case may be) from the Name options.
4. Repeat steps 2 and 3 until all settings are correct.

21-12 The Setup Utility
Printer Configuration Settings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning and Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Type of printer driver: 1(Epson FX80), 2(HP LaserJet), 3(INN Proprietary)</td>
</tr>
<tr>
<td>Interface</td>
<td>Port for input/output communication: ![Com1 serial), 2(Com2 serial), or 3(Parallel)</td>
</tr>
<tr>
<td>Baud</td>
<td>Baud rate: 1(300), 2(1200), 3(2400), 4(4800), 5(9600, the default), or 6(19200)</td>
</tr>
</tbody>
</table>

For the HP 96LX, selecting Com2 defaults to Com1.

These settings remain until you change them. You cannot change the parameters for character bits, parity bit, stop bit, and handshaking options just as you cannot for 1-0-3. Instead, the settings on your printer should match the settings that the HP 96LX requires: 8 bits/character, 1 stop bit, no parity, XON/XOFF handshaking enabled. Refer to the printer's owner's manual for instructions.

To save the current settings in a printer configuration file (.PCF):
1. Select Save.
2. Select or type in a file name. (If that file name already exists, you will be prompted for permission to overwrite that file.)

Unless you provide a different path or extension, printer configuration files are automatically stored in C:\DAT and given a .PCF file extension.

To select an existing configuration file:
1. Select Printer Use.
2. Use the arrow keys to highlight the name of the desired file, then press ENTER.

The choices for configuration files are any configuration files you might have saved. Your choice remains the current configuration file until you specify a different one.

The Setup Utility 21-12
To delete a printer configuration file:
Use the Filer. See "Copying, Moving, and Deleting Files" in chapter 20.

Creating and Using User Keys

A user key—also called a user-defined key—is a function key (F1) through (F10) with a (CHAR) function defined by you, the user. A user key is similar to a 1-2-3 macro in that it represents a set of keystrokes (letters, digits, and action keys) that you record and store for quick, automatic recall. Use the Char command in the Setup utility to define user keys for any HP 6XLX application, such as the Editor, the Appointment Book, and the Calculator. (Note that user keys and 1-2-3 macros, while similar, are separate features. Also, user keys do not work when you've accessed the DOS command line.)

Selecting Char displays the list of the current user keys, such as:

![User Key Diagram]

To view the list of current user keys:
Select Char in the Setup utility.
The list displays up to 36 characters of each user key or its comment line, if there is one.

21-14 The Setup Utility
To view the full text of a long user key from the list (User mode):
1. Use the arrow keys to highlight the desired user key, if necessary.
2. Press [F10] or [ENTER]

Defining and Editing User Keys

There are two methods for defining user keys: User mode (in Char) and Locen mode. To edit (change) a user key, use User mode.

User Mode for Defining User Keys

User mode is for writing new-key instructions and editing them. All Clipboard functions and editing keys are active. See the table of Clipboard Function Keys, later in this section.

To define a user key in User mode:
1. Display the list of user keys (select Char).
2. Use the arrow keys to highlight the desired line, if necessary.
3. Press [F10] (or [ENTER]).
4. To describe your user key, type a comment after the highlighted Comment field. Press [ENTER] to move to the next field.
5. Type the text and action keys you want to record. To specify an action key (such as cursor movement), first press [Key: [F2]]. This signals that the next keystroke is to be recorded instead of executed. Then press the desired action key. The key name in braces then automatically appears. (See the next table for valid action keys.)
6. Repeat step 5 as necessary, up to 255 keys. (Text wraps automatically.)
7. To save the user key, press [End] (F6). Otherwise, press [ESC].

Pressing [End] (F6) Also Detects Errors. If there is an error in a user key you have just saved (by pressing [End]), an error message appears.
1. Press [ESC] to highlight the location of the error, then correct it.
3. Repeat steps 1 and 2 as necessary. Only one error is detected at a time.
Valid Actions for User Keys

A user key is not limited to text—it can include almost any sequence of keys. To record keystrokes other than text, remember to press $\text{[Esc]}$ first.

<table>
<thead>
<tr>
<th>Keystroke</th>
<th>Recorded As</th>
<th>Keystroke</th>
<th>Recorded As</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{[DOWN]}$</td>
<td></td>
<td>$\text{[BACKSP]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[UP]}$</td>
<td></td>
<td>$\text{[Insert]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[LEFT]}$</td>
<td></td>
<td>$\text{[Delete]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[RIGHT]}$</td>
<td></td>
<td>$\text{[End]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[LBRACE]}$</td>
<td></td>
<td>$\text{[Enter]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[RBRACE]}$</td>
<td></td>
<td>$\text{[ESC]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[ALT-key]}$</td>
<td></td>
<td>$\text{[F1]}$ to $\text{[F10]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[ALT-key]}$</td>
<td></td>
<td>$\text{[Ins]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[SETUP]}$</td>
<td>$\text{[RME}]$</td>
<td>$\text{[Menu]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[FILE]}$</td>
<td></td>
<td>$\text{[Shift}+\text{[Tab]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[COMM]}$</td>
<td></td>
<td>$\text{[PF1]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[APFT]}$</td>
<td></td>
<td>$\text{[PF2]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[PHONE]}$</td>
<td></td>
<td>$\text{[PF3]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[MEMO]}$</td>
<td></td>
<td>$\text{[PF4]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[123]}$</td>
<td></td>
<td>$\text{[PF5]}$</td>
<td></td>
</tr>
<tr>
<td>$\text{[CALC]}$</td>
<td></td>
<td>$\text{[PF6]}$</td>
<td></td>
</tr>
</tbody>
</table>

Note that application keys are valid entries—a user key can activate an application. However, user keys cannot turn the HP 91XL off, print the screen, set caps lock, or set scroll lock. Also, the $\text{[ALT-key]}$ sequences to record and run a user key cannot be recorded in user keys.

Editing User Keys

1. Display the list of user keys (select $\text{[Clear]}$).
2. Highlight the desired user key and enter User mode (press $\text{[Mode]}$ $\text{[Exit]}$ or $\text{[Enter]}$).
3. Make your changes using any editing keys on the keyboard or the Clipboard (the four function keys in the table below).
4. To save the changes, press $\text{[Exit]}$ $\text{[Exit]}$.
5. To set save the changes, press $\text{[Exit]}$ as needed.

21-16 The Setup Utility
Learn Mode for Recording User Keys

This mode simply records into a user key each keystroke as you make it. Except while in User mode, you can use Learn mode in any context, in any application.

Since you execute the user key as you recorded it, the user key is automatically tested: you see exactly what it will do. However, so editing is possible in Learn mode (as in User mode).

To record a user key in Learn mode:

1. Choose the function key for the user key by pressing SHIFT function-key. A two-toned sound signals the start of Learn mode. (If the chosen function key already contains instructions, or if you're in User mode, the HP 90LX will sound a beep and Learn mode will not start. You must delete a user key before you can redefine it.)

2. Performs the action(s) that you would like the user key to be able to execute later. Your keystrokes are automatically recorded as instructions. (There is a maximum of 246 keys per user key.) As each key is pressed in Learn mode, the keyboard clicks.

3. Press SHIFT function-key to complete the user key. The two-toned sound signals the end of Learn mode.

The Setup Utility 21-17
Executing User Keys

Since user keys can contain different kinds of information, executing a user key can mean different things. It will automatically execute almost any series of keystrokes. For example, a user key can:

- Automatically switch to a commonly used screen.
- Automatically find information in a Phone Book record.
- Automatically format a RAM card.
- Automatically enter text strings into the Appointment Book.

To execute a user key:

Press [F11] Function-key. This executes the user key assigned to that function key.

Deleting User Keys

To delete a user key:

1. Display the user key list (select Ch3).
2. Highlight the user key to be deleted.
3. Press [DEL]. Type Y (for yes).

Example: Defining and Using User Keys

Define the following two user keys:

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Definition</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>F2</td>
<td>Prompt for saving a file.</td>
<td>(MKNU) F S</td>
</tr>
<tr>
<td>F5</td>
<td>Look up the fax number for the B&amp;D Co. in the Phone Book (card view).</td>
<td>(ESC) (ESC) (ESC) (F7) B&amp;D Co. (ENTER) (F0)</td>
</tr>
</tbody>
</table>

21.10 The Setup Utility
First define F2 in User mode:

**Keys:**

- **SET UP** C
- **ENTER**
- **ENTER**

**Description:**

- **SET UP** C: Selects Ch4 in Setup, displays the list of user keys with F1 highlighted.
- **ENTER**: Highlights F2 and displays its contents.
- **ENTER**: Type the words "Save a file" as a descriptive comment.

**Comment:**

**Save a file**

**File key: MENU F S**

Enters instructions to select **MENU** File Save.

**Content:**

**Save**

**(MENU) F S**

**Index**

Save the user key.

Then define F5 in Learn mode. (Suppose a record for the B&D Co. exists in the Phone Book, with the fax number in the bottom field of the card screen.)
Opens the Phone Book.

Starts Learn mode for the F5 user key. A two-beep sound indicates Learn mode is active.

Ensures you’re at the top level of the menu, searches for “B&D Co.” and displays the card. (Note that each key press produces a click sound to remind you that Learn mode is active.)

Completes the user key.

Returns to the Setup utility and displays the list of two user keys.

Remember, once you’ve defined a user key, you can execute it by simply pressing [Function-Keypad]. Try the F2 user key you just created in the Menu Editor, for example.
Specifying a Business Card or Picture Display

The Business Card is your personalized display for the HP 95LX. It appears whenever you meet the system (press \texttt{CTRL-A} \texttt{DEL}) and whenever you close all applications (select \texttt{Quit}).

You can create a monochrome graphics image to appear in place of the Business Card if you have PC graphics software that uses the .PCX file format.

To fill out a new Business Card:

1. Select Owner Name, Title, or Company.
2. Enter the new information in the highlighted field.
3. Press \texttt{ENTER}.

To substitute a customized graphic image for the Business Card:

1. Create the desired image in a .PCX graphics file on a PC. The .PCX file must contain a monochrome image (single plane) that is no larger than 240 pixels by 126 pixels.
2. Transfer the file to the HP 95LX using the File (see "Copying, Moving and Deleting Files" in chapter 20), for which you need the Connectivity Pack hardware and software. (You can also use the Datacomm application for transfer via \texttt{XMODEM} or \texttt{Kermit} protocol. See chapter 31 for information.)
3. Select Owner Picture-File.
4. Highlight the file name of the desired image file (.PCX) or type one in.
5. Press ENTER.

To remove your graphic image and restore the Business Card:
1. Select Owner Picture-File.
2. Use  to erase the entire file name and path (including the C:).
3. Press ENTER.

Formatting a RAM Card

1-2-3 must be closed before you can format a RAM card on your HP 90LX.

To format a RAM card:

1. Prepare the RAM card as explained in "Preparing a RAM Card for Use" in chapter 1: install its batteries, record the date, and set the write-protect switch to read/write.
2. Insert the card into the plug-in slot.
3. Select Format and follow the instructions on the screen. (If you want to exit this screen without formatting the card, press CANCEL or CANCEL [REPLACE].)
Part 4

The HP Financial Calculator
The HP 15SLX Financial Calculator application puts answers at your fingertips for problems dealing with:
- General arithmetic (chapter 22).
- Business percentage calculations (chapter 24).
- Time value of money (chapter 25).
- Interest rate conversions (chapter 25).
- Currency and other unit conversions (chapter 26).
- Solver equations that you enter (chapter 28-30).
- Function graphing (chapter 25).

This chapter covers the fundamentals of the Calculator, starting the Calculator, using the keyboard and display, storing and manipulating numbers, and using the Clipboard to move data from the Calculator to other applications.
Starting the Calculator

Press the 2 key on the second row of the keyboard to start the Calculator.

You can exit the Calculator by selecting MENU Quit, or you can suspend it in the background by starting another application (for example, by pressing Ctrl). If you leave the Calculator to go to another application, just press Enter when you want to reenter where you left off.

Using the Display and Keyboard

The Calculator Display

When you start the Calculator, the arithmetic screen is displayed. To display the main menu in Lotus 1-2-3, press MENU to see the Calculator menu.

[Diagram of Calculator Display]

22-2 Calculator Basics
Calculator menu. To make a selection, press the key corresponding to the last letter of a word (for example, pressing \( \text{B} \) selects the Solver), or use the arrow keys to highlight a word and press \( \text{ENTER} \). \( \text{ESC} \) lets you back out of a selection you made by mistake.

Labeled data area. This shows you the status of variables, registers, etc. that relate to the type of problem you are working on.

Calc line. This is where you enter numbers and see results.

Function key labels. These correspond to \( \text{F}1 \) through \( \text{F}12 \) on the keyboard and their definitions change with different menu selections. A function key label with some lowercase letters generally means that it leads you to another set of function keys; one in all uppercase letters means that it executes a Calculator function.

Immediately above the calc line is the area the Calculator uses to display annunciators—symbols that tell you when the Calculator is in a special state or mode.

- The \( \text{RPN} \) annunciator is described in appendix I.
- The \( \text{RAD/GRAD} \) annunciator tells you how angles are interpreted: radians (\( \text{RAD} \)), grads (\( \text{GRAD} \)), or degrees (no annunciator). This annunciator displays only in the main screen and the Solver.
- The \( \text{STO}/\text{RCL} \) annunciator turns on when you’re storing or recalling the contents of registers.
Changing the Display Format

There are two ways you can change the format of the Calculator display:

- You can change the number of displayed decimal places.
- You can change the numeric notation.

Note

You can interchange the period and comma as numbers in all HP 9815X applications by using the Setup Utility. For information, see chapter 21.

Changing the Number of Displayed Decimal Places

When you start the Calculator the first time, numbers are displayed with two places to the right of the decimal point. To change the number of decimal places, select [MATH] Options Format Fix and then select the number of places you want displayed—from 0 to 15.

For example, if you enter 25.41 and then press [MATH] O F F 4, it will be displayed as 26.4780. Pressing [MATH] O F F 1 would then change the display to 26.5 (however, the number would still be stored in memory as 26.47—numbers are always stored in the Calculator with full precision).

To show numbers to their full precision, select [MATH] Options Format All. If you then enter 4, it is displayed as 4; 237.4500 is displayed as 237.45, with the trailing zeros removed.

To temporarily view displayed numbers to their full precision, select [MATH] View. Press [ESC] to return to the previous display.

Changing the Numeric Notation

You can change the numeric notation in the calculator to either Scientific Notation (a mantissa with an exponent) or Engineering Notation (a mantissa with an exponent that is a multiple of 3).

- To change to Scientific Notation, select [MATH] Options Format Scientific and then select the number of decimal places—0 through 15.
- To change to Engineering Notation, select [MATH] Options Format Engineering and then select the number of decimal places—0 through 15.
For example, if the number 13,246,5790 is displayed in the Calculator and you press [MENU] O F S 3, the number is displayed in scientific notation as 1.32E5. If you press [MENU] O F E 3, the number is displayed in engineering notation as 13.25E3.

The Calculator Keyboard
The Calculator primarily uses three areas of the keyboard:

- Function keys
- Special Calculator keys
- Numeric keypad

The Function Keys
The function keys [1] through [15] correspond to the function-key labels at the bottom of the Calculator screen. Their definitions change with each selection from the Calculator menu. [16], however, always gives you help.

The Numeric Keypad
The numeric keypad contains the 10-key digit pad for numeric entry as well as the [0] key and math operators (+, -, etc.).
The Special Calculator Keys

Most of the time the alpha keys are not active within the Calculator. The Calculator takes advantage of this by redefining the bottom row of alpha keys (Q W E etc.) along with the F key to give you a set of special Calculator keys. The Calculator definitions are printed just below the corresponding keys—Q becomes 22, W becomes 21, E becomes 20, etc.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Calculates the square root of the number in the calc line.</td>
</tr>
<tr>
<td>21</td>
<td>Calculates the reciprocal of the number in the calc line.</td>
</tr>
<tr>
<td>20</td>
<td>If the calc line contains a number, exchanges that number with the result of the previous calculation (see “Using the History Stack” in chapter 23). If the calc line contains two numbers separated by an operator, swaps the order of the numbers (for example, 3-4 changes to 4-3).</td>
</tr>
<tr>
<td></td>
<td>Rolls down the history stack. (See “Using the History Stack” in chapter 23.)</td>
</tr>
<tr>
<td>LAST</td>
<td>Copies the result of the previous calculation into the current calculation. (See “Using the LAST Key” in chapter 23.)</td>
</tr>
<tr>
<td>CTO</td>
<td>Copies a number from the calc line into the designated register or variable. (See “Using Registers” in chapter 23.)</td>
</tr>
<tr>
<td>REC</td>
<td>Recalls the number from the designated register or variable. (See “Using Registers” in chapter 23.)</td>
</tr>
<tr>
<td></td>
<td>Makes a positive number negative or a negative number positive. For example, pressing 22 with the number 1.18 in the calc line changes it to -1.18. Pressing it a second time makes the number positive again.</td>
</tr>
</tbody>
</table>

Other Keys

Other keys, such as QWE, QW, and W, have specific uses that are described in procedures throughout the Calculator part of this manual.

Here’s a business percentage calculation to demonstrate how the Calculator works:

22-4 Calculator Basics
Example: Calculating a Percentage Change in Costs. As the new Procurement Manager at Everett Racquet, Inc., you have the assignment of estimating the percentage increase in the raw-material cost for your new Krypton-Flex racquet over the next 5 years. The current cost is $120; the cost estimate for 5 years from now is $280. Press the following keys, read the descriptions, and watch your display to determine the percent change in costs.

**Keys** | **Description**
--- | ---
(1) | Starts the Calculator.
B | Selects **B**u.
120 | Enters today's cost into the calc line.
OLD | Puts the number in the calc line into the **OLD** register.
280 NEW | Enters the estimated future cost into the **NEW** register.
%CHG | Calculates the percentage change from **OLD** to **NEW** as a 133.33% increase

Old value,.............. **OLD** = 120.00
New value,............. **NEW** = 280.00
Percent change,........ **%CHG** = 133.33
Total amount........... **TOTAL** = 0.80
Part of total........... **PART** = 0.00
Percent of total........ **%TOTAL** = 0.00

**%CHG** = 133.33

The previous example demonstrates entering data using the function keys that correspond to the variables on the screen. An alternate method for data entry involves highlighting a variable on the screen using the arrow keys, typing a number, and then pressing **A** or **E**. Then, once you’ve entered all the necessary data, highlighting the variable to solve for and pressing the spacebar returns the answer.

So that you can decide which method you prefer, try the same example with this “point-and-shoot” method:

**Calculator Basics** 22-7
**Keys:**

[GRID] E D
Selects [GRID] Error Data to clear the data.

[ ]
Highlights the OLD variable.

120 [x]
Enters today's cost into OLD and advances the highlight to NEW.

26 [x]
Enter the estimated future cost into NEW and advances the highlight to [CHG].

**Spacebar:**
Calculates the percentage change from OLD to NEW as a 130.33% increase.

Old value . . . . . . . . . . . . . . . . . . . . . . . . O LD = 120.00
New value . . . . . . . . . . . . . . . . . . . . . . . . NEW = 266.00
Percent change . . . . . . . . . . . . . . . . . . . . . . %CHG = 130.33

Total amount . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . TOTAL = 0.00
Part of total . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . PART = 0.00
Percent of total . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . %TOTAL = 0.00

%CHG = 130.33

The point-and-shoot method is available throughout the Calculator.
When you're ready to do something else with the Calculator, simply press [QUIT] to display the Calculator menu and then make another selection.

---

**Doing Arithmetic**

Arithmetic is done in the calc line. This is a brief introduction to arithmetic; it's covered in greater detail in chapter 28.

**Note**

The examples in the Calculator part of this User's Guide use algebraic syntax to enter numbers. If you are familiar with Hewlett-Packard's RPN syntax and prefer to use it, refer to appendix D for instructions.

---

24-6 Calculator Basics
Example: Addition. Add 721.07 and 223.89.

Keys: | Description:
---|---
721.07 [+] | Enters the two numbers and displays them on the calculation line.
223.89 | 721.87 + 223.89 = 944.76

Completes the calculation.

Once the Calculator has completed a calculation, pressing another number key starts a new calculation.

Negative Numbers

To key in a negative number, type the number and then press [\(\text{\textasciitilde}\)].

Keys: | Description:
---|---
75 [\(\text{\textasciitilde}\)] | Changes the sign of 75.
-75.00

4.52 [\(\text{\textasciitilde}\)] 7.1 [\(\text{\textasciitilde}\)] | Changes the sign of 7.1 and then completes the multiplication.
-32.09

Using a Result in Another Calculation

As you've seen, pressing a number key when the calculation line contains a result starts a new calculation. If you press an operator key instead, the Calculator continues the calculation.
Keys:  
145  
Descripion:  
Calculates 75 + 145.

228, 09

Divides 210 by 3.5.

62, 86

The Calculator also lets you do chain calculations (calculations based on the results of previous calculations) without using \( \Box \) at the conclusion of each step. "Chain Calculations" in chapter 25 explains how to do this.

**Editing and Clearing the Calc Line**

Use \( \Box \) (backspace) to edit the calc line. When the cursor is visible—
which is when you are in the process of keying in a number—\( \Box \) deletes the last character you keyed in. When the cursor is not visible, \( \Box \) erases the rightmost number or operator.

To clear the calc line, press \( \text{CE} \).

**The History Stack**

The Calculator keeps a four-line record of your calculations in the history stack. The calc line is the bottom of this stack and is usually the only visible line. You can see these results in other calculations. How to view and use the stack is explained in "Using the History Stack" in chapter 23.

22-10 **Calculator Basics**
Clearing Information in Calculator Memory

[MENU] Erase enables you to clear various parts of Calculator memory:

- To erase the data associated with the current Calculator screen, select [MENU] Erase Data. For example, if you previously selected [MENU] TVM so that the TVM screen is displayed, selecting [MENU] Erase Data erases all your TVM data.
- To erase the calc line, select [MENU] Erase Calcine.
- To erase the history stack, select [MENU] Erase Stack.
- To erase the storage registers, select [MENU] Erase Registers.

Pressing [CSE] is another way to clear just the calc line.

Using the Clipboard with the Calculator

This section covers the general use of the Clipboard within the Calculator. The Calculator Solver has a special use for it, which is described in “Using the Clipboard in the Solver” in chapter 28.

The Clipboard lets you capture a number from the calc line and move it to another HP 95LX application (or even back into the Calculator). For example, you could use the Clipboard to capture the result of a percentage calculation and insert it in a memo you’re writing in the Editor.

To copy a number from the calc line into the Clipboard:

Press [CSE] > COPY (F3). The rightmost number is copied into the Clipboard. (Any previous contents of the Clipboard are erased when you copy something new into it.)

To insert the contents of the Clipboard into the active HP 95LX application:

1. Position the cursor where you want the text inserted. (Except in the Solver, anything inserted into the Calculator goes onto the calc line.)

Calculator Basics 22-11
1-2-3 interprets the contents of the Clipboard as a label. So, if you move a number from the Calculator to 1-2-3 using the Clipboard, it will go into 1-2-3 as a label, not as a value. To move numbers from the Calculator to 1-2-3 that 1-2-3 would interpret as values, use 
\[ \text{Calc} \]\] and 
\[ \text{Calc}\] \]. For more information, see "Moving Values between the Calc Line and 1-2-3" in chapter 22.

When you paste the contents of the Clipboard into the calc line, only the last number copied into the Clipboard is pasted; all non-numeric characters are ignored.
Arithmetic and Math Functions

Simple Arithmetic

Here are some examples of simple arithmetic in the Calculator using the keys ① (1), ② (2), ③ (3) (times), and ④ (4) (divide). Notice how the ⑤ key completes the calculation.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.60 ② 28.33 ①</td>
<td>Adds 54.60 to 28.33 and displays the result in the calc line.</td>
<td>83.02</td>
</tr>
<tr>
<td>⑤ 6 ② 200 ④</td>
<td>Multiplies the previous result by 6 and then subtracts 200 from that result.</td>
<td>290.12</td>
</tr>
</tbody>
</table>

Chain Calculations

Notice in the second part of the example above that you did not need to press ⑤ to multiply 83.02 by 6—the multiplication was completed when you pressed the operator (in that case, ④) for the next part of the calculation. Calculations strung together are called chain calculations.
Operator Priority and Pending Operations

Some chain calculations might be interpreted several different ways. For example, \(9 + 12 \div 3\) has two interpretations:

\[
\frac{9 + 12}{3} = 7 \quad \text{or} \quad 9 + \frac{12}{3} = 7
\]

The HP 95LX uses a system of operator priority to evaluate expressions:

\[
\begin{array}{c}
\text{Highest priority} \\
\text{Middle priority} \\
\text{Lowest priority}
\end{array}
\]

The HP 95LX calculates an intermediate result when the next operator you enter has a lower or equal priority. When the next operator has higher priority, the HP 95LX retains the previous numbers. For example, in the calculation \(9 \div 12 \times 3 \div 2\), division has a higher priority than addition. Thus, the 9 and \(\div 12\) are retained as a pending operation until the division is completed.

Example. Calculate \(4 \times 7^2\) plus \(5 \times 7^2\) plus 6.

Keys: \[
\begin{array}{c}
4 \div \times 7^2 \div 5 \times 7^2 + 6
\end{array}
\]

Description:

\[
\begin{array}{l}
4 \div \times 7^2 \div 5 \times 7^2 + 6 \\
1 \div 372 \div 20 + \\
5 \div \times 7^2 \div 5 \times 7^2 + 6 \\
1 \div 372 \div 20 + \\
7 \div \times 7^2 \div 5 \times 7^2 + 6 \\
1 \div 372 \div 20 + \\
2 \div \times 7^2 \div 5 \times 7^2 + 6 \\
1 \div 372 \div 20 + \\
6 \div \times 7^2 \div 5 \times 7^2 + 6 \\
1 \div 372 \div 20 + 
\end{array}
\]

Result: \(1,625 \div 00\)

---

Arithmetic and Math Functions

23-2
If a calculation requires that operations be done in a particular order (consistent with operator priority, for example, addition before multiplication), use parentheses. You can have a maximum of eight pending operations.

### Using Parentheses in Calculations

Use parentheses when you need to postpone calculating an intermediate result until you’ve completed lower-priority operations. For example, suppose you want to calculate:

\[
\frac{35}{85 - 12} \times 9
\]

If you were to key in 35 85 12, the Calculator would calculate the intermediate result, 0.35. However, that’s not what you want. To delay the higher-priority division until you’ve subtracted 12, use parentheses:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 85 12</td>
<td>The parenthesis prevents an intermediate calculation.</td>
</tr>
<tr>
<td>12</td>
<td>Calculates 85 - 12.</td>
</tr>
<tr>
<td>9</td>
<td>Calculates 30 ÷ 73.</td>
</tr>
<tr>
<td></td>
<td>Completes the calculation.</td>
</tr>
</tbody>
</table>

\[
30 \div (85 - 12) \times 9 = 2.70
\]
Percent

In most cases, ⑧ (the shifted ⑧ key) divides the number farthest to the right in the calc line by 100. The exception is when a plus or minus sign precedes the number. Then, the ⑧ key uses the rightmost number as a percent and calculates that percent of the number preceding the plus or minus sign.

Find 27% of 85.3.

Keys: 85.3 ⑧ 27 ⑧ 106 ⑧

Description: Divides 27 by 106.

85.3 × 0.27

Calculates 27% of 85.3.

23.03

Example: Calculating Simple Interest. You borrow $1,250 from a relative and agree to repay the loan in a year with 7% simple interest. How much money will you owe?

Keys: 1250 ⑧ 7 ⑧ 1 ⑧ 250 ⑧ 97.59

Description: Interest on the loan (7% of $1250) is $87.59.

1250 × 0.07 ⑧ 97.59

Displays the total amount you must repay at the end of 1 year.

1337.59

23.4 Arithmetic and Math Functions
### Other Keyboard Arithmetic

The other keyboard arithmetic keys are \( \div \) (the \( \div \) key), \( \times \) (the \( \times \) key), and \( \boxed{\sqrt[3][\phantom{0}] \) (the shifted \( \sqrt[3][\phantom{0}] \) key) They act on the number furthest to the right in the calc line.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ( \div )</td>
<td>Calculates the reciprocal of 4.</td>
<td>0.25</td>
</tr>
<tr>
<td>20 ( \sqrt[2]{} )</td>
<td>Calculates the square root of 20.</td>
<td>4.47</td>
</tr>
<tr>
<td>1.1 ( \sqrt[3]{} )</td>
<td>Calculates ( \sqrt[3]{1.1} ).</td>
<td>1.21</td>
</tr>
</tbody>
</table>

The \( \sqrt{} \) function is useful for calculating the root of a number.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 ( \sqrt[3]{} )</td>
<td>Calculates ( 125^{1/3} ).</td>
<td>5.00</td>
</tr>
<tr>
<td>( \boxed{\sqrt[3][\phantom{0}] )</td>
<td>Calculates the cube root of 125.</td>
<td></td>
</tr>
</tbody>
</table>

---

*Arithmetic and Math Functions* 23-5
Using the Automatic Constant in Calculations

An Automatic Constant is an operator (+, −, ×, ÷, or "%") and a number or percentage that can be used for repetitive calculations. To initiate an automatic constant, press an operator twice followed by a number or percentage. Once initiated, the constant is displayed to the right of the calculation in brackets, for example (+3%).


<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>128 × 3.2</td>
<td>Stores &quot;×3.2&quot; as a constant and multiplies 128 by 3.2.</td>
</tr>
<tr>
<td></td>
<td>469.60 (+3.20)</td>
</tr>
<tr>
<td>219 × 3.2</td>
<td>Multiplies 219 by 3.2.</td>
</tr>
<tr>
<td></td>
<td>700.80 (+3.20)</td>
</tr>
<tr>
<td>316 × 3.2</td>
<td>Multiplies 316 by 3.2.</td>
</tr>
<tr>
<td></td>
<td>1,011.20 (+3.20)</td>
</tr>
</tbody>
</table>

Example. Calculate 10+10%, 11+10%, and 25+10%.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 + 10%</td>
<td>Stores &quot;+10%&quot; as a constant and adds 10% to 10.</td>
</tr>
<tr>
<td></td>
<td>11.00 (+10.00%)</td>
</tr>
<tr>
<td></td>
<td>Adds 10% to 11.</td>
</tr>
<tr>
<td></td>
<td>12.10 (+10.00%)</td>
</tr>
<tr>
<td>25 + 10%</td>
<td>Adds 10% to 25.</td>
</tr>
<tr>
<td></td>
<td>27.50 (+10.00%)</td>
</tr>
</tbody>
</table>

23-6 Arithmetic and Math Functions
If it causes the contents of the calc line to become too long to be viewed in the display, the constant is abbreviated as \( X \) as in \( 1 \times 10^4 \).

Pressing \( \text{C} \) clears the constant and the result from the calc line. Pressing another operator key or \( \text{C} \) clears just the constant and leaves the result.

**Totaling a List of Numbers**

The Calculator enables you to total a column of up to 100 numbers using a special screen and function keys. Select \( \text{MTH} \) \( \text{List} \) to see the number list screen:

To add a number to the list at the position of the highlight, type the number in the calc line and press \( \text{ENTER} \). (If an uncompleted calculation is in the calc line when you press \( \text{ENTER} \), it is completed and the result is added to the list.) Whenever you add or delete a number from the list, the current total is displayed in the calc line.

The function keys give you flexibility in manipulating the numbers in the list.
<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>INSERT</td>
<td>Inserts the value 0.00 at the highlight, moving the rest of the list down one position.</td>
</tr>
<tr>
<td>DELETE</td>
<td>Deletes the value at the highlight, moving the rest of the list up one position.</td>
</tr>
<tr>
<td>TOTAL</td>
<td>Returns to the calc line the sum of all the items in the list.</td>
</tr>
<tr>
<td>LIST</td>
<td>Enters the value in the calc line into the list at the position of the highlight and moves the highlight down one position. An existing value is overwritten.</td>
</tr>
</tbody>
</table>

The up and down arrow keys (A and V), (ZUP), (ZODD), (ZODD), and (ZODD) are all used to move the highlight up and down the list. (The arrow keys can also be used to enter a number into the list at the position of the highlight by typing the number into the calc line then pressing A or V.)

To clear the list, select (CLEAR) Erase Data when the list is displayed. To leave the list screen, either select another screen within the Calculator or select another HP 48SX application altogether. The list is left intact until you clear it or until you do a system reset.

23-8 Arithmetic and Math Functions
Example: Balancing a Checkbook. Use the number list feature to find the month-end balance for a checking account that had a month's activity of five checks and two deposits. It had a starting balance of $10,128.46.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Selects the number list screen.</td>
</tr>
<tr>
<td>10128.46 ENTER</td>
<td>Enters the starting balance as item 1.</td>
</tr>
<tr>
<td>52.49 LIST-</td>
<td>Enters the amount of the first check as a negative number.</td>
</tr>
<tr>
<td>180.10 LIST=</td>
<td>Enters the rest of the checks as negative numbers.</td>
</tr>
<tr>
<td>1000 LIST=</td>
<td></td>
</tr>
<tr>
<td>72.50 LIST=</td>
<td></td>
</tr>
<tr>
<td>200 LIST=</td>
<td></td>
</tr>
<tr>
<td>1411.77 LIST+</td>
<td>Enters the deposits into the account as positive numbers. The total for the list is updated at each entry and shows a final amount in the account of $10,096.05.</td>
</tr>
<tr>
<td>67.34 LIST+</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>10,128.46</td>
</tr>
<tr>
<td>2)</td>
<td>-52.49</td>
</tr>
<tr>
<td>3)</td>
<td>-180.10</td>
</tr>
<tr>
<td>4)</td>
<td>-1,000.00</td>
</tr>
<tr>
<td>5)</td>
<td>-72.50</td>
</tr>
<tr>
<td>6)</td>
<td>-200.00</td>
</tr>
<tr>
<td>7)</td>
<td>1,411.77</td>
</tr>
<tr>
<td>8)</td>
<td>67.34</td>
</tr>
<tr>
<td>9)</td>
<td></td>
</tr>
<tr>
<td>10)</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL = 10,096.05

Now try using the other function keys—for example, change one of the check amounts as if you’re correcting an error. Remember, when you’re finished using this feature and want to go on to something else, you can exit it by selecting another feature from the Calculator menu.
Recalling Numbers to the Calc Line

Sometimes, you may want to include the result of a previous calculation in a new calculation. There are several ways to reuse numbers.

Using the History Stack

The history stack is a four-level record of activities within the Calculator. It includes the calc line and three levels "above" the calc line. When you start a new operation on the calc line, the previous contents move up to level 3, bumping level 2 contents to level 2, level 2 to level 1, and level 1 off the stack. Numbers are lost when bumped off the stack.

The history stack always contains four numbers. If you clear the stack, the numbers change to 0's.

The current state of the history stack can be viewed in two ways:

- By selecting **[MEM]** Math. The history stack is always displayed in the Math screen.
- By selecting **[MEM]** Arith and then pressing **[F5]** (12). This screen can be displayed as long as you want and is updated as you work. When you want the screen to go away, press **[H2]** (13).

The **(12)** key (the **(2)** key when the Calculator is active) "rolls" the history stack down one line. For example, pressing **(12)** once with the above stack moves 50.00 to the top of the stack (level 3) and rolls the other numbers down one level, putting 50.00 in the calc line. Pressing **(12)** four times cycles through the entire stack.
The 2nd key (the 1st key when the calculator is active) normally swaps a number in the calc line with the number in stack level 1. For example, if your stack looks like the one in the illustration above, pressing 2nd puts 40.00 in the calc line and moves 50.00 to level 1.

The exception to this rule is when you have an incomplete calculation in the calc line. Then, 2nd swaps the two operands. For example, pressing 2nd changes 2.00/3.00 in the calc line to 3.00/2.00.

To clear the history stack (including the calc line), select MENU Erase Stack.

Using the LAST Key

Pressing LAST (the 3rd key when the Calculator is active) copies the number in level 1 of the history stack into a calculation you are in the process of doing.

For example, here is one way to calculate $\frac{\sqrt{123+17}}{2+8}$.  

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>123 + 17</td>
<td>Calculates 123 + 17.</td>
</tr>
<tr>
<td>$\sqrt{}$</td>
<td>Calculates the square root of 123 + 17.</td>
</tr>
<tr>
<td>47.00/11.83</td>
<td>Copies 11.83 to the calc line.</td>
</tr>
<tr>
<td>$\div$</td>
<td>Completes the calculation.</td>
</tr>
</tbody>
</table>

Arithmetic and Math Functions 23-11
Using Registers

The Calculator has 10 registers (storage locations), numbered 0 through 9, that can be used to store and recall numbers.

Storing and Recalling Numbers

To store or recall a number, press \( \text{STO} \) (the \( \text{S} \) key when the Calculator is active) or \( \text{RCL} \) (the \( \text{R} \) key when the Calculator is active), followed by a number in the range 0 through 9.

\( \text{STO} \) copies the number from the calc line to a designated register. If there is more than one number in the calc line, \( \text{STO} \) copies only the rightmost number. \( \text{RCL} \) recalls the stored number back to the calc line.

To cancel the store or recall after you’ve pressed \( \text{STO} \) or \( \text{RCL} \), press \( \text{ESC} \) or \( \text{DEL} \).

The following keystrokes solve these two calculations using two registers:

\[
\begin{align*}
475.6 & \quad \text{STO} \quad 1 \\
39.15 & \quad \text{RCL} \quad 2 \\
560.1 & \quad \text{+} \quad 475.6
\end{align*}
\]

Key | Description
--- | ---
475.6  | Stores 475.6 into register 1.
39.15  | Stores 39.15 (the rightmost number) into register 1.
| Completes the first calculation.
560.1  | Recalls the contents of register 1.
\( x+ \)  | \( 475.6 \times 39.15 \)
\( 12.15 \) | \( 560.1 + 475.6 \)

23-12 Arithmetic and Math Functions
Adds the two numbers.

Recalls the contents of register 2.

Completes the second calculation.

The [STO] and [ECM] keys can also be used with variables. For example, pressing [STO] [PMT] [tvn] stores the rightmost number in the calc line into the variable PMT. Pressing [ECM] [PMT] copies the contents of PMT into the calc line.

Viewing Registers

The current values in the registers can be viewed at any time by selecting [MENU] [Reg] and then pressing [SHOW] (F9). The first time you press [SHOW], registers 0 through 4 are displayed along with the history stack. Press it a second time to see all 10 registers. Here is a typical screen you might see:
You can continue using the calc line while the registers are displayed. However, if you want to remove them from the display, press [NONE].

Clearing Registers

In most cases, it is unnecessary to clear registers, since storing a number replaces the previous contents. However, you can clear a single register by storing 0 in it. To clear all the registers, select [MENU] Ease Registers.

Doing Arithmetic inside Registers

The Calculator lets you do arithmetic on numbers that are stored inside registers regardless of which menu is in the display. The following example stores 45.7 in register 3, multiplies that number by 2.5, and stores the result back in register 3:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
<th>Reg 3 =</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.7 [STO] 3</td>
<td>Stores 45.7 into register 3.</td>
<td>45.70</td>
</tr>
<tr>
<td>2.5 [STO] 3</td>
<td>Stores 114.25 (45.7 x 2.5) into register 3.</td>
<td>114.25</td>
</tr>
<tr>
<td>RCL 3</td>
<td>Displays the contents of register 3.</td>
<td></td>
</tr>
</tbody>
</table>

The following table shows the options for arithmetic inside registers:

<table>
<thead>
<tr>
<th>Keys</th>
<th>New Number in Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>[STO]</td>
<td>old number + displayed number</td>
</tr>
<tr>
<td>[STO]</td>
<td>old number - displayed number</td>
</tr>
<tr>
<td>[STO]</td>
<td>old number x displayed number</td>
</tr>
<tr>
<td>[STO]</td>
<td>old number + displayed number</td>
</tr>
</tbody>
</table>

23-14 Arithmetic and Math Functions
You can also do arithmetic on numbers stored in variables. For example, if \( \text{STO} \ P \ PMT \), multiplies the current contents of \( PMT \) by 2 and stores the product in \( PMT \).

**Using the M Register**

Register 0 (the M register) is a special register that has its own set of "shortcuts" memory keys. You can use the \( \text{STO} \) key-combinations and \( \text{RCL} \) with register 0 just like you would with the rest of the registers, or you can use the four function keys that are present wherever you select \( \text{MEM} \) Arith. These keys do storage operations on register 0 with a minimum of keystrokes.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{STO} ) ( 0 )</td>
<td>Stores the value in the calc line into register 0. (Same as ( \text{STO} ) ( 0 ).)</td>
</tr>
<tr>
<td>( \text{RCL} ) ( 0 )</td>
<td>Recalls the contents of register 0 to the calc line. (Same as ( \text{RCL} ) ( 0 ).)</td>
</tr>
<tr>
<td>( \text{RCL} ) ( + )</td>
<td>Adds the value in the calc line to the old value in register 0 and stores the sum in register 0. (Same as ( \text{STO} ) ( + ) ( 0 ).)</td>
</tr>
<tr>
<td>( \text{RCL} ) ( - )</td>
<td>Subtracts the value in the calc line from the old value in register 0 and stores the difference in register 0. (Same as ( \text{STO} ) ( - ) ( 0 ).)</td>
</tr>
</tbody>
</table>

Example: Using the M Register. The following example stores 355.6 in register 0, and then adds 69.5 into the register. (If you want to watch register 0 as it changes in this example, press \( \text{SHIFT} \) \( \text{MATH} \) before you start.)

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>355.6 ( \text{STO} ) ( 0 )</td>
<td>Stores 355.6 into register 0.</td>
</tr>
</tbody>
</table>

\[ \text{Reg0(M)} = 355.60 \]

Arithmetic and Math Functions 23:15
Moving Values between the Calc Line and 1-2-3

If you’re using the Calculator while you have an open 1-2-3 worksheet, you have the ability to copy values from the calc line to a 1-2-3 cell and from a 1-2-3 cell to the calc line. Any numbers copied into 1-2-3 this way are treated as values by 1-2-3.

To copy the rightmost number in the calc line to a 1-2-3 cell:
1. Press \( \text{STO} \) \( \text{1} \) from the Calculator. The open 1-2-3 worksheet is displayed.
2. Move the cell pointer to the cell you want to receive the number.
3. Press \( \text{ENTER} \). The number from the calc line is copied to the highlighted cell, and you’re returned to the Calculator.

To copy a number in a 1-2-3 cell to the calc line:
1. Press \( \text{SEL} \) \( \text{1} \) from the Calculator. The open 1-2-3 worksheet is displayed.
2. Move the cell pointer to the cell with the value you want to copy.
3. Press \( \text{ENTER} \). The number in the highlighted cell is copied to the calc line.

If in step 2 you selected an empty cell or a cell with a label, 0.00 is returned to the calc line.
Technical Math Functions

When you select **MATH** Math, the math functions screen is displayed.

![Math Functions Screen]

This screen contains the current status of the history stack, the calculation line, and function keys for the technical math functions. There are four sets of page function keys—pressing **PAGE** shows you the next page, and pressing **PAGE** shows you the previous page. The Calculator remembers the current page when you leave the math functions screen so that it is displayed again when you return.

**Rounding a Number.** **RND** rounds the number in the calculator line to the number of displayed decimal places. (Before rounding, the stored version of the number may have additional non-zero digits that are not displayed.) Any subsequent calculations using that number will be based on the rounded value.

Note that after you select **MATH** Math you may have to press **MORE** to get to the function keys used in this example.

### Keys | Description
--- | ---
4.59 | Displays result to two decimal places.
Selects View to see the full number.

Rounds the number to two decimal places.

Views the full number to verify that it has been rounded.

Integer Part, Fractional Part, and Absolute Value. The following table describes three other math functions that manipulate real numbers:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP</td>
<td>Integer part of the rightmost real number in the calc line.</td>
</tr>
<tr>
<td>FP</td>
<td>Fractional part of the rightmost real number in the calc line.</td>
</tr>
<tr>
<td>ABS</td>
<td>Absolute value of the rightmost real number in the calc line.</td>
</tr>
</tbody>
</table>

Exponential and Logarithmic Functions. There are four exponential and logarithmic functions:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN</td>
<td>Natural (base e) logarithm of a positive number.</td>
</tr>
<tr>
<td>e^X</td>
<td>Natural antilogarithm; e^x.</td>
</tr>
<tr>
<td>LG</td>
<td>Common (base 10) logarithm of a positive number.</td>
</tr>
<tr>
<td>10^X</td>
<td>Common (base 10) antilogarithm; 10^x.</td>
</tr>
</tbody>
</table>

Note that after you select Menu Math, you may have to press [ENTRY] ([ES]) to get to the function keys used in this example.

Arithmetic and Math Functions
Changing the Trigonometric Mode. The trigonometric functions and polar/rectangular coordinate conversions involve angles that can be interpreted either as degrees or radians, depending on the current trigonometric mode. Annunciators just above the calc line indicate the mode—the RAD annunciator indicates Radians mode, the GRADE annunciator indicates Grads mode, and no annunciator indicates Degrees mode.

To change to Radians mode, select (MODE) Options Radians; the RAD annunciator appears above the calc line. 
To change to Grads mode, select (MODE) Options Grade; the GRADE annunciator appears above the calc line. 
To change back to Degrees mode, select (MODE) Options Degrees; the RAD or GRADE annunciator turns off.

Trigonometric Functions. Except for π, trigonometric functions interpret angles in degrees, radians, or grads, depending on the trigonometric mode.

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIN</td>
<td>sine</td>
</tr>
<tr>
<td>COS</td>
<td>cosine</td>
</tr>
<tr>
<td>TAN</td>
<td>tangent</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIN</td>
<td>arc sine</td>
</tr>
<tr>
<td>ACOS</td>
<td>arc cosine</td>
</tr>
<tr>
<td>ATAN</td>
<td>arc tangent</td>
</tr>
</tbody>
</table>
For the following example if the RAD or GRAD annunciator is on select

[MENU] Options Degrees to change to Degrees mode. Also, note that
after you select [MATH] Math you may have to press [MODE] (F2) to
goto the function keys used in this example.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Selects the math functions.</td>
</tr>
<tr>
<td>15 SIN</td>
<td>Sine of 15°.</td>
</tr>
</tbody>
</table>

2.72 \arctan | Arc tangent of 2.73. |

Angle and Unit Conversions. The following table describes the four
angle- and unit-conversion functions:

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
</table>
| \text{\texttt{DEG}} | To degrees; converts the number from a radian value to its
decimal degree equivalent. |
| \text{\texttt{RAD}}  | To radians; converts the number from a decimal degree
decimal equivalent. |
| \text{\texttt{HR}}   | To hours; converts the number from
hour(s)-minutes-seconds format
(HH.MMSSss or D:MMSSss) to decimal hours (or degrees) format. |
| \text{\texttt{MINSEC}} | To hours-minutes-seconds; converts the number from
decimal hours (or degrees) to
hour(s)-minutes-seconds format (HH.MMss or D.MMss). |

In the following example you may have to press [MODE] (F2) after
you select [MATH] Math to get to the \texttt{F1} function key.

23-26 Arithmetic and Math Functions
Polar/Rectangular Coordinate Conversions. These functions interpret the angle as degrees, radians, or grads, depending on the current trigonometric mode.

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>XCOORD</td>
<td>Stores the x-coordinate or calculates the x- and y-coordinates.</td>
</tr>
<tr>
<td>YCOORD</td>
<td>Stores the y-coordinate or calculates the x- and y-coordinates.</td>
</tr>
<tr>
<td>RADIUS</td>
<td>Stores the radius or calculates the radius and angle.</td>
</tr>
<tr>
<td>ANGLE</td>
<td>Stores the angle or calculates the radius and angle.</td>
</tr>
</tbody>
</table>

For the following example, if the Radian or Grads annunciator is on, select [MODE] Options Degrees to change to Degrees mode. Also, note that after you select [MATH] Math you may have to press [MODE] (PIE) to get to the function keys used in this example.

Convert the rectangular coordinates \((10, -15)\) to polar coordinates:
**Keys:**

- **MENU** M Selects the math functions.
- **10 RECORD** Stores the x-coordinate.
  \[ XCOORD = 10.89 \]
- **15 YCOORD** Stores the y-coordinate.
  \[ YCOORD = -15 \]
- **RADIUS** Calculates the radius and angle.
  \[ RADIUS = 18.83 \]

**Probability Functions.** Combinations, permutations, factorials, and random numbers are included in the probability functions.

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>Stores ( n ) for calculating combinations and permutations.</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Stores ( n ) for calculating combinations and permutations.</td>
</tr>
<tr>
<td><strong>COM</strong></td>
<td>Combinations; calculates the number of different sets containing ( n ) items that can be taken from a larger group of ( n ) items. Different orders of the same ( n ) items are not counted separately.</td>
</tr>
<tr>
<td><strong>PERM</strong></td>
<td>Permutations; calculates the number of different arrangements of ( n ) items that can be taken from a larger group of ( n ) items. Different orders of the same ( n ) items are counted separately.</td>
</tr>
<tr>
<td><strong>FACT</strong></td>
<td>Calculates the factorial of the rightmost number in the calculation.</td>
</tr>
<tr>
<td><strong>SEED</strong></td>
<td>Stores a seed for the random number generator. A seed is a number that initiates the sequence of random numbers. Pressing 0 ( \text{SEED} ) uses a new seed from the system clock. To specify a particular seed, key in a non-zero number and press ( \text{SEED} ). You can repeat a random number sequence by storing the same non-zero seed.</td>
</tr>
<tr>
<td><strong>RAN#</strong></td>
<td>Displays a random number between 0 and 1. All random numbers have 12 significant digits.</td>
</tr>
</tbody>
</table>

**Arithmetic and Math Functions**
Note that after you select [MATH] you may have to press [2nd] [F3] to get to the function keys used in this example.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
<th>Example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>[MATH] M</td>
<td>Selects the math functions.</td>
<td>y = 5.00</td>
</tr>
<tr>
<td>3 [X]</td>
<td>Stores x.</td>
<td>y = 3.00</td>
</tr>
<tr>
<td>4 [Y]</td>
<td>Calculates combinations.</td>
<td>( C_{x,y} = 10.00 )</td>
</tr>
<tr>
<td>3 [X], y</td>
<td>Returns the number of permutations to the next line.</td>
<td>( P_{x,y} = 60.00 )</td>
</tr>
</tbody>
</table>

When you calculate either combinations or permutations, the other of the two is automatically calculated at the same time, and both are displayed near the top of the screen.

Arithmetic and Math Functions 23-23
Business Percentage Calculations

When the Calculator is active and you select (MENU) Bus% the first time, this business percentage screen appears:

<table>
<thead>
<tr>
<th>Business Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old value........... Old = 0.00</td>
</tr>
<tr>
<td>New value........... NEW = 0.00</td>
</tr>
<tr>
<td>Percent change....... CHG = 0.00</td>
</tr>
<tr>
<td>Total amount......... TOTAL = 0.00</td>
</tr>
<tr>
<td>Part of total........ PART = 0.00</td>
</tr>
<tr>
<td>Percent of total..... TOTAL = 0.00</td>
</tr>
</tbody>
</table>

This screen displays the results and function keys for percent-change and percent-of-total calculations. If you press (HELP) from this screen, you see the other business percentage screen, which you use for calculating markup and margin.
When you leave the business percentage screen, the Calculator remembers the last displayed screen so that it is redisplayed when you return.

Calculating Percent Change

The percent change function keys are $\%\text{OLD}$ ($\text{FX}$), $\%\text{NEW}$ ($\text{FX}$), and $\%\text{CHG}$ ($\text{FX}$). Percent change is expressed as a percentage of the OLD number.

Note that after you select $\text{ functionalities you may have to press } \text{ MORE}$ ($\underline{\text{FX}}$) to get to the function keys used in the following example. Also, this example uses the function keys to enter data; you can also use the point-and-shoot method described in chapter 22.
Example: Calculating the Percent Change. Part 1. Last year, total sales for Paddy McGowen's Fine Irish Potatoes were $110,000. This year, sales are $115,000. What is the percent change between last year's sales and this year's?

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/D/H B</td>
<td>Selects M/D/H Bus%.</td>
</tr>
<tr>
<td>110000</td>
<td>OLD =</td>
</tr>
<tr>
<td>115000</td>
<td>NEW =</td>
</tr>
<tr>
<td>[% CHG]</td>
<td>Calculates the percent change.</td>
</tr>
</tbody>
</table>

Old value ........ OLD = $110,000.00
New value ........ NEW = $115,000.00
Percent change .... [% CHG] = 4.55

Total amount .... TOTAL = $0.00
Part of total .... PART = $0.00
Percent of total .... %TOTAL = 0.00

%CHG = 4.55

Part 2. What would this year's sales have to be to grow a 12% increase from last year? (OLD remains 110,000, so you don't have to key it in again.)
Calculating Percent of Total

The percent of total function keys are \( \text{TOTAL} \), \( \text{PART} \), and \( \text{TOTAL} \). After you select \( \text{TOTAL} \), you must then press \( \text{PART} \) to get to the totalizer keys for this example.

Example: Calculating the Percent of Total. Part 1. Total assets for Lynn Winter’s Travel Insurance are \$675,000. The firm has \$234,576 cash on hand. What percentage of total assets is cash on hand?

Keys: \( \text{TOTAL} \) \( \text{PART} \) \( \text{TOTAL} \)

Description:

Sets \( \text{TOTAL} \) as base.
Stores the amount of total assets.
Stores the cash-on-hand part of the assets.
Calculates the percent of total.

\[
\begin{align*}
\text{Total amount} & \quad \text{TOTAL} = 675,000.00 \\
\text{Part of total} & \quad \text{PART} = 234,576.00 \\
\text{Percent of total} & \quad \% \text{TOTAL} = 34.71 \\
\% \text{TOTAL} & \quad - \text{TOTAL} = 34.71
\end{align*}
\]
Part 2. Last year, due to missed and rerouted flights, the company incurred special expenses that were 65% of operating expenses. If operating expenses were $76,249, how much were the special expenses?

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>Stores the percent of total for special expenses.</td>
</tr>
<tr>
<td>76249</td>
<td>Stores the total operating expenses.</td>
</tr>
<tr>
<td>PART</td>
<td>Calculates the special expenses part of the total.</td>
</tr>
</tbody>
</table>

\[
\text{Total amount} \ldots \ldots \text{TOTAL} = 76,249.00 \\
\text{Part of total} \ldots \ldots \text{PART} = 34,812.05 \\
\text{Percent of total} \ldots \% \text{TOTAL} = 45.10 \\
\text{PART} = 34,812.05
\]

Calculating Markup and Margin

The Calculator enables you to calculate cost, selling price, markup, and margin. Markup calculations are expressed as a percent of cost. Margin is markup expressed as a percent of price.

Note that after you select [Markup] and [Margin] you may have to press [MORE] to get to the function keys used in the following examples.

Examples: Calculating Markup. The standard markup on running shoes at Steppin' Steppe Shoe Store is 60%. They just received a shipment of running shoes costing $49 per pair. What is the retail price per pair for those shoes?

Business Percentage Calculations 24-5
### Key:

<table>
<thead>
<tr>
<th>Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Selects (Menu) Bus%.</td>
</tr>
<tr>
<td>47</td>
<td>COST</td>
</tr>
<tr>
<td>60</td>
<td>MARKUP</td>
</tr>
<tr>
<td>PRICE</td>
<td></td>
</tr>
</tbody>
</table>

**Example:** Calculating Margin. Jean’s Jeans Company purchases designer blue jeans for $25 per pair. The jeans are then sold for $35. What is the margin?

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Selects (Menu) Bus%.</td>
</tr>
<tr>
<td>25</td>
<td>COST</td>
</tr>
<tr>
<td>395</td>
<td>PRICE</td>
</tr>
<tr>
<td>MARGIN</td>
<td></td>
</tr>
</tbody>
</table>

Cost.................. COST = 25.00  
Price.................. PRICE = 395.00  
Mark up.............. MARKUP = 140.00  
Margin................ MARGIN = 92.67  
MARGIN = 92.67  

24-4 Business Percentage Calculations
Example: Using Margin and Markup Together. A food cooperative buys cases of canned soup with an invoice cost of $9.00 per case. If the co-op routinely uses a 15% markup, for what price should it sell a case of soup? What is the margin?

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(MENU) B</td>
<td>Selects (MENU) Bunch.</td>
</tr>
<tr>
<td>9.00 COST</td>
<td>Stores the cost.</td>
</tr>
<tr>
<td>15 MARKUP</td>
<td>Stores the markup and calculates the margin of 13.04%.</td>
</tr>
<tr>
<td>PRICE</td>
<td>Calculates the selling price of $11.04.</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{Cost} & = 9.00 \\
\text{Price} & = 11.04 \\
\text{Markup} & = 15.00 \\
\text{Margin} & = 13.04 \\
\text{PRICE} & = 11.04
\end{align*}
\]
Time Value of Money and Interest Conversions

When you select [MENU] TVM within the Calculator, you get the time-value-of-money (TVM) feature, which enables you to do compound-interest, amortization, and interest-rate-conversion calculations.

- Compound interest occurs when earned interest is added to the principal at specified compounding periods, and then the combined amount earns interest. Many financial calculations are compound interest calculations—for example, savings accounts, mortgages, pension funds, leases, and annuities.
- Amortization calculations determine the amounts applied toward principal and interest in a series of payments.
- Interest-rate conversions enable you to compare nominal and effective interest rates.

You can use TVM when there is a series of cash flows (money received or money paid) that meet these criteria:

- The dollar amount is the same for each payment.
- The payments occur at regular intervals.
- Payment periods coincide with the compounding periods.
Making Cash Flow Diagrams

You can represent and understand many types of financial transactions using cash flow diagrams. A cash flow diagram is a time line divided into equal segments representing the compounding periods. Arrows represent the cash flows. Money received is a positive value, and money paid out is a negative value. Cash flow diagrams are used in the examples in this manual to help describe the problems.

The cash flow diagram for a transaction depends on the point of view you take in your problem statement. For example, a loan is an initial positive cash flow for the borrower, but it’s an initial negative cash flow for the lender. The following cash flow diagram shows a loan from a borrower’s point of view.

Present value (PV) (Loss)

Money received is a positive number

Money paid out is a negative number

Equal periods

Payment (PMT)

Equal payments

Future value (PV)

1 2 3 4 5

(PMT) (PMT) (PMT) (PMT)

35-2 Time Value of Money and Interest Conversions
The following cash flow diagram shows a loan from a lender's point of view.

In addition, cash flow diagrams specify when payments occur relative to the compounding periods: at the beginning of each period or at the end. TVM provides both of these payment modes: Begin mode and End mode.

The following cash flow diagram shows lease payments at the beginning of each period.
The following cash flow diagram shows deposits into an account at the end of each period:

```
PV
1  2  3  4  5
PMT PMT PMT PMT PMT
```

**The TVM Screen**

Selecting [TVM] TVM the first time displays the main TVM screen, which contains the TVM variables and their corresponding function keys:

```
<table>
<thead>
<tr>
<th>Time Value of Money - case 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of periods........... N = 0.00</td>
</tr>
<tr>
<td>Annual interest............. I/YR = 0.00</td>
</tr>
<tr>
<td>Payments value.............. PMT = 0.00</td>
</tr>
<tr>
<td>Future value................. FV = 0.00</td>
</tr>
<tr>
<td>Payments per year........... P/YR = 12</td>
</tr>
<tr>
<td>Begin/End mode.............. B/E = END</td>
</tr>
</tbody>
</table>

```

Two of the function keys, Amort (amortization) and Intconv (interest rate conversion), bring up other screens with their own sets of function keys.

25-4 Time Value of Money and Interest Conversions
After the first time you use TVM, it starts where you last left off. If the amortization or interest conversion screen is displayed and you want to get back to the main TVM screen, press \[ \text{ENTRY} \] until you get to that screen.

### The TVM Function Keys

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \text{AMORT} ]</td>
<td>Brings up the amortization screen and function keys (see &quot;Calculating Amortization&quot; later in this chapter).</td>
</tr>
<tr>
<td>[ \text{ICONV} ]</td>
<td>Brings up the interest conversion screen and function keys (see &quot;Calculating Interest Rate Conversions&quot; later in this chapter).</td>
</tr>
<tr>
<td>[ \text{B/E} ]</td>
<td>Switches the payment mode between BEGIN (for payments made at the beginning of periods) and END (for payments made at the end of periods).</td>
</tr>
<tr>
<td>[ \text{P/YR} ]</td>
<td>Stores the number of payments or compounding periods per year. The value must be an integer in the range 1 through 999.</td>
</tr>
<tr>
<td>[ \text{N} ]</td>
<td>Stores or calculates the total number of payments (or compounding periods). ( N ) can be expressed in any unit of time—for example, days, months, or years. [ \text{C} ] [ \text{N} ] multiplies the number in the [ \text{C} ] line by ( P/YR ) and stores the result in ( N ). For example, if ( P/YR = 12 ), pressing [ \text{C} ] [ \text{N} ] [ \text{3} ] [ \text{6} ] [ \text{0} ] stores 360 in ( N ).</td>
</tr>
<tr>
<td>[ \text{I/YR} ]</td>
<td>Stores or calculates the nominal annual interest rate as a percentage.</td>
</tr>
<tr>
<td>[ \text{PV} ]</td>
<td>Stores or calculates the present value of a series of future cash flows. To a lender or borrower, ( PV ) is the amount of the loan; to an investor, ( PV ) is the initial investment. ( PV ) always occurs at the beginning of the first period.</td>
</tr>
<tr>
<td>[ \text{PMT} ]</td>
<td>Stores or calculates the amount of each periodic payment. The payments are the same amount, and no payments are skipped. Payments can occur at the beginning or end of each period.</td>
</tr>
<tr>
<td>[ \text{FV} ]</td>
<td>Stores or calculates the future value—the amount of the final cash flow, or the compounded value of the series of previous cash flows. ( PV ) always occurs at the end of the last period.</td>
</tr>
</tbody>
</table>

*Time Value of Money and Interest Conversions* 25-5
Switching TVM Cases

The Calculator lets you keep two different sets of TVM variables in memory, cases 1 and 2. They are displayed one at a time, with the current case being noted at the top of the TVM screen.

To switch cases, press 2 or 3. The displayed case number and values in the variables change.

Clearing the TVM Variables

The Calculator retains the values stored in the TVM variables until they are changed or cleared. To clear the variables for the displayed TVM case—the other case is not affected—select 2 CLEAR Data. This clears \( N, \text{ I/YR, PV, PMT, and FV} \) to 0, sets \( P/YR \) to 12, and sets End mode.

Making TVM Calculations

To make TVM calculations, follow this general procedure:

1. Select 1 TVM.
2. If necessary, press 2 to display the main TVM screen.
3. Check and set these TVM conditions:
   - Number of payments per year.
   - Payments at beginning or end of periods.
4. Store values for the four known TVM variables.
5. Find the unknown value.

The next few pages contain a series of TVM examples. These examples demonstrate entering data using the function keys that correspond to the variables on the screen. The point-and-shoot method for data entry also works. It is demonstrated in an example in chapter 22 and involves highlighting a variable on the screen using the arrow keys, typing a number, and then pressing 4 ENTER or ENTER.

Calculating the unknown variable is done by highlighting it and pressing the spacebar.
For more keystroke examples, see "Additional TVM Examples" at the end of this chapter.

**Note**

The examples in this chapter assume the main TVM screen appears when you select (MENU) TVM. However, depending on where you left off in TVM the last time you used it, you may see the amortization screen or the interest conversion screen first. If this occurs, press (ESC) after you select (MENU) TVM to return to the main TVM screen.

**Example: A Car Loan.** Otto Telfin is financing the purchase of a car with a 3-year loan at 10.5% annual interest, compounded monthly. The purchase price of the car is $11,250, and his down payment is $500. What are his monthly payments? (Assume that payments start at the end of the first period.)

*Time Value of Money and Interest Conversions* 25-7
Keys: 

**MEN** | **E** | **D**
---|---|---
**MEN** | **E** | **D**

Description:
Selects **MEN** TVM to display the TVM screen.

3 | **N** | E

Clears any prior TVM data.

10.5 | **i** | **YR**

Enters the total number of monthly payments.

1,125 | **2** | **P** | **V**

Enters the annual interest rate.

0 | **F** | **V**

Enters the amount of the loan as the present value.

**PMT**

Enters 0 as the future value because the loan will be completely paid off at the end of 3 years. (This step is really not necessary because **FV** was set to 0 when the data was cleared above.)

Calculates the monthly payment.

Number of periods, ..., N = 36.00
Annual interest, ..., i/YR = 10.50
Present value, ..., PV = 8,750.00
Payment, ..., PMT = -284.40
Future value, ..., FV = 0.00
Payments per year, ..., P/YR = 12
Begin/End mode, ..., B/E = END

PMT = -284.40

Example: A Mortgage with a Balloon Payment. Ross T. Pipe has taken out a 25-year, $75,250 house mortgage at 13.8% annual interest. He expects to sell the house in 4 years, repaying the loan in a balloon payment. Find the size of the balloon payment—the value of the mortgage after 4 years of payments.

25-8 Time Value of Money and Interest Conversions
Keys: 

- **MENU T**: Selects TVM to display the TVM screen.
- **MENU E D**: Clears any prior TVM data.
- **25**: Enters the total number of monthly payments.
- **13.8**: Enters the annual interest rate.
- **75,250**: Enters the amount of the mortgage as the present value.
- **0**: Enters 0 as the future value.
- **PMT**: Calculates the monthly payment.

Description:

- **Number of periods**: \( n = 300 \) months
- **Annual interest rate**: \( i_{12} = 13.5\% \)
- **Present value**: \( P = 75,250 \) dollars
- **Payment**: \( PMT = -894.39 \) dollars
- **Future value**: \( FV = 0 \) dollars
- **Payments per year**: \( P/Y = 12 \)
- **Begin/End mode**: \( B/E = EHD \)

\[ PMT = -894.39 \]
Calculates the balloon payment at the end of 4 years.

Number of periods... N = 48.00
Annual interest..... I/YR = 12.00
Present value....... PV = 75,253.99
Payment............. PMT = -894.33
Future value....... FV = -75,499.81

Payments per year... P/YR = 12
Start/End mode...... B/E = END

FV = -75,499.81

Example: A Savings Account. Penny Border deposits $3000 into a savings account that pays 7.5% annual interest, compounded annually. If she makes no other deposits into the account, how long does it take for the account to contain $3000?
Keys:  

- **TV**: Selects the TVM screen.
- **BAR**: Calculates any prior TVM data.
- **FV**: Enters the future value.
- **PV**: Enters the amount of the deposit.
- **PMT**: Enters the monthly payment.
- **N**: Calculates the number of periods.

Description:

- **PV**: Present value.
- **FV**: Future value.
- **I/YR**: Interest rate per year.
- **PMT**: Payment per period.
- **N**: Number of periods.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of periods (N)</td>
<td>5.83</td>
</tr>
<tr>
<td>Annual interest rate (I/YR)</td>
<td>7.20</td>
</tr>
<tr>
<td>Present value (PV)</td>
<td>-2,000.00</td>
</tr>
<tr>
<td>Payment (PMT)</td>
<td>0.00</td>
</tr>
<tr>
<td>Future value (FV)</td>
<td>3,000.00</td>
</tr>
<tr>
<td>Payments per year (P/YR)</td>
<td>1</td>
</tr>
<tr>
<td>Begin/End mode (B/E)</td>
<td>END</td>
</tr>
</tbody>
</table>

Since the calculated value of N is between 5 and 6, it will take 6 years of annual compounding to achieve a balance of at least $3,000. The actual balance at the end of 6 years can be calculated:

\[
N = 5.83
\]

Example: A Lease. Sandy Lome is leasing fax equipment for 4 years. The monthly payment is $240. An additional $2400 payment at the beginning of the leasing period replaces the final payment. The leasing agreement includes an option to buy the equipment for $15,000 at the end of the leasing period. Calculate the capitalized value of the lease, assuming that the interest rate Lome pays to borrow funds is 18%, compounded monthly.

The formula for the capitalized value of the lease is:

\[
FV = \sum_{t=1}^{N} PMT \times (1 + r)^{-t}
\]

Where:
- **FV**: Future value of the lease
- **PMT**: Monthly payment
- **r**: Interest rate per period
- **N**: Number of periods

**Example Solution**:

\[
FV = 240 \times \frac{1 - (1 + 0.18)^{-48}}{0.18} + 2400 \times (1 + 0.18)^{-48} - 15000
\]

\[
FV = \$3,035.20
\]
Make the calculation as four steps:

1. Calculate the present value for the 47 monthly payments—the initial investment required to make the monthly payments.
2. Add the advance payment to the result of step 1.
3. Calculate the present value of the buy option—the initial investment required to generate the option price after 48 months.
4. Add the values calculated in steps 2 and 3.

Step 1. Calculate the present value of the monthly payments.

Keys: 

- **[MEMO]** 
  - Selects **[MEMO]** TVM to display the TVM screen.
- **[CED]**
  - Clears any prior TVM data.
- **[E]**
  - Sets payments at the beginning of the periods.
- **[47]**
  - Enters the number of payments.
- **[18]**
  - Enters the annual interest rate.
- **[240]**
  - Enters the monthly payment.
- **[PV]**
  - Calculates the present (capitalized) value of the 47 monthly payments.

\[ PV = 81,957.50 \]
Step 2. Add the additional advance payment to \( PV \) and store the answer.

\[ \text{Add 2400 to PV.} \]
\[ \text{Store the result in register 1.} \]

\[ \text{Reg1 = 64,185.58} \]

Step 3. Find the present value of the buy option.

\[ \text{Enter number of periods.} \]
\[ \text{Enter the amount of buy option.} \]
\[ \text{Clears PMT.} \]
\[ \text{Calculates the present value of the buy option.} \]

\[ PV = 7,340.43 \]

Step 4. Add the results of steps 2 and 3.

\[ \text{Calculates the present (capitalized) value of the lease.} \]

\[ 91,476.90 \]

Calculating Amortization

Amortization calculations determine the amounts applied toward principal and interest in a payment or series of payments. When you select [MEMO] TVM and press [RCL] (10), you get the amortization function keys.
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GO</td>
<td>Calculates the amortization for a group of payments. If you enter a number in the line and then press GO, that number is used as the number of payments in the group; if you press GO without entering a number, the current number of payments per year (P/YR) is used, which is 12 unless you change it.</td>
</tr>
<tr>
<td>ADJUST</td>
<td>Displays the amortization adjustment screen and function keys.</td>
</tr>
<tr>
<td>INVR</td>
<td>Stores or calculates a new interest rate or returns the current interest rate to the line.</td>
</tr>
<tr>
<td>PMT</td>
<td>Stores or calculates a new payment amount or returns the current payment to the line.</td>
</tr>
<tr>
<td>BAL</td>
<td>Returns the amount of the remaining balance of the loan to the line. (Pressing STO BIAL: stores a new balance.)</td>
</tr>
<tr>
<td>INT</td>
<td>Returns the amount of the payments applied toward interest to the line.</td>
</tr>
<tr>
<td>ACCUM</td>
<td>Returns the amount of accumulated interest since the start of the amortization (period 0) to the line.</td>
</tr>
<tr>
<td>PRIN</td>
<td>Returns the amount of the payments applied toward principal to the line.</td>
</tr>
<tr>
<td>1-2-3</td>
<td>Specifies the current 1-2-3 worksheet as the destination for the amortization table. When an amortization table is generated, it is sent to the 1-2-3 worksheet starting at the current cell. This feature works only when a 1-2-3 worksheet is currently loaded.</td>
</tr>
</tbody>
</table>

To make amortization calculations, follow this general procedure:

1. Start TVM by selecting MENU TVM.
2. Check that these TVM conditions are set:
   - Number of payments per year.
   - Payments at beginning or end of periods.
3. Store values for three TVM variables: I/YR, PV, and PMT.
   - These variables define the payment schedule. (For an adjustable rate mortgage, also store the total number of payments in N.)
4. Press F1 (12) to select the amortization screen.

25-14 Time Value of Money and Interest Conversions
5. Decide one of the following:
   a. Simply press \( \boxed{GO} \) to calculate amortization for the number of periods stored in \( P/YR \) (which is 12 unless you changed it).
   b. Enter the number of payments to amortize, then press \( \boxed{GO} \) \( \boxed{12} \).

6. For an Adjustable Rate Mortgage (ARM):
   a. At the point in the schedule where the interest rate changes, adjust it by typing the new rate in the calc line and pressing \( \boxed{12/P/YR} \) \( \boxed{12} \).
   b. Calculate the adjusted payment by pressing \( \boxed{CHG/OUT} \) \( \boxed{12} \).
   c. Optionally press \( \boxed{CHG/OUT} \) \( \boxed{12} \) to select the amortization adjustment screen. (This screen enables you to adjust other amortization variables, if necessary, for your particular problem.)
   d. Continue using \( \boxed{CHG/OUT} \) \( \boxed{12} \) to calculate the adjusted amortization schedule.
   e. When you're finished, press \( \boxed{EXIT} \) to return to the amortization screen.

To start the amortization schedule over, select \( \boxed{Erase Data} \) and begin again.

Amortization calculations use values of \( PV \), \( PMT \), and \( INT \) rounded to the number of decimal places specified by the current display setting. However, the stored values of \( PV \) and \( PMT \) do not change. Amortization uses all 12 digits of \( P/YR \).

Pressing \( \boxed{EXIT} \) from the amortization screen returns you to the main TVM screen.

Example: Amortization Schedule for a Home Mortgage. Part 1. Robby Larkin has taken out a 30-year, $85,000 mortgage at 12.5% annual interest. Calculate his monthly payment, and then calculate the first year's payments that are applied toward principal and interest.

Time Value of Money and Interest Conversions: 25-15
Keys:  
- **MENUS**: T
- **MENUS**: D
- **30**: d
- **15.5**: YR
- **6500**: M
- **PMT**:  

**Description:**

Selects **MENUS** TVM to display the TVM screen.

**Description:**

Clears any prior TVM data.

**Description:**

Enters the number of payments.

**Description:**

Enters the annual interest rate.

**Description:**

Enters the amount of the mortgage.

**Description:**

Calculates the monthly payment.

- **Number of periods**: \( n = 360.00 \)
- **Annual interest**: \( i_{\text{YR}} = 12.50 \)
- **Present value**: \( P/V = 54,000.00 \)
- **Payment**: \( PMT = -699.72 \)
- **Future value**: \( F/V = 0.00 \)

**Description:**

Calculates the payment per year.

**Description:**

Calculates the amortization per year.

- **Payments per year**: \( P/YR = 12 \)
- **Begin/End mode**: \( B/E = \text{END} \)

**Description:**

Calculates the amortization for the first year.

**Description:**

Calculates the amortization for the first year (12 payments).

- **Group 1**: Payments 1 - 12
- **Payments per group**: 12
- **Amort interest rate**: \( i_{\text{YR}} = 12.50 \)
- **Amort payment**: \( PMT = -699.72 \)
- **Remaining balance**: \( BRL = 64,786.52 \)
- **Interest**: \( INT = -8,113.16 \)
- **Accrued interest**: \( A/CUM = -8,113.16 \)
- **Principal**: \( P/R = -211.40 \)

**Part 2.** Calculate the loan balance after 3 \( \frac{1}{2} \) years. (You've already amortized the first 12 months, so if you amortize 30 more months, you will have amortized a total of 42 months, or 3 \( \frac{1}{2} \) years.)

**25-16 Time Value of Money and Interest Conversions**
Calculates the amortization for the next 30 payments.

Group 2: Payments 13 - 30

Payments per group: 30

Amort interest rate, IOR' = 12.50%
Amort payment, PMT = -699.72

Remaining balance, BAL = 64,129.05
Interest, INT = -28,152.15
Accum. interest, ACCUM = -28,152.15
Principal, PRIN = -659.47

After 3 1/2 years, Rufus has an unpaid balance of $64,129.05.

Example: Adjustable Rate Mortgage. Part 3. Pete Mosi took out a $100,000, 20-year ARM to purchase the building for his garden supply store. His interest rate for the first year is 8.25%. Mosi expects the rate for the second year to increase to 8.75%. How would the increase affect his monthly payment for the second year?

Keys: Description:

Selects TVM to display the TVM screen.

Clears any prior TVM data.

Enters the number of payments.

Enters the annual interest rate.

Enters the amount of the mortgage.

Calculates the monthly payment.

PMT = -982.07

Time Value of Money and Interest Conversions 25-17
Short:
Select the amortization screen.

GO:
Calculates the amortization for the first year (12 payments).

Group 1: Payments 1 - 12
Payments per group 12

Amort interest rate, \( i_{\text{YR}'} = 9.75\% \)
Amort payment \( \text{PAY} = -852.07 \)

Remaining balance... \( R_{\text{HL}} = 97,948.74 \)
Interest........... \( INT = -8,173.98 \)
Accum. interest....... \( ACCUM = -8,173.98 \)
Principal.............. \( PRINC = -8,173.98 \)

8.75 \( i_{\text{YR}'} \)
Enters the adjusted interest rate.

\[ \text{PAY} = -852.62 \]
Calculates the adjusted payment. [The number of remaining periods is updated automatically to 228.]

Moss's monthly payment would increase from $852.07 in year 1 to $852.62 in year 2.

Part 2. How much would Moss pay in interest the second year?
Calculates amortization for the second year.

Group 2 Payments 13 - 24
Payments per group: 12

Amort interest rat. \( \frac{I}{YR} \) = 8.75
Amort payment \( \text{PM} \) = \(-0\).08
Remaining balance \( \text{BAL} \) = 95,944.76
Interest \( \text{INT} \) = \(-8\).487.46
Accum. interest \( \text{ACCU} \) = \(-16\).661.04
Principal \( \text{PRIN} \) = \(-9\).163.96

Pete's interest total for the second year is \(8\).487.46.

Note
The previous adjustable rate mortgage example uses the variables in the main amortization screen for the calculations. This same example could be done using the amortization adjust screen. (Press Adjust (13) from the main amortization screen to see the screen; press Exit to leave it.) The amortization adjust screen is most useful when you have a more complicated adjustment problem that requires adjusting more than just the payment or interest rate.

Example: Graduated Payment Mortgage. To purchase a vacation condominium, Bill Bonsor took out a 15-year, 12.5% GPM for $90,000. His monthly payment for the first 2 years is $875, after which time the payment increases to fully amortize the loan. What will the remaining balance be at the end of the 2 years? How much will Bill's payment have to increase to fully amortize the loan by the end of the original 15-year period?

Time Value of Money and Interest Conversions 25-19
Key:

MIND T

Selects TVM to display the TVM screen.

MIND E D

Clears any prior TVM data.

15 E N

Enters the number of payments.

12.5 E Y

Enters the annual interest rate.

35000 E P Y

Enters the amount of the mortgage.

875 E P T

Enters the monthly payment during the first 2 years.

AORT

Selects the amortization screen.

24 E G O

Calculates the amortization for the first 2 years, showing a remaining balance of $98,106.01.

Group 1 Payments: 1 - 24

Payments per group: 24

Payment: 12.50

Amount: 875.00

Remaining balance: 98,106.01

Interest: -24,106.01

Accum. interest: -24,106.01

Principal: 3,105.01

Calculate the payment required to fully amortize the loan over the remaining number of periods. For the last 13 years of the loan, Bill's monthly payment will be $1,275.15.

PMT' = 1,275.15
Note

The previous example involves negative amortization—a case in which payments are less than accrued interest for a time, causing the principal to increase by the difference between paid and accrued interest. In negative amortization the interest amounts shown in the amortization screen reflect the accrued interest, not the interest paid. As long as the payment is less than the accrued interest for the period, you can calculate the interest paid for a group of payments by multiplying the payment amount by the number of payments in the group.

Sending an Amortization Table to 1-2-3 or a Printer

The Calculator enables you to print an amortization table or send it to a 1-2-3 worksheet as the table is created.

To print an amortization table:

1. From the amortization screen, select [PRINT] Print Data to turn printing on. When printing is on, a PRINT annunciator appears in the upper-right corner of the display.
2. Use [LEFT] and [RIGHT] to generate the parts of the table you want printed. [LEFT] is very useful here because it prints the table for the number of groups specified in the calc line.) The groups are printed as they are generated.
3. When you're finished printing, select [CLEAR] Print Data again to turn printing off. Leaving the amortization screen also turns off printing.

You cannot send an amortization table to a printer and a 1-2-3 worksheet at the same time. If output is set to go to 1-2-3, selecting [PRINT] Print Data turns that feature off when it directs output to the printer.
To send an amortization table to the current 1-2-3 worksheet:

1. Select [MENU] TVM Amort and press F2 (Send). The current 1-2-3 worksheet is displayed.
2. Move the cell pointer to the cell where you want to start receiving input and press ENTER. Eight amortization column headings are put into the worksheet and you are returned to the amortization screen. The amortization screen now shows a 1-2-3 annunciator in the upper-right corner of the screen to remind you that output will be sent to 1-2-3.
3. Calculate the amortization as described earlier in this chapter. Each time you press F2 (or F5:50) the results are sent to the current 1-2-3 worksheet—a row of information is sent for each group of payments calculated.
4. When you no longer want the results sent to the current worksheet, press F1 (F4:OFF) again. The 1-2-3 annunciator turns off.

When you display the worksheet, you'll be able to see the amortization output. Here is an example of five groups sent to a worksheet:

![Amortization Table Example]

25-22 Time Value of Money and Interest Conversions
The table sent to the worksheet comprises eight columns of data:

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>The group number.</td>
</tr>
<tr>
<td>BAL</td>
<td>The remaining balance at the end of that group of payments.</td>
</tr>
<tr>
<td>PRINC</td>
<td>The principal paid for that group of payments.</td>
</tr>
<tr>
<td>INT</td>
<td>The interest paid for that group of payments.</td>
</tr>
<tr>
<td>RCUM</td>
<td>The accumulated interest paid.</td>
</tr>
<tr>
<td>#PMTS</td>
<td>The number of payments in that group.</td>
</tr>
<tr>
<td>INTYR</td>
<td>The annual interest rate for that group of payments.</td>
</tr>
<tr>
<td>PRT</td>
<td>The periodic payment for that group.</td>
</tr>
</tbody>
</table>

You cannot send an amortization table to a printer and a 1-2-3 worksheet at the same time. If output is set to go to the printer, pressing 1=2=3 turns that feature off when it directs output to the current worksheet.

Calculating Interest Rate Conversions

Interest rates are generally stated as nominal annual interest rates. A nominal annual interest rate is an annual rate that is compounded periodically—for example, 18% per year, compounded monthly (12 times per year). When investments have different compounding periods, effective interest rates are used to compare them. The effective rate is the annual rate that would produce the same interest earnings as the nominal rate, compounded P times per year. For example, earning 15% annual rate compounded monthly (nominal rate) is equivalent to earning 19.56% effective annual interest.

Time Value of Money and Interest Conversions 25-21
The Calculator lets you easily convert interest rates for comparison. When you select TVM and press 12 (F2), you get these function keys.

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/YR</td>
<td>Stores the number of payments per year</td>
</tr>
<tr>
<td>I/YR</td>
<td>Stores or calculates the nominal annual rate</td>
</tr>
<tr>
<td>EFF%</td>
<td>Stores or calculates the effective annual rate</td>
</tr>
<tr>
<td>APY%</td>
<td>Stores or calculates the periodic interest rate ((I/YR + P/YR))</td>
</tr>
<tr>
<td>360/365</td>
<td>Stores or calculates the Visitor-compounded rate</td>
</tr>
</tbody>
</table>

Storing any of the interest rate values automatically updates the others. Storing P/YR updates the other values based on the effective rate. Also, pressing 2ND before a function key recalls that value to the edit line.

When you press 2ND 12 (F2), the interest conversion screen appears with conversions based on the P/YR and I/YR values used in the main TVM screen. Changing any of the values on this screen updates all the other values automatically.

Pressing 2ND from this screen returns you to the main TVM screen.

Example: Converting and Comparing Interest Rates. Rodeo star Buck Doff is considering how to invest his recent winnings. He has two investment options: One promises to pay 13.6% annual interest, compounded daily, and the other promises to pay 14.5%, compounded semi-annually. Which of Doff’s options would give him the highest effective rate?

25-24 Time Value of Money and Interest Conversions
Key:
- **MTH** T: Selects TVM.
- **MTH** ED: Erases any prior TVM data.
- **FNDW**: Selects the interest conversion screen.
- **365 P/YR**: Enters the number of compounding periods in option 1.
- **13.6% I/YR**: Enters the nominal annual rate for option 1.

\[
\begin{align*}
\text{Payments per year} & \quad \text{P/YR} = 365 \\
\text{Nominal annual rate} & \quad \text{I/YR} = 13.60 \\
\text{Effective annual rate} & \quad \text{EFF%} = 14.57
\end{align*}
\]

- **2 P/YR**: Enters the number of compounding periods in option 2.
- **16.0% I/YR**: Enters the nominal annual rate for option 2.

\[
\begin{align*}
\text{Payments per year} & \quad \text{P/YR} = 2 \\
\text{Nominal annual rate} & \quad \text{I/YR} = 14.00 \\
\text{Effective annual rate} & \quad \text{EFF%} = 14.49
\end{align*}
\]

The effective annual rate for option 1 (14.57%) is higher than that for option 2 (14.49%).

---

**Compounding Periods Different from Payment Periods**

TVM in the Calculator assumes that the compounding periods and the payment periods are the same. However, regularly occurring deposits and withdrawals do not necessarily coincide with the investment's compounding periods. To solve a TVM problem where they don’t coincide, first convert the interest rate to an equivalent interest rate with compounding periods that match the regular deposits or withdrawals.
Example: A Savings Account with Compounding Periods Different from Payment Periods. Starting today, Penny Holder makes monthly deposits of $25 into an account paying 5% interest compounded daily (365-day basis). At the end of 7 years, how much will Penny receive from the account?

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU E</td>
<td>Selects TVM.</td>
</tr>
<tr>
<td>MENU D</td>
<td>Erases any prior TVM data.</td>
</tr>
<tr>
<td>365 P/YR</td>
<td>Selects the interest conversion screen.</td>
</tr>
<tr>
<td>5 INT/yr</td>
<td>Enters the nominal annual rate for daily compounding. Notice the effective annual rate is automatically calculated.</td>
</tr>
<tr>
<td>12 P/YR</td>
<td>Enters monthly compounding periods, and calculates the equivalent nominal rate for monthly compounding.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payments per year, P/YR</th>
<th>365</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal annual rate, INT/YR</td>
<td>5.00</td>
</tr>
<tr>
<td>Effective annual rate, EFF%</td>
<td>5.12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Payments per year, P/YR</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal annual rate, INT/YR</td>
<td>5.01</td>
</tr>
<tr>
<td>Effective annual rate, EFF%</td>
<td>5.10</td>
</tr>
</tbody>
</table>

15-20 Time Value of Money and Interest Conversions
Displays the main TVM screen.
Sets payment mode to beginning of a period.
Enter the total number of periods.
Enter the payment per period.
Enter the present value.
Calculates the amount in Penny's account after 7 years.

Number of periods...... N = 94.00
Annual interest....... I/YR = 5.01
Present value........ PV = 0.00
Payment............... PMT = -25.00
Future value.......... FV = 2,519.61

Payments per year...... P/YR = 12
Begin/End mode....... B/E = BEGIN
FV = 2,519.61

Example: Canadian Mortgages. In Canadian mortgages, interest is compounded semi-annually while payments are made monthly. The Canadian mortgage factor is calculated by converting the stated nominal interest rate (compounded semi-annually) to the nominal rate compounded monthly (the payment period). The factor is then used as the TVM variable I/YR.

The multinational law firm of Konig, Bradley, and Erickson has opened a Canadian office in Toronto. What is the monthly payment required to fully amortize their 30-year, $300,000 Canadian mortgage with an interest rate of 17%?


Keys:  

Selects TVM.

Erases any prior TVM data.

Selects the interest conversion screen.

Enters the number of compounding periods.

Enters the nominal annual interest rate and calculates the effective annual rate.

Payments per year........ P/YR = 2

Nominal annual rate...... I/YR = 12.00

Effective annual rate.... EFF% = 12.36

Enters monthly compounding periods, and calculates the equivalent nominal rate for monthly compounding (the Canadian mortgage factor).

Payments per year........ P/YR = 12

Nominal annual rate...... I/YR = 11.71

Effective annual rate.... EFF% = 12.36

25-38 Time Value of Money and Interest Conversions
Additional TVM Examples

Yield of a Discounted (or Premium) Mortgage

The annual yield of a mortgage bought at a discount or premium can be calculated given the original mortgage amount (PV), interest rate (I/YR), periodic payment (PMT), balloon payment (if any) (FV), and the price paid for the mortgage (new PV).

Example: Yield of a Discounted Mortgage. Seymour Profit wishes to purchase a $100,000 mortgage from Skip Towne. Towne originally issued the mortgage at 9% interest for 20 years. Since the mortgage was issued, 42 monthly payments have been made. The loan is to be paid in full (a balloon payment) at the end of its fifth year. What is the yield if the purchase price of the mortgage is $79,000?

1. Calculate PMT for the fully amortized loan (N = 20 x 12, PV = 0, PV = -100,000, and I/YR = 9).
2. Calculate the balloon payment (PV). (Use PMT from step 1, \( N = 5 \times 12 = 60 \)).

3. Store the number of payments remaining until the balloon payment as \( N \) (5 x 12 = 60), and store the proposed purchase price as \( PV \) (\( \$79,000 \)); calculate \( I \text{YR} \) (the annual yield).

Step 1. Calculate \( PMT \).

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEIN T</td>
<td>Selects MEIN TVM to display the TVM screen.</td>
</tr>
<tr>
<td>MEIN E D</td>
<td>Clears any prior TVM data.</td>
</tr>
<tr>
<td>20</td>
<td>Enter the total number of monthly payments for a 30-year mortgage.</td>
</tr>
<tr>
<td>9</td>
<td>Enters the annual interest rate.</td>
</tr>
<tr>
<td>1000000</td>
<td>Enters the amount of the original loan.</td>
</tr>
<tr>
<td>0</td>
<td>Enters 0 as PV.</td>
</tr>
<tr>
<td>( \text{PMT} )</td>
<td>Calculates the monthly payment received from the borrower.</td>
</tr>
</tbody>
</table>

Number of periods... \( N \) = 240.00
Annual interest.... \( I \text{YR} \) = 9.00
Present value..... \( PV \) = \( -100,000 \), 00
Payment............ \( PMT \) = 899.73
Future value..... \( FV \) = 0.00

Step 2. Calculate the balloon.

5 | Enters the number of payments is 5 years. |
\( \text{FV} \) | Calculates the balloon due in 5 years. |

\( FV = 88,707.05 \)
Step 3. Calculate the yield.

- **RC**: N = 48
  - Enters the number of payments remaining until the balloon payment.
- **79000**: PV =
  - Enters proposed, discounted purchase price.
- **1NYX**:
  - Calculates annual yield for discounted mortgage with balloon.

1/YR = 20.72

**Loans With Fees**

The annual percentage rate, APR, incorporates fees charged when a mortgage is issued, which effectively raises the interest rate. The actual amount received by the borrower (PV) is reduced, while the periodic payments remain the same.

**Example:** APR of a Loan with Fees. Ernest Mannix is charged two points for the issuance of his mortgage. (One point is equal to 1% of the mortgage amount.) If the mortgage amount is $60,000 for 36 years and the interest rate is 11.5% annually with monthly payments, what APR is Ernest paying?

1. Calculate **PMT**, using **PV=$60,500** and **1/YR=11.5%**.
2. Adjust **PV** to reflect the amount of the loan minus the fees. Then, calculate the **APR (1/YR)**, using the **PMT** calculated in step 1 (all other values remain the same).
Step 1. Calculate \( PMT \).

**Keys:**

- \( \text{M} \text{EM} \) \( \text{M} \) \( \text{R} \): Selects the TVM to display the TVM screen.
- \( \text{EM} \text{EM} \) \( \text{E} \) \( \text{D} \): Clears any prior TVM data.
- \( 30 \) \( \text{C} \) \( \text{M} \) \( \text{R} \): Enters the number of monthly payments.
- \( 11.5 \) \( \text{M} \text{APR} \): Enters the annual interest rate.
- \( 60 \) \( \text{M} \text{PV} \): Enters the amount of the loan.
- \( 0 \) \( \text{M} \text{FV} \): Enters \( FV \) since there's no balloon payment.
- \( \text{P} \text{MT} \): Calculates the monthly payment.

\[
\begin{align*}
\text{Number of periods: } N & = 260.08 \\
\text{Annual interest: } I/Y & = 11.50 \\
\text{Present value: } PV & = -8,000.00 \\
\text{Payment: } PMT & = -94.17 \\
\text{Future value: } FV & = 0.00
\end{align*}
\]

Step 2. Adjust \( FV \) and calculate the APR.

- \( \text{EM} \text{EM} \) \( \text{FV} \) \( \text{C} \): Enters the actual amount of money received by the borrower.
- \( 7 \) \( \text{M} \text{APR} \): Calculates the APR.

\[
\text{I/YR} = 11.76
\]

Example: Interest-Only Loan with Fees from the Lender's Point of View. Bill Lender is making a $1,000,000, 10-year, 10.5% (annual interest) interest-only loan with an origination fee of 3 points. What is the yield to Bill? Assume that the interest-only payments are made monthly. \( (PMT = 1,000,000 \times 10.5 \div 12, FV \) is the entire loan amount, and \( PV \) is the loan amount minus the points.)

25-32 Time Value of Money and Interest Conversions
A Tax-Free Account

You can use the TVM screen to calculate the future value of a tax-free or tax-deferred account, such as an IRA or Keogh account. Current tax law will determine the extent to which the account is tax-free. The purchasing power of the future value depends on the inflation rate and the duration of the account.

\[ S = \text{the number of payments until retirement.} \]
\[ i/YR = \text{the annual dividend rate.} \]
\[ PV = \text{the present value of the retirement account.} \]
\[ PMT = \text{the amount of your deposit. (It must be constant for the duration of the account.)} \]
\[ FV = \text{the future value of the retirement account.} \]

Number of periods, \( N = 120 \)  
Annual interest... \( i/YR = 11\% \)  
Present value..... \( PV = -970,000,000 \)  
Payment.......... \( PMT = 8,750,000 \)  
Future value..... \( FV = 1,000,000,000 \)

Part 1. Les Tuckis plans to open an individual retirement account with a dividend rate of 8.175%, and invest $1,000 at the beginning of each year until he retires in 35 years. Calculate the account balance at retirement.

**Keys:**

<table>
<thead>
<tr>
<th>Menu</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[TVM]</td>
<td>Selects [TVM] TVM to display the TVM screen.</td>
</tr>
<tr>
<td>[END]</td>
<td>Clear any prior TVM data.</td>
</tr>
<tr>
<td>1 [P/YR]</td>
<td>Sets payments per year to 1.</td>
</tr>
<tr>
<td>1 [P/YR]</td>
<td>Sets payment mode to BEGIN.</td>
</tr>
<tr>
<td>35 [N]</td>
<td>Enters the number of periods.</td>
</tr>
<tr>
<td>8.175 [I/YR]</td>
<td>Enters the dividend rate.</td>
</tr>
<tr>
<td>0 [FV]</td>
<td>The present value is 0 before the first payment.</td>
</tr>
</tbody>
</table>

2000 [CF] [PMT] | Enters the annual deposit. |
| [FV] | Calculates the amount in the account at retirement. |

<table>
<thead>
<tr>
<th>Number of periods... N</th>
<th>35.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual interest..... I/YR</td>
<td>8.175</td>
</tr>
<tr>
<td>Present value...... PV</td>
<td>0.00</td>
</tr>
<tr>
<td>Payment.............. PMT</td>
<td>-2,000.00</td>
</tr>
<tr>
<td>Future value........ FV</td>
<td>287,640.45</td>
</tr>
</tbody>
</table>

Payments per year... P/YR = 1
Begin/End mode..... B/E = BEGIN

FV = 287,640.45

25-34 Time Value of Money and Interest Conversions
Part 2. How much has Lee paid into the account at retirement?

Calculates \( PMT \times N \).

\(-70,000.00\)

Part 3. How much interest has the account earned. (The interest earned equals the difference between \( FV \) and the total amount deposited.)

Calculates the interest part of \( FV \).

\(317,640.45\)

Part 4. If his post-retirement tax rate is 15%, what is the after-tax future value of the account? Assume only interest is taxed.

Calculates taxes, 15% of total interest.

Subtracts taxes from total \( FV \) to calculate after-tax \( FV \).

\(399,994.39\)

Part 5. Calculate the purchasing power of this amount in today’s dollars, assuming an 8% annual inflation rate.

Calculates the purchasing power in today’s dollars. (A negative number indicates money available to flow from the investor, so it represents positive purchasing power.

\( PV = -22,995.37 \)
A Taxable Retirement Account

The following example calculates the future value of a taxable retirement account that receives regular, annual payments. The annual tax on the interest is paid out of the account. (Assume the deposits have been taxed already.)

\[
N = \text{the number of payments until retirement.}
\]
\[
P_{\text{F/YR}} = \text{the annual interest rate diminished by the tax rate: interest rate \times (1 - \text{tax rate}).}
\]
\[
PV = \text{the amount in the retirement account.}
\]
\[
PMT = \text{the amount of the annual payment.}
\]
\[
FV = \text{the future value of the retirement account.}
\]

Example: Future Value and Purchasing Power of a Taxable Retirement Account. Part I. Harry Smart is considering investing his money with E. Norman Spayth & Co. They claim that if Harry invests $5,000 with them each year for 35 years at a dividend rate of 8.175%, with dividends taxed as ordinary income, he'll be rich at retirement with close to $500,000. Exactly how much would Harry have in the account at retirement? Assume a tax rate of 28%, and that payments begin today.

Keys: Description:

**MENU T** Selects **MENU TVM** to display the TVM screen.

**CLEAR** Clears any prior TVM data.

1 **P/YR** Sets payments per year to 1.

**1 ENTER** Sets payment mode to BEG/N.

35 **N ENTER** Enters the number of periods.

8.175 **2nd 2** Enters and stores the dividend rate diminished by the tax rate.

1 **NEX** The present value is 2 before the first payment.

25-38 Time Value of Money and Interest Conversions
Calculates the future value of the taxed account.

Number of periods... \( N = 35.00 \)
Annual interest..... \( i/V/n = 5.09 \)
Present value...... \( PV = 0.00 \)
Payment............... \( PMT = -3,000.00 \)
Future value........ \( FV = 345,505.61 \)

Payments per year... \( P/Y = 1 \)
Begin/End mode..... \( B/E = \text{BEGIN} \)

\( FV = 345,505.61 \)

**Part 2. What would be the purchasing power of that amount in today's dollars, assuming 8% annual inflation?**

Calculates the purchasing power in today's dollars. (A negative number indicates money available to flow from the investor, so it represents positive purchasing power.)

\( PV = -29,368.11 \)

*Time Value of Money and Interest Conversions* 25-37
Currency and Other Unit Conversions

The Calculator has a conversion feature that enables you to easily convert related units within the following categories:

- **Currency** (U.S. dollars, pounds, marks, francs, liras, pesetas, escudos, Canadian dollars, yen, and others of your own choosing).
- **Length** (miles, yards, feet, inches, kilometers, meters, centimeters, millimeters, nautical miles, statute miles, chains, rods, survey feet, and fathoms).
- **Area** (square miles, acres, square yards, square feet, square inches, square kilometers, hectares, square meters, and square centimeters).
- **Volume** (gallons, quarts, pints, liters, cubic yards, cubic feet, cubic inches, cubic meters, cups, fluid ounces, tablespoon, teaspoons, milliliters, imperial gallons, bushels, and pecks).
- **Mass** (pounds, ounces, troy ounces, kilograms, grams, milligrams, tons, hundredweights, and metric tons).

Select **Cnv** from within the Calculator to bring up the main conversion menu. Then select the type of units you want.

Select **Cnv** Erase Data to set all the displayed unit values to 0.

If you want to return to the main conversion menu from one of the conversion screens, press **ESC**.
Converting Currencies

Since exchange rates change frequently, often daily, you have the ability to set the exchange rates between currencies whenever you need to. You must do this the first time you use the currency conversion feature.

Setting Exchange Rates

1. Select [MENUS] Conv Currency and press EDIT to display the currency conversion editing screen.
2. Type an exchange rate in the calc line and press the function key for the associated currency. (A rate of 0 removes a currency from consideration when you calculate exchanges.)
3. Repeat the previous step for all the desired currencies. When you’re done with the currencies on the main screen, be sure to press [MORE] and set the rates for the rest of the currencies found there.
4. When you’re finished assigning rates, press ESC to return to the main currency conversion screen.

The previous procedure demonstrates entering rates using the function keys. The point-and-shoot method described in chapter 22 also works here. Highlight a currency using the arrow keys, type a number, and then press [ ] when you’re done entering rates. Press [ESC].

Here is what a set of exchange rates might look like in the edit screen:

```
<table>
<thead>
<tr>
<th>Currency</th>
<th>Conversion Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar</td>
<td>1.00</td>
</tr>
<tr>
<td>Pound</td>
<td>0.65</td>
</tr>
<tr>
<td>Mark</td>
<td>1.11</td>
</tr>
<tr>
<td>Franc</td>
<td>132.00</td>
</tr>
<tr>
<td>Peseta</td>
<td>0.08</td>
</tr>
</tbody>
</table>
```

26-2 Currency and Other Unit Conversions.
Calculating Exchanges

Once you’ve entered the exchange rates, you’re ready to calculate conversions.

1. Select **MENU** Conv Currency to display the currency conversion screen.
2. Type the number of units in the calc line and press the function key for the corresponding currency—for example, 20 Pound. All the currencies are shown simultaneously in equivalent amounts—in this case, in amounts equal to 20 Pounds.

The point-and-shoot method of data entry—highlighting a currency, typing a number, and pressing **F** or **ENTER**—works for calculating currencies, too.

Here is what a set of exchanges might look like:

<table>
<thead>
<tr>
<th>Currency Conversions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dollar = 37.24</td>
</tr>
<tr>
<td>Pound = 20.00</td>
</tr>
<tr>
<td>Mark = 20.00</td>
</tr>
<tr>
<td>Franc = 44.130.00</td>
</tr>
<tr>
<td>Peseta = 313.970.00</td>
</tr>
<tr>
<td>Escudo = 313.970.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Edit</th>
<th>Pound</th>
<th>Franc</th>
<th>Peseta</th>
<th>Escudo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
</tr>
</tbody>
</table>

A currency value can be returned to the calc line by pressing **ESC** followed by the function key for the currency you want.
Adding Currencies to the List
You can add up to five currencies to the list of currencies, plus you can change the name of any currency in the original list. Effectively, this means that you can create a list with any 14 currencies you want. After you make a change, follow the instructions earlier in the chapter to give the new currency an exchange rate.

Any changes you make are preserved until you change them again or until you do a system reset.

Adding a New Currency
1. Select [MEN] Conv Currency and press [Edit] (12) to display the currency conversions editing screen.
2. Press [More] (10) to display the next screen of currencies.
3. Use the arrow keys to highlight a line without a currency and press [NAME] (12).
4. Type the name of the new currency and press [ENTER].
5. Type the exchange rate for the new currency and press [ENTER].
6. Repeat steps 3 and 4 for all the changes you want to make.
7. When you're finished, press [ESC] to return to the main currency conversion screen.

Changing the Name of an Existing Currency
1. Select [MEN] Conv Currency and press [Edit] (12) to display the currency conversions editing screen.
2. Use the arrow keys to highlight the currency you want to change and press [NAME] (12).
3. Type the new name and press [ENTER].
4. Repeat steps 2 and 3 for all the changes you want to make.
5. When you're finished, press [ESC] to return to the main currency conversion screen.

26-4 Currency and Other Unit Conversions
Example: Exchanging Currencies. Part 1. Change “Dollar” to the existing list to “U.S. Dollar”, and add Kenya Shilling to the bottom of the list with a rate of 18.33 Shillings to 1 U.S. Dollar. (Assume U.S. Dollar has a rate of 1.66.)

Keys:  
- **MENU C C**: Selects (MENU) Core Currency to display the currency conversion screen.
- **C**: Displays the conversion editing screen.
- **M**: Highlights the Dollar currency.
- **NAME: U.S. Dollar**
- **ENTER**: Changes the name to U.S. Dollar.
- **MORE**: Displays the next screen of currencies.
- **F**: Highlights the first blank currency line.
- **NAME: Kenya Shilling**
- **ENTER**: Enters the name of the new currency.
- **18.3**: Enters the exchange rate for the Kenya Shilling.
- **ENTER**: Returns you to the main conversion screen.

<table>
<thead>
<tr>
<th>Currency</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian $</td>
<td>1.16</td>
</tr>
<tr>
<td>Yen</td>
<td>140.06</td>
</tr>
<tr>
<td>Kenya Shilling</td>
<td>18.33</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>More</td>
<td>Displays the currency conversion screen with U.S. Dollars.</td>
</tr>
<tr>
<td>500 U.S.</td>
<td>Enters 500 U.S. Dollars. Note that when you enter one value the other value changes to equivalent numbers automatically.</td>
</tr>
<tr>
<td>More</td>
<td>Displays the next set of currencies, which shows the number of Kenya Shillings.</td>
</tr>
<tr>
<td>Kenya</td>
<td>Returns the number of Kenya Shillings to the calc line. 500 U.S. Dollars exchanges to 9,265 Kenya Shillings at the current rate.</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian $</td>
<td>588.00</td>
</tr>
<tr>
<td>Yen</td>
<td>70,000.00</td>
</tr>
<tr>
<td>Kenya Shilling</td>
<td>9,265.00</td>
</tr>
</tbody>
</table>

Converting Other Units

Besides currency conversions, you have the ability to convert related units within the categories of length, area, volume, and mass. For example, you can convert a given number of kilometers to miles, grams to ounces, or gallons to liters.

The conversion rates between units are built into the HP 94DX, so all you need to do is enter a number for one unit, and all the related units are displayed with equivalent values automatically.

1. Select (MENU) Conv to display the menu of conversion options.

26-6 Currency and Other Unit Conversions
2. Select the command for the category of units you want to convert: Length, Area, Volume, or Mass.

3. Type a value and press the function key corresponding to its unit. (If the unit you want isn't currently displayed, remember that \[ \text{More} \] \[ \text{CFD} \] displays another screen of related units for most unit types.)

The point-and-shoot method of data entry works here, too, and involves highlighting a unit, typing a number, and pressing \[ \text{F5} \] or \[ \text{ENTER} \].

A unit value can be returned to the call line by pressing \[ \text{DEL} \] followed by the function key for the unit you want.

Example: Length Conversion How many meters are there in 1 mile?

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \text{MENU} ] [ \text{C L} ]</td>
<td>Selects [ \text{MENU} ] Conv Length to display the length conversion screen.</td>
</tr>
<tr>
<td>[ \text{INC MILE} ]</td>
<td>Enters 1 mile and displays the conversions.</td>
</tr>
<tr>
<td>[ \text{INC METER} ]</td>
<td>Returns the number of meters to the call line. There are 1609.34 meters in 1 mile.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Miles</th>
<th>Feet</th>
<th>Yards</th>
<th>Inches</th>
<th>KILOMETERS</th>
<th>CENTIMETERS</th>
<th>MILLIMETERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5280</td>
<td>1760</td>
<td>63360</td>
<td>1609.34</td>
<td>166,334.40</td>
<td>1,689,344.00</td>
</tr>
</tbody>
</table>

METER = 1609.34

Currency and Other Unit Conversions 26.7
Printing Calculator Information

This chapter covers the specific printing commands within the Calculator. To execute them you need to have a properly configured printer attached to your HP 95LX. If you need information on connecting and configuring a printer or on printing within other applications, appendix C will guide you to that information.

**Note**

Printing an amortization table is a special case of printing and is covered under “Sending an Amortization Table to 1-2-7 or a Printer” in chapter 25.

Select **[PRINT]** Print to see the menu of printing commands.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Prints the data associated with the current Calculator screen. For instance, if you’re doing currency exchanges and select <strong>[CURRENCIES]</strong> Print Data, the displayed currencies with their current values are printed. You can print the data associated with every Calculator feature.</td>
</tr>
<tr>
<td>Calculon</td>
<td>Prints the contents of the calc line.</td>
</tr>
<tr>
<td>Stack</td>
<td>Prints the contents of the history stack.</td>
</tr>
<tr>
<td>Registers</td>
<td>Prints the contents of the storage registers.</td>
</tr>
</tbody>
</table>

Once printing is completed using any of these commands, you are returned to the screen from which you started the print operation.
Using the Solver and Function Plotting

Introduction

You can customize your HP 95LX by entering equations into the Solver. Then you can solve for any of an equation’s variables using special function keys, one for each variable, that the Solver creates for you. Type in the value, press that variable’s function key, repeat for the other known variables, then press the key for the unknown variable. The Solver does the rest and displays the solution.

The Solver and 1-2-3 work together to expand the power of each. You can enter known values into individual worksheet cells related to a formula, enter data cells or formula cell, and then calculate the value of the remaining cell.

Near the end of the chapter, the power of the Solver’s function plotting is demonstrated. You can plot an equation against any of its variables, solve the equation graphically for any variable, and zoom in and out repeatedly to view minute details of very large structures.

This final example will introduce you to the power and ease of the Solver. Suppose you frequently buy carpet and must calculate how much it will cost. The price is quoted to you per square yard. Regardless of how you are doing the calculation (even if you’re doing it longhand), you are using an equation.

\[
\frac{P \times S \times W}{9} = \text{Cost}
\]
where \( PPSY \) = price per square yard, \( L \) = length (feet), and \( W \) = width (feet).

The Solver lets you type in this equation. When you press the Solve function key \( \text{Calc} \) \( \text{F5} \), the Solver creates a function key label for each of the variables in the equation. You can store numbers into the variables using these keys and do calculations the same way you use built-in features.

**Note**
The examples in this chapter assume you get the solve catalog when you select \( \text{Shift} \) \( \text{F2} \) Solve. However, depending on where you left off in the Solver last time, you may see another Solve screen instead. If this occurs, press \( \text{ESC} \) repeatedly until the solve catalog is displayed.

**Example: Entering an Equation and Using Its Function Keys. Part 1.**
Enter the above Carpet equation into the Solver.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{F2} )</td>
<td>Starts the Calculator application.</td>
</tr>
<tr>
<td>( \text{F2} ) ( \text{Shift} ) ( \text{S} )</td>
<td>Selects the solve catalog. If you don’t see the solve catalog screen (see the figure below), press ( \text{ESC} ) one or more times.</td>
</tr>
</tbody>
</table>

![Solve Catalog](image-url)

28.2 **Using the Solver and Function Plotting**
Keys:

END

Description:
Moves the highlight to the end of the catalog. If the catalog is empty, pressing END is unnecessary.

Ensures the highlight is in the name field—the left-hand area of the screen where equation names are displayed.

Enter the equation name into the name field. To correct any errors, use the editing keys, such as (and (backspace). If you want to correct or change the name after you've pressed ENTER, press EDIT (ESC), make your changes, then press ENTER again.

Moves the highlight to the equation field.

Automatically displays another screen, the solve editor, and types the Casper equation. To correct any errors, use the editing keys.

Using the Solver and Function Plotting
Keys: \text{Calc}\text{C}

Description:

Verify the equation, enter it into the equation list, select the solve calc screen, and displays the function key labels. If the Solver detects an error, the cursor in the solve editor loops the problem. Correct the error and press \text{Calc}\text{(E)} again.

Your screen should look like the figure below, except the calc line can contain any number.

Part 2. Calculate the cost of carpet needed to cover a 9 foot by 12 foot room. The carpet costs \$22.50 per square yard.
Part 3. Determine the most expensive carpet you can buy if the maximum amount you can pay to carpet the room is $300.

The following steps illustrate the "point and shoot" way to enter a value into a variable and to solve for a variable. In either case, first highlight the variable. Then, enter a value into that variable, key in the number, and press ENTER or move the cursor. To solve for a highlighted variable, simply press ENTER.
The Solve Catalog

Equations are stored in the Solver’s solve catalog. The current equation is identified by the highlighted name or equation in the solve catalog. This is the equation acted upon by various function keys associated with the several Solver screens. These function keys are explained in the following table.

To display the solve catalog:
1. Select MENU Solve.
2. If the solve catalog is not displayed, press ESC repeatedly until it is.

The first figure in the chapter shows the highlight in the equation field. The equation name field is the region to the left of the equation field. This figure also shows the function key labels at the bottom of the screen.

You use and or to move the highlight between the equation and name fields of the solve catalog. Within either field, use or to move between different equations or between different names.

28-4 Using the Solver and Function Plotting
<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edit</strong> (F2)**</td>
<td>Allows you to edit a highlighted name or equation. Also allows you to view an entire equation that is longer than 25 characters.</td>
</tr>
<tr>
<td><strong>DELETE</strong> (F3)**</td>
<td>Allows you to delete a highlighted name, a highlighted equation and/or its variables, or a blank row.</td>
</tr>
<tr>
<td><strong>INSERT</strong> (F4)**</td>
<td>Inserts a blank row above the highlighted row. This row is ready to accept your new name and your new equation.</td>
</tr>
<tr>
<td><strong>Find</strong> (F7)**</td>
<td>Allows you to search the selected (highlighted) name or equation field for a specified group of characters.</td>
</tr>
<tr>
<td><strong>1-2-3</strong> (F8)**</td>
<td>Displays the solve 123 screen. Allows you to “Back-Solve” a 1-2-3 worksheet; that is, make a cell containing a formula equal to a desired value by solving for a specified input cell.</td>
</tr>
<tr>
<td><strong>Calc</strong> (F9)**</td>
<td>Verifies the equation or expression, enters it into the equation list, selects the solve calc screen, and displays a function key label for each variable.</td>
</tr>
<tr>
<td><strong>Graph</strong> (F10)**</td>
<td>Displays function graphing. Allows you to graph the highlighted function with respect to a specified independent variable.</td>
</tr>
<tr>
<td>or <strong>Y</strong></td>
<td>Moves the highlight between the name and equation fields.</td>
</tr>
<tr>
<td><strong>UP</strong> (F1)**</td>
<td>Moves the highlight within the name or equation field.</td>
</tr>
</tbody>
</table>

Using the Solver and Function Plotting 28-7
Entering Equations

The equation list can contain as many equations as you like, limited only by the HP 95LX's memory.

To enter an equation and its name:

1. Display the solve catalog. (Select [MENU] Solve, then press [EXEC] one or more times if necessary.)

2. Use [L], [G], [C], and [A] if you want to move the highlight. Names (optional) are entered in the left column, equations in the right. If the highlight shows a blank row, the name of equation is entered on that line. If the highlight shows an existing entry, the name of equation is entered on a new blank line automatically inserted below that entry.

3. Type a name (optional). Only the first 12 characters will display if there is an equation on the same line. If there is no equation on that line, up to 38 characters will display.

4. Press [ENTER].

5. Type the equation. As soon as you start, the solve editor screen is automatically displayed which provides the usual editing keys (BACKSPACE, [LEFT], arrow keys, etc.). You may use the typing aids in the following table, “Solve Editor Function Keys.” These are for functions described in the chapter 29 table “Solver Functions.” You can also type those functions in directly if you wish. Before that table is more information about typing your equation in the solve editor.

6. Choose one:
   - Press [C] to enter the equation into the solve catalog's equation field.
   - Press [CALC] to enter the equation into the equation field and display the equation’s function keys, one for each variable.

When you press [CALC] the Solver verifies the equation. If the equation cannot be interpreted, the Solver briefly displays:seheneneneT and the cursor is positioned before the first character the Solver could not interpret. Check to be sure you've made no typing mistakes, and that you've followed the rules for writing equations in chapter 29.
Typing an Equation in the Solve Editor

In addition to the typing aids provided by the solve editor's function keys, the editor offers other useful abilities described below. For more detailed information about equation writing, see chapter 26.

Adding Spaces in an Equation
To improve readability, you can add spaces throughout an equation, except spaces are not allowed within variable or function names.

Adding Comments to an Equation
You can add one comment at any point in an equation. Simply start and end the comment with an exclamation point (!).

Creating Line Breaks
From the tab key (\(\text{\textasciitilde}\text{\textasciitilde}\)) to break an equation at any point to improve clarity. If you don't use (\(\text{\textasciitilde}\)), the line will automatically break when you reach the right margin of the screen.

Creating Indented Lines
Use (\(\text{\textasciitilde}\)) or (\(\text{\textasciitilde}\text{\textasciitilde}\text{\textasciitilde}\text{\textasciitilde}\)) to indent a line. Use (\(\text{\textasciitilde}\)) to break the end of that line (and as many following lines as you wish) to preserve the indentation. If you modify or eliminate that indentation on any line using (\(\text{\textasciitilde}\text{\textasciitilde}\)) or (\(\text{\textasciitilde}\)) (backspace), (\(\text{\textasciitilde}\)) will maintain that modified indentation.

Maximum Length of an Equation
The equation's length can be up to 279 characters or 5 12-line screens. When the 150 character screen is full, a new blank line needs to be inserted as you continue typing.

Maximum Number of Variables in an Equation
A single equation can have up to 256 different variables.
Solve Editor Function Keys

The function names in the table below may either be typed in from the keyboard or displayed by the function keys. For example, when you're entering an equation and want to display the function PMT, you may type the function name or press from the solve editor to display PMT(, , ). The commas (argument separators) and parentheses are displayed as well as the three letters. As you type in the arguments to the function, use 3 to skip over the commas and parentheses. To display the previous set of function keys, press 33.

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td>Provides typing aids for RND, IP, FP, ABS, LN, EXP, LOG, ALOG, SQRT, SQ, INV, TRN, LNP1, EXP, EXP1, INT, MOD, MIN, MAX, SG, SIGMA.</td>
</tr>
<tr>
<td><strong>Trig</strong></td>
<td>Provides typing aids for PI, SN, COS, TAN, ASIN, ACOS, ATAN.</td>
</tr>
<tr>
<td><strong>Conv</strong></td>
<td>Provides typing aids for DEG, RAD, HR, HMS, XCOORD, YCOORD, RADIUS, ANGLE, CTME, CDATE, LATE, DDAYS.</td>
</tr>
<tr>
<td><strong>Prob</strong></td>
<td>Provides typing aids for COMB, PERM, FACT, RANG.</td>
</tr>
<tr>
<td><strong>Fin</strong></td>
<td>Provides typing aids for N, F6YR, PV, FMT, FY, SPF1, SPFY, USFV, USPV.</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Provides typing aids for STOCELL, HCLCELL, CALCCELL, LENGTH, WIDTH, CWCOL.</td>
</tr>
<tr>
<td><strong>NUM+</strong></td>
<td>Inserts into the editor the last number or other operand displayed in the calc line. The number is inserted in full precision.</td>
</tr>
<tr>
<td><strong>Calc</strong></td>
<td>Verifies the equation, selects the solve catalog, enters the equation into the equation list, and displays a set of function keys for the equation's variables.</td>
</tr>
<tr>
<td><strong>Graph</strong></td>
<td>Displays the function plotting / plot conditions screen of the function graphing feature.</td>
</tr>
</tbody>
</table>

28-10 Using the Solver and Function Plotting
Editing the Equation List

To edit equation names:
1. Display the solve catalog.
2. Highlight the name you want to edit.
3. Press Edit (F2). The selected name is now in the calc line.
4. Edit the name. To cancel an edit, press ESC.
5. Press ENTER to put the edited name into the equation list.

To edit equations:
1. Display the solve catalog.
2. Highlight the equation you want to edit.
3. Press Edit (F2). The solve editor is displayed together with the selected equation.
4. Edit the equation. The editing keys in the table below are available, as are the typing aids in the previous table "Solve Editor Function Keys." To cancel an edit before making changes, press ESC. To cancel an edit after you've made changes, press ESC, then press NO (F2) to cancel your changes or YES (F3) to save them.
5. Press ENTER or Calc (F2) to replace the previous version with the edited version.

Solve Editor Editing Keys

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>← → ↑ ↓</td>
<td>Moves the cursor left, right, up, or down.</td>
</tr>
<tr>
<td>Backspace</td>
<td>Deletes the character under the cursor.</td>
</tr>
<tr>
<td>HOME</td>
<td>Moves the cursor to the beginning of the current line.</td>
</tr>
<tr>
<td>END</td>
<td>Moves the cursor to the end of the current line.</td>
</tr>
<tr>
<td>PAGEUP</td>
<td>Scrolls the screen's contents up one page.</td>
</tr>
<tr>
<td>PAGEDOWN</td>
<td>Starts a new line. Allows a line break at any place within an equation.</td>
</tr>
</tbody>
</table>

Using the Solver and Function Plotting 25-11
Calculating With Solver Variables

Pressing **[F2]** creates a Solver screen dedicated to the equation highlighted in the solve catalog. A function key is dedicated to each variable, as shown in the earlier figure. If the equation contains more than nine variables, the Solver creates the function key **[F9]** used to switch between sets of function keys.

To perform a calculation:

1. Display the solve catalog screen.
2. Highlight the equation you want to calculate, making it the current equation.
3. Press **[F2]**. This selects a new screen dedicated to the current equation. Each variable is represented by a function key.
4. Store a value in all but one of the variables. For example, to use the function keys in the earlier figure, you can store values in \( PPX \), \( L \), and \( W \) to calculate \( COST \). Or, you can store values in \( PPX \), \( W \), and \( COST \) to calculate \( L \). To store a value, key in the number and press the appropriate function key. For example, 25.50 \( PPX \) stores 25.50 in \( PPX \).
5. Press the function key for the value you want to calculate. If the Solver is able to find a solution to the equation, the answer is displayed in the calc line.

In most cases, this is all you will need to know about how the Solver works. However, there are certain types of equations that are more difficult to solve. If, during the calculation, the display temporarily shows sets of changing numbers, such as:

\[
\begin{align*}
\text{At:} & \quad 5000000000 & \quad \text{R1:} & \quad 11476129894 + \\
\end{align*}
\]

the Solver is searching for a solution. You should read "How the Solver Works" later in this chapter.

Example: Return on Equity. The Return on Equity of a business can be defined as:

\[
\text{ROE} = \frac{\text{Operating income} - \text{Interest} - \text{Taxes}}{\text{Common equity}}
\]

Operating income = assets \times \text{percentage earnings on assets} = \text{ASSETS} \times \text{EARN}
Interest = debt x percentage interest paid on debt = \( \text{DEBT} \times \text{INT} \)

Common equity = amount of common equity used for financing = \( \text{EQUITY} \)

The Solvency equation would be:

\[
\text{ROE} = \text{ASSET} \times \text{EARN} - \text{DEBT} \times \text{INT} - \text{TAX} - \text{EQUITY}
\]

Find the ROE of a small firm with $2,000 in assets. The assets earned 10%, while its debt cost 8%. The assets were financed using $500 of common equity and $1,500 of debt. The firm paid no taxes.

**Keys:**

- **Shift** S
  - Description: Selects the solve catalog. (If necessary, press [ESC] several times to display the solve catalog.)

- **Equity Gain** ENTER
  - Description: Enters the name of your equation into the name field.

- **ROE**
  - Description: Moves the highlight to the equation field.

- **ASSET**
  - Description: Types the equation.

- **EARN**
  - Description: Verifies the equation, enters the equation into the equation list, selects the solve calc screen, and displays a set of function keys for the equation's variables.

- **DEBT**
  - Description: Stores the value of the assets.

- **INT**
  - Description: Stores the percentage earnings on assets.

Using the Solver and Function Plotting 28-13
Stores the debt.

Stores the percentage interest paid on debt.

Stores the common equity.

Calculates the return on equity.

<table>
<thead>
<tr>
<th>ROE</th>
<th>16.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET</td>
<td>2,400.00</td>
</tr>
<tr>
<td>EIN</td>
<td>10.00</td>
</tr>
<tr>
<td>DEBT</td>
<td>1,500.00</td>
</tr>
<tr>
<td>LINT</td>
<td>8.00</td>
</tr>
<tr>
<td>TRX</td>
<td>0.00</td>
</tr>
<tr>
<td>EQTY</td>
<td>500.00</td>
</tr>
</tbody>
</table>

Erasing Data in Solver Variables

Erasing Solver variables sets them equal to 0. To clear the variables in a particular solve solve screen, display the screen and select (ERASE).

Erase Data. Be sure you display the solve solve screen, not the solve solve catalog screens.

Note

In the solve solve catalog screen, you can erase all variables and all equations by selecting Erase Data.

Viewing Long Equations

The equation list shows the first 25 characters of an equation. To view the entire current equation, press (EDIT) to display the solve solve editor screen. If your equation is longer than 456 characters, press (Y) on (NEXT) to see additional lines.

28-14 Using the Solver and Function Plotting
Shared Solver Variables

If two or more equations contain the same variable names, that variable is shared among the equations in which it appears. For example, suppose your equation list includes these two equations named CARPETPRICE and TOTALPRICE:

CARPETPRICE: PPSY + L/H/3 = COST
TOTALPRICE: COST + HOURS * 25 + 50 = CHARGE

COST is a shared variable. You can calculate a value for COST using the Solver's function keys for CARPETPRICE, and then switch to the function key for TOTALPRICE. Since the value for COST is shared, you do not need to store it again. After entering HOURS, you can calculate CHARGE.

No sharing occurs between built-in variables and Solver variables. For example, the COST user-variable in the Solver is not shared with the COST built-in variable in the Business Percentages screen (select MENU Run «.

Deleting Names, Equations, and Variables

To delete an empty line (containing neither name nor equation):
Highlight the empty line and press DELETE (DELE)

To delete a single name:
In the solve catalog, highlight the name you want to delete, then press DELETE (DELE).

To delete a single equation and/or its variables:
1. Highlight the equation in the solve catalog you want to delete.
2. Press DELETE (DELE). You're asked if you want to delete the equation, variables, or both.
3. Press EQU (EQU), VARS (VARS), or EQU (EQU). To cancel the delete command, press EQU (EQU).

Using the Solver and Function Plotting
When deleting one or all equations, you should first delete an equation’s variables, if any are used in other equations. These variables have no purpose, but they do use memory. Deleting these variables releases memory for other uses.

If you delete the equation’s variables but not the equation, the variables are created again with values of zero the next time you use the equation. If the variable is a shared variable, its value is lost to all the equations that share it. (Refer to the previous section “Shared Solver Variables.”)

To delete all variables and/or all equations:


To release all variable memory:

1. Select [E:G:R: A:R: S: E:R:ACE:R:E: D:AT: A]. The number of allocated variables is displayed to give you an idea of how much memory those variables are using. (The memory used by a single variable, in bytes, is 15 plus ten number of characters in the variable.)
2. Press [V:ARS: (E:G:R: A:R: S: )]. All memory taken up by variables, whether referenced by an equation, or not, is released. When you use any equation again, its variables are again created with their values set to zero.

28-16 Using the Solve and Function Plotting
Finding Equations

You can search for an equation in two ways:

- Scroll through the name or equation list using the highlight-moving keys (see the earlier table "Solve Catalog Function Keys and Highlight-Moving Keys").
- Use /Find (F3) from the solve catalog screen.

Using /Find you can search the entire name or equation list (but not both simultaneously) for a text you specify using the find function keys described below. This text can be up to 38 characters.

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next (F2) or Enter</td>
<td>Searches the field containing the highlight for the specified text until a match is found or the search fails. The search begins with the next entry.</td>
</tr>
<tr>
<td>Prev (F3)</td>
<td>Searches the field containing the highlight for the specified text using a match is found or the search fails. The search begins with the previous entry.</td>
</tr>
</tbody>
</table>

To find an equation:

1. Select (Menu) Solve to display the solve catalog screen showing the equation list.
2. Put the highlight in either the name or equation list, depending on which list you want to search. Press (4) to move between the name and equation lists.
3. Press /Find (F3).
4. Type the text you wish to find. The text can be up to 38 characters long, and the search will be case sensitive ("X" is different from "x").
5. Press /Enter, Next (F2), or Prev (F3) to search the entire name or equation list. If the search is successful, the highlight will identify the found text. If unsuccessful, the message Characters not found will be displayed and a beep will sound.
6. Press /Enter, Next (F2), or Prev (F3) again repeatedly to search for other occurrences of this text.

Using the Solver and Function Finding 29:17
Using the Clipboard in the Solver

The general use of the Clipboard in the Calculator is covered in "Using the Clipboard with the Calculator" in chapter 22. The following procedure illustrates the use of the Clipboard together with FIND, COPY, and EDIT, in simplifying a complex equation that's similar to one already in the equation list.

To use an existing equation segment in a new equation:

You want to enter an equation into the Solver’s equation list that’s similar to an existing equation in that list. Your plan is to put a copy of that existing equation into the solve editor and edit it to create your new equation.

1. Use FIND (ﬁnd) to highlight the existing equation in the solve catalog. (See the previous procedure, "To find an equation.")
2. Press COPY (copy) (press COPY) and hold it down as you press COPY to put a copy of the found equation on the Clipboard.
3. Press EDIT to move the highlight to the end of the equation list.
4. Press PRST (prst) to add the copy of your found equation to the end of the list.
5. Press EDIT (edit) to put this equation in the solve editor.
6. Edit the equation to create the equation you want.
7. Press ENTER or CALC (calc) to add your new equation to the equation list. If you want, press I and type a name for your equation.

Using Multiple Equation Lists

When you quit the Calculator (QUIT), the current solve catalog and the values of its variables are stored. When you open the Calculator again (CALC), you’ll see the same values displayed that existed before Quit was selected.

If you want to use more than one equation list, the procedures below show you how to save and retrieve equation lists, how to create a new, empty equation list, and how to insert one equation list into another.
To save an equation list in a new file:
1. Select **[FILE]** File Save. You’ll see displayed C: \_CAT \* .E0F with perhaps some file names also displayed.
2. Type a file name (8 characters maximum). File names are case insensitive (X = x). Your first character will replace * . If you type no extension, .E0F will be appended to identify your file as an equation list.
3. Press **[ENTER]** to save your equation list.

To open an existing equation list file:
1. Select **[FILE]** File Retrieve.
2. Highlight the displayed name of the file you want to open and press **[ENTER]**. If the file you want to open is not displayed, see the following procedure, “To display all file names.”

To save an equation list in an existing file:
This procedure enables you earlier selected **[FILE]** File Retrieve to open an existing equation list. After changing it, you follow this procedure to save it in the same file.
1. Select **[FILE]** File Save. You’ll see displayed C: \_CAT \* .E0F where filename is the existing name of your file.
2. Press **[ENTER]** to save your file under its existing name.

To create a new, empty equation list:
1. Select **[FILE]** File New. One of the following will happen:
   - If your current equation list is saved, a new, empty equation list will be displayed.
   - If your current equation list is not saved, a prompt asks: **Clear current equation list?** Do one of the following:
     - Press **[YES]** to clear your current list and to display a new, empty equation list.
     - Press **[NO]** to cancel the File New command.

To insert another equation list into your current equation list:
1. Position the cursor in your present equation list at the position you want the other list inserted.
2. Select **[FILE]** File Insert to display all files names with the extension .E0F in the current directory.
3. To insert all the equations from one of the displayed files, highlight the file name and press ENTER. If the file you want is not displayed, see the procedure below, "To display all file names."

To display all file names:
After executing MENU File Save, MENU File Retrieve, or any other file related command, follow this procedure to display all file names in the HP's files and A: directories. If necessary, press EOB to display the C: \ or \ directory, press EOB prompt.

- To display files in the D: directory, type *.* and press ENTER.
- To display all files and subdirectories in the C: \ directory with the .EOB extension, highlight .. \ and press ENTER.
- To display all files and subdirectories in the root directory of the RAM disk, press (backspace) repeatedly to erase all but C: \, type *.* then press ENTER.
- To display all files and subdirectories in the root directory of a plug-in card, press (backspace) to erase the entire line, type *.* then press ENTER.
- To display all files in any subdirectory, highlight the subdirectory name (for instance, FUNCTION), then press ENTER.

Using the Solver in a 1-2-3 Worksheet.

A worksheet often contains a series of cells, where all but one contain variable values (the variable names are the cell names), and where that one remaining cell contains the result of a formula calculation. The formula uses the other cell names as its variables, and the contents of those other cells are the values for those variables.

Normally, the values in the variable cells are entered first, then the formula cell calculates the result. The solve catalog's 1-2-3 feature (1-2-3 \#B) allows this calculation order to be reversed. Rather than have the formula-cell's value calculated last, it's entered first, and a variable-cell's value is calculated last. This variable cell is called the solve cell, and this method of calculating for that cell's value is called back-solving.
Example: Adjusting a Day's Expenses. Say you want today's expenses on your trip to be no more than $300. You want this $300 to cover transportation, meals, entertainment, and lodging. You consider all but entertainment to be fixed. You’re using an HP 95LX 1-2-3 worksheet to record your trip expenses, and you’ve already entered $30 for transportation, $60 for meals, and $110 for lodging. Before you enter the cell B8 formula, your worksheet looks like the figure below.

<table>
<thead>
<tr>
<th>EXPENSE REPORT</th>
<th>05-23-82</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSPORTATION</td>
<td>$30.00</td>
</tr>
<tr>
<td>MEALS</td>
<td>$60.00</td>
</tr>
<tr>
<td>ENTERTAINMENT</td>
<td>$110.00</td>
</tr>
<tr>
<td>TOTALS</td>
<td>$190.00</td>
</tr>
</tbody>
</table>

If you want to press keys as you follow this example, put the numbers shown in the figure in cells B3 through B5 of a new current worksheet, and leave blank the entertainment expense cell, B6. This is the solve cell. Then enter the formulas =B3+B4+B5 into cell B8. The row and column titles are not necessary for this example. At this point, the formula cell B8 is no longer blank, but shows a value of $240.00 (assuming automatic recalculation is in effect).
Keys:  Description:

F2 (MENU) S  Displays the “Solve” catalog of the Calculator application (press F5 once or more times if necessary to display the solve catalog).

1-2-3 (F3)  Displays the 1-2-3 screen.

F5 (F1)  Displays your current worksheet in point mode and asks you to highlight the formula cell, the cell that calculates your total day’s expenses. Then use F3, F4, and F5 as necessary to highlight cell B8.

ENTER  Returns to the calculator’s solve 1-2-3 screen and enters B8 in the solve 1-2-3 screen as the formula cell.

300 VALUE (F5)  Enters 300 as the desired total expenses calculated by cell B8.

Solve (F3)  Displays the worksheet in point mode and asks you to highlight the solve cell, the cell whose value you want to determine. Use the arrow keys to highlight the entertainment expense cell B6.

ENTER  Returns to the solve 1-2-3 screen and enters B6 as the solve cell, the cell whose value is to be calculated so the total (B8) equals $300. The calculation occurs automatically and gives $60 as the allowable entertainment expense.

F3  Displays the worksheet. Note that the solve cell B6 now shows $60.00.

F1  Returns to the calculator’s solve 1-2-3 screen.

To calculate a 1-2-3 solve cell value that will produce a specified formula cell value:

This is the general procedure to perform a backsolve similar to that described in the example above.
1. Create or identify a 1-2-3 worksheet segment (press [F3]) that includes a formula cell and the data cells representing all the variables used in the formula cell. Ensure that this worksheet is the current worksheet (the one displayed when [F5] is pressed).
2. Enter values into all but one of the data cells. The remaining data cell is the solve cell.
3. Select [F6] Solve (and press [F6] one or more times, if necessary) to display the solve catalog.
4. Press 1-2-3 (F2) to display the calculator’s solve 1-2-3 screen.
5. Press F9 (F9) to display the current 1-2-3 worksheet.
6. Move the cursor to highlight the formula cell.
7. Press [F9] to define that cell as the formula cell and to return to the calculator’s solve 1-2-3 screen.
8. Type the value of the result you want that formula cell to calculate and press [F9] to display the current 1-2-3 worksheet.
9. Move the cursor to highlight the data cell you choose to be the solve cell—the cell whose value is to be determined.
10. Press [F9] to define that cell as the solve cell and to return to the calculator’s solve 1-2-3 screen. The cell’s value is calculated, displayed in the solve 1-2-3 screen, and entered in the worksheet.

To restore the solve cell to its previous value:
Press [F9] (F9). The solve cell is restored to the value it had just before the last backsolve took place.

Example: Creating and Using a Solver Worksheet. A 1-2-3 worksheet working with the solve 1-2-3 screen can be used to solve for any one of an expression’s variables given values for the other variables. This is the same ability offered by the calc screen. Using a simple expression, this example demonstrates how to set up the solver worksheet and how to use it.

The equation used in this example is RATE = TIME = DISTANCE. The solver worksheet uses expressions, not equations, so form the left—right give the expression <RATE * TIME> = DISTANCE. If you want to press keys as you follow this example, create the worksheet shown in the following figure. Cells B3, B4, and B5 contain values only; no formulas. Cell B3 contains the formula +B9*F4-B5. When the example starts, this worksheet is the current worksheet.

Using the Solver and Function Plotting 28-23
Keys: Description:

(Use arrow keys) Move the cursor to cell B3.
40 Enters 40 miles per hour into B3.
100 Enters 100 miles into B5.
(If necessary, press [ESC] one or more times). Displays the Calculator's solve catalog screen.
1-2-3 (FD) Displays the Calculator's 1-2-3 screen.
FORM (FS) Displays the current 1-2-3 worksheet. The cursor highlights cell B8, the formula cell.
ENTR Displays B8 as the formula cell and returns to the Calculator's 1-2-3 screen.
0 VALUE (FS) Enters the value the formula cell is to calculate.
SOLVE (F8) Displays the worksheet. The formula cell, B8, is highlighted.

26-24 Using the Solver and Function Plotting
Highlights cell B4, TIME. This is the cell whose value is to be calculated to force cell B8 to equal zero.

Defines B4 (TIME) as the solve cell and returns to the solve 1-2-3 screen. The calculation is performed and the display shows 24 hours (the Solve result) as the time required to cause RATE * TIME = DISTANCE (B8) to equal zero. If you return to the worksheet, you'll see that B8 now contains 0.

To set up a solver worksheet:

The example above illustrates this procedure.

1. Write down your chosen formula (like DISTANCE = RATE * TIME), then convert it to an expression by subtracting the right side from the left (like DISTANCE - RATE * TIME).
2. Reserve a set of adjacent 1-2-3 cells, one for each variable in your expression and the last one (the formula cell) for the expression itself.
3. Enter the expression into the formula cell.
4. Select SETUP Solve (and press [F5]) one or more times, if necessary, to display the solve catalog.
5. Press 1-2-3 (F3) to display the calculator's solve 1-2-3 screen.
6. Press FORM (F4) to display the current 1-2-3 worksheet.
7. Move the cursor to the formula cell.
8. Press ENTER to define that cell as the formula cell and to return to the calculator's solve 1-2-3 screen.
9. Type 0 as the result you want that formula cell to calculate and press [VALUE (F3)]. Your solver worksheet is now ready to be used. The next procedure describes how this is done.

To use a solver worksheet:

This procedure starts with the worksheet set up as described in the above procedure "To set up a solver worksheet." This worksheet is now the current worksheet. You know the values of all but one of the variables, and you'll use this solver worksheet together with the
Calculator’s solve 1-2-3 screen to solve for that unknown. If the solve 1-2-3 screen is not displayed, press [F3] Solve to display the solve catalog (if necessary, press [F3] once or more times), then press 1=2^x (F3).

1. Press [F3] to display the solver worksheet.
2. Enter values into all but one of the variable’s cells.
3. Move the cursor to the unknown variable’s cell.
4. Press [F3] Solve (F3) and see the solution in the cell line labeled Solve result. If the expression in the worksheet’s formula cell does not evaluate to zero exactly, that cell will contain a very small number.
5. To solve for another variable, repeat these steps.

How the Solver Works

The operation of the Solver is explained in the earlier section, “Calculating with Solve Variables.” This section explains Solver operation in more detail.

The Solver has two ways of finding an answer—direct solutions and iterative solutions.

Initially, the Solver tries to find a direct solution by rearranging the equation and then solving for the variable. If the Solver finds a direct solution, the HP 95LX displays the answer on the command line, and no other information is displayed.

If the Solver is unable to find a direct solution, the Solver tries to find an iterative solution. (Iterative refers to the repetitive numerical procedures used.) This involves searching for the answer by estimating a set of answers, seeing how close they are to a solution, and then making another set of estimates. The HP 95LX displays the current estimates while the Solver is searching for an answer iteratively. You should keep in mind that there may be more than one solution to an equation, and that it may be necessary for you to enter guesses in order to influence which solution the Solver finds.

If the displayed estimates don’t appear to be proceeding towards a number you judge to be a reasonable answer, you may want to stop the iterative process, enter your own guesses, and restart the search.
(refer to the following sections: "Halti ng and Restarting an Iterative Search" and "Entering Guesses."

Since the process of finding an iterative solution is very complex, there are four possible outcomes that you should be aware of:

- The HP 981LX displays an answer but displays an error message. It is very likely that the Solver has found a solution. The HP 981LX may display additional information if you repeat the calculation by pressing the function key for the variable you solved for.

- The HP 981LX displays an answer and automatically displays a message. The Solver has found a possible solution, but you must use judgement in interpreting the results.

- The HP 981LX displays TRY AGAIN, BAD GUESSES and the guesses the Solver used when the calculation was started (or restarted). This indicates that the Solver cannot begin the search with the current guesses. (See the following section "Entering Guesses."

- The HP 981LX displays SOLUTION NOT FOUND because the Solver was unable to find a solution. Check to see if your equation and stored values are correct. If the equation is correct, you may be able to find a solution by entering very good guesses.

**Halti ng and Restarting an Iterative Search**

When the Solver is searching for an iterative solution (in other words, when the Solver is displaying sets of estimates), you can halt the calculation by pressing any key. The HP 981LX displays the best estimate the Solver has found so far, and the message INTERRUPTED. You can restart the search from where it left off by pressing the function key for the variable you are solving for. Or, you can restart the search using your own guesses (see "Entering Guesses," below).

**Entering Guesses**

Entering your own guesses serves two purposes. First, it can save time by telling the Solver where to start searching. Second, if more than one solution exists, entering guesses can help the Solver select the answer you want. The closer your guesses are to the answer you want, the better chance the Solver has of finding it.

**Using the Solver and Function Plotting** 28-27
You can enter guesses at these times:

- Before beginning the calculation, after you've stored a value for every variable except the unknown variable.
- After you've halted the iterative search.
- After the Solver has returned an answer, and you want to begin searching for another answer somewhere else.

You can enter one or two guesses. If you enter one guess, the Solver makes a second guess. If you enter two guesses, the Solver starts searching for a solution in the range between the two guesses. The Solver works most efficiently when the answer is between your two guesses. For example, if you know the answer is between 5 and 12, you should enter 5 and 12 as the starting guesses.

To enter one guess:

Key in the value and press the function key twice. For example, 4.5 A enters 4.5 as a guess for a variable named A and starts the calculation.

To enter two guesses:

1. Key in the first guess and press the function key.
2. Key in the second guess and press the function key twice.

Example: Calculating Profit for a Manufacturing Operation.

The following Solver equation calculates the profit from a piano-manufacturing operation:

\[
\text{PROFIT} = \text{PRICE} \times \text{QUAN} - \text{VARCOST} \times \text{QUAN} - \text{FIXED}
\]

where

- \( \text{PROFIT} \) = profit for the manufacturing operation.
- \( \text{PRICE} \) = the retail price of a piano.
- \( \text{QUAN} \) = the number of pianos sold.
- \( \text{VARCOST} \) = variable costs (per piano).
- \( \text{FIXED} \) = fixed costs.

The Bill Johnson Piano and Dog Whistle Corporation sells pianos for $6,000. Variable costs are $4,100; fixed costs per year are $112,000.

How many pianos must Bill Johnson sell this year in order to earn a profit of $100,000? (In past years, Johnson has had to sell between
100 and 200 pluses to make an acceptable profit. You can use this information as initial guesses.)

### Keys:

- **Menu**: S
- **Click**
- **Enter**
- **Profit** =
- **Price** =
- **VarCost** =
- **Quan**
- **Fixed**
- **Calc**

### Description:

Selects the solve catalog. If you don’t see the solve catalog, press one of more times. Ensures the highlight is in the name field.

Enters the equation name into the name field.

Moves the highlight to the equation field.

Types the equation. Verifies the equation, enters the equation into the equation list, selects the solve calc screen, and displays a set of function keys for the equation’s variables.

Stores the price.

Stores the variable costs.

Stores the fixed costs.

Stores the profit.

\[
\begin{align*}
\text{PROFIT} & = 120,000.00 \\
\text{PRICE} & = 5,000.00 \\
\text{VarCost} & = 4,500.00 \\
\text{Fixed} & = 112,000.00
\end{align*}
\]

The next two steps are optional. They enter guesses for Quan. If the Solver must do an iterative search to solve for Quan, it will begin the search using the estimates 100 and 200 you’ll enter.

---

Using the Solver and Function Plotting 28-29
Function Plotting

The Solver's function plotting lets you draw a graph and determine roots of an equation or mathematical expression. You can autoscale the graph so the curve is sure to appear in the display. You can also zoom in and zoom out to see more detailed or wider views of the graph, and you can display the coordinates of any point on the graph.

Example: Finding the Roots of an Equation. This example shows how to find graphically the two roots of the following equation:

\[ x^2 + 10x = 15 \]

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[MENU] [S]</td>
<td>Displays the solve catalog screen. If it's not displayed, press [SIE] one or more times.</td>
</tr>
<tr>
<td>[X] 2</td>
<td>Ensures that the highlight is in the equation field, not the name field.</td>
</tr>
<tr>
<td>[X] 75</td>
<td>Enters the equation into the solve editor.</td>
</tr>
</tbody>
</table>

28-30 Using the Solver and Function Plotting
Enters the equation into the equation list in the solve catalog screen. The equation you entered is highlighted. The highlighted equation or expression is the one whose graph will be plotted.

Graph

Displays the function plotting screen.

MAX & D

Initializes the function plotting data. The plot-variable is x.

AUTO

Plots the equation as the expression $x^2 - 2x - 10 \leq 0$. Note that the equation is converted to an expression by subtracting the right side from the left.

The minimum and maximum x-values (the left and right boundaries) are those specified by XMIN and XMAX in the function plotting screen. The minimum and maximum y-values (the bottom and top boundaries) are chosen by the AUTO function to ensure that the curve is displayed on the screen.

ESC

Returns to the function plotting screen. This screen shows that AUTO set these values: YMIN = -105 and YMAX = 5.

DRAW: (F3)

Redraws the graph.
**Keys:**
- (4 times)

**Description:**
Zooms out and autoscales the y-axis for a single operation. The range covered by the x-axis is increased by 5 times, and the y-axis range is automatically chosen (autoscaled) to ensure that the curve appears on the screen. Both roots are now shown (where the curve crosses the x-axis).

Moves the cursor to an x-value near the left root. The cursor position now locates an initial guess for the root. (The initial guess is determined only by the x-value of the cursor’s position, so there’s no need to move the cursor to a y-value close to zero.)

---

28-52 Using the Solve and Function Plotting
How Function Plotting Works

Function plotting plots values of a function for a number of evenly spaced values of the plot variable (independent variable) measured along the x-axis. When the graph is drawn, these function values or points are connected by straight lines. The number of these plotted points is determined by RES (resolution), the plot boundaries are given by XMIN, XMAX, YMIN, and YMAX, and the plot variable is given by XVAR. These values are shown in the screen that displays plot conditions.

The number of evenly spaced values (points) of the plot variable XVAR is determined by the value of RES. For instance, a RES value

Using the Solver and Function Plotting
of 10 means that the XVAR values between XMIN and XMAX are divided into 10 equal parts. If XMIN is -50 and XMAX is 500, the function would be plotted for x-values of -50, -40, -30, ..., 0, 50, and 100, and each of these plotted points would be connected by straight lines to produce the graph.

Selecting the Expression to Plot

Every graph is a plot of a function versus an independent variable (the XVAR value). You select a function or an equation to plot (the current equation) from the Solver’s equation list. If you plot an equation of the form y = f(x), the function f(x) is plotted. If you plot an equation of the form expression = expression (such as \( x^2 + 10x = 5x^2 + 79 \)), the HP 55LX automatically changes it into a single expression (no equal sign) by subtracting the right side of the equation from the left side (\( x^2 + 10x - 5x^2 - 79 \)). The value of this expression is then plotted against XVAR.

This table shows examples of how equations would be converted to expressions by function plotting, and what choices you would have for the independent variable, XVAR.

<table>
<thead>
<tr>
<th>Expression or Equation in Equation List</th>
<th>What’s Plotted as y-value</th>
<th>XVAR Choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>y = sin(x)</td>
<td>sin(x)</td>
<td>y, x</td>
</tr>
<tr>
<td>sin(x)</td>
<td>sin(x)</td>
<td>x</td>
</tr>
<tr>
<td>( \frac{(PSY+4*W)}{9} = COST )</td>
<td>(PSY+4*W)/9 - COST</td>
<td>PSY, W, COST</td>
</tr>
<tr>
<td>(first example in chapter)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \frac{(PSY+4*W)}{4} )</td>
<td>PSY, W, COST</td>
<td></td>
</tr>
</tbody>
</table>

Setting the Plot Conditions

Function plotting uses two screens, one that shows plot conditions and one that shows the graph. You set the plot conditions on the first of these two screens, the one you reach from the solve catalog by pressing [GRAPH] (F2). The function keys provided by this first function plotting screen are described in the table below.
### Keys Active in the Function Plotting / Plot Conditions Screen

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUSTO: (53)</td>
<td>Sets the upper and lower boundaries of the graph (YMAX and YMIN) to ensure that the curve will appear in the display, then draws the graph of the current equation. Using RUSTO: (53) is generally the easiest way to begin plotting an equation.</td>
</tr>
<tr>
<td>XFIN: (53)</td>
<td>Draws the graph of the current equation using the values of the variables described below in this table.</td>
</tr>
<tr>
<td>XMIN: (53)</td>
<td>Defines the left boundary of the graph; the minimum x-axis value or XMIN. To change this value, type the value and press XMIN: (53).</td>
</tr>
<tr>
<td>XMAX: (53)</td>
<td>Defines the right boundary of the graph; the maximum x-axis value or XMAX. To change this value, type the value and press XMAX: (53).</td>
</tr>
<tr>
<td>YMIN: (53)</td>
<td>Defines the lower boundary of the graph; the minimum y-axis value or YMIN. To change this value, type the value and press YMIN: (53).</td>
</tr>
<tr>
<td>YMAX: (53)</td>
<td>Defines the upper boundary of the graph; the maximum y-axis value or YMAX. To change this value, type the value and press YMAX: (53).</td>
</tr>
<tr>
<td>XVAR: (53)</td>
<td>Specifies the independent variable. Pressing XVAR cycles through the equation's variables, specifying each in turn as the independent variable.</td>
</tr>
<tr>
<td>RES: (53)</td>
<td>Determines the resolution, the number of XVAR values for which the function is plotted. Larger values of RES provide greater accuracy but the graph is drawn more slowly. To change this value, type the value and press RES: (53).</td>
</tr>
</tbody>
</table>

---

To reset function-plotting conditions to initial values:

When you first use function plotting, the graph boundaries and the resolution have these initial values:

- **XMIN** = -5.00
- **XMAX** = 5.00
- **YMIN** = -3.00
- **YMAX** = 3.00
- **RES** = 60.00

---

Using the Solver and Function Plotting 28-79
To return to these values:
Select **MENy** Erase Data.

**Drawing the Graph**

1. Highlight an equation (or function or expression) in the solve catalog's equation list.
2. Press **Graph** (F2) to display the first function-plotting screen.
3. Select **MENy** Erase Data to set the plot conditions to initial values, or if you know the range of interest, enter values for XMIN and XMAX (use **DARtO** (F5) and **DARtO** (F5)).
4. Press **DARtO** (F2) to draw the graph.

Another approach is to set XMIN, XMAX, YMIN, and YMAX yourself and press **DARtO** (F2).

**Interacting with the Graph**

Once the graph is drawn, you can use specially-defined keys to zoom in, zoom out, define a specific part of the graph to enlarge, find the function's roots, and perform other operations. These special keys and their actions are described in the table below.
Keys Active in the Function Plotting / Interactive Graphics Screen

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Move graph's cursor around the graph by jumps.</td>
</tr>
<tr>
<td>B</td>
<td>Move the graphic cursor around the graph by individual dots (pixels).</td>
</tr>
<tr>
<td>C</td>
<td>Zooms in by a factor of 1/2.</td>
</tr>
<tr>
<td>D</td>
<td>Zooms out by a factor of 1/2.</td>
</tr>
<tr>
<td>E</td>
<td>Centers the graph at the graphic's cursor position.</td>
</tr>
<tr>
<td>F</td>
<td>Zooms in by a factor of 1 and autoscales the y-axis.</td>
</tr>
<tr>
<td>G</td>
<td>Zooms out by a factor of 1 and autoscales the y-axis.</td>
</tr>
<tr>
<td>H</td>
<td>Centers the graph at the graphic's cursor position and autoscales the y-axis.</td>
</tr>
<tr>
<td>I</td>
<td>Sets a mark (x) that remains when the cursor is moved. This mark can be used in two ways:</td>
</tr>
</tbody>
</table>

1. The mark defines one corner of a zoom box. The cursor is moved to define the diagonally opposite corner of this box. When I is pressed, the area defined by the zoom box expands to fill the whole screen.

2. The mark defines the first of two guesses for a root. The cursor is moved to define the second guess. When Solve is pressed, the Solver uses these two guesses to start the search for a root, which is then displayed.

I   | Enlarges to fill screen the portion of the graph defined by the zoom box (by the mark (x)—see I above—and the graphic's cursor position).
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-0</td>
<td>Enlarges to full screen the x-axis portion of the graph defined by the zoom box (by the mark (x) and the graph's cursor position), then autoscales the y-axis.</td>
</tr>
</tbody>
</table>
| Trace | Solves for a root using either one or two guesses chosen as follows:  
1. One guess is provided by the XVAR value of the cursor's position when Trace is pressed.  
2. The first of two guesses is provided by the XVAR value of a mark (x) produced at the cursor's position when the Trace key is pressed. The second guess is provided by the XVAR value of the cursor's position when Trace is pressed.  
When pressed repeatedly, rotates through three graph display modes:  
- Standard mode, showing labeled axes only.  
- Coord mode, where the coordinates of the cursor position are displayed as the cursor moves throughout the interactive graphics screen.  
- Trace mode, where the cursor traces the function as you press C and A, and the value of the function is displayed for each cursor position (for each XVAR value). |
| EGF | Exits the graph and displays the function plotting / plot conditions screen. |

28-38 Using the Solver and Function Plotting
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ENTER] or [ENTER]</td>
<td>Enters the x-value of the cursor's position into the calc line. To exit the graph and view the calc line, press [ESC].</td>
</tr>
<tr>
<td>[ENTER]</td>
<td>Enters the y-value of the cursor's position into the calc line. To exit the graph and view the calc line, press [ESC].</td>
</tr>
<tr>
<td>[ENTER]</td>
<td>(Alternately, you can press [ENTER] + [ENTER].) Enters both the x-value and the y-value of the cursor's position into the history stack. To view the stack, press [GRAPH] M. Since the x-value was entered first, the x-value is in level 1 and the y-value is in the calc line.</td>
</tr>
</tbody>
</table>

Note: The Solver interprets all expressions with an equal sign as left = right, but graphics ignores the left side for equations of the form: single variable = expression. See the earlier section “Selecting the Expression to Plot.”

To zoom in (to view a smaller region of the graph in more detail):

1. Draw the graph (see the earlier “Drawing the Graph”).
2. Do one of the following:
   - Press [ZOOM] (or [GRAPH]) one or more times to zoom in. Each pressing of [ZOOM] zooms in by a factor of 2 and autoscales the y-axis. Each pressing of [ZOOM] zooms in on both axes by a factor of 5.
   - Use an x, y zoom box.
     a. Move the cursor to one corner of the area you wish to expand.
     b. Press [ZOOM].
     c. Move the cursor to the diagonally opposite corner.
     d. Press [GRAPH] to enlarge the dotted area to fill the entire screen.
   - Use an x, autoscale-y zoom box.
     a. Move the cursor horizontally to an x-value that defines one end of the x-range you want to expand.

Using the Solver and Function Plotting 28-19
b. Press \[ \text{to } \] to move the cursor horizontally to an x-value that defines the other end of the x-range you want to expand.

c. Press \[ \text{to } \] to enlarge the defined area to fill the entire screen, and then auto-scale the y-axis.

d. Press \[ \text{to } \] to zoom out (to view a larger region of the graph in less detail):

1. Draw the graph (see the earlier "Drawing the Graph").
2. Press \( \text{C} \) once or more times to zoom out. Each pressing of \( \text{C} \) zooms out by a factor of 5 and auto-scales the y-axis.
   Each pressing of \( \text{C} \) zooms out on both axes by a factor of 5.

To display the coordinates of any point on the screen:

1. Draw the graph (see the earlier "Drawing the Graph").
2. Press \[ \text{C} \] once or more times to select coordinate mode. COORD will be displayed in the upper-left corner of the screen.
3. Press \( \text{A} \) (or \( \text{B} \)), \( \text{C} \) (or \( \text{D} \)), \( \text{E} \) (or \( \text{F} \)), \( \text{G} \) (or \( \text{H} \)), or \( \text{I} \) (hold down \( \text{C} \) and press \( \text{J} \)) repeatedly) to select the point you want. Then read on the screen the coordinates of that point.

To display a function’s value for any point on the curve:

1. Draw the graph (see the earlier "Drawing the Graph").
2. Press \( \text{C} \) once or more times to select trace mode. TRACE will be displayed in the upper-left corner of the screen.
3. Press \( \text{B} \) (or \( \text{C} \)), \( \text{D} \) (or \( \text{E} \)), or \( \text{F} \) (hold down \( \text{G} \) and press \( \text{H} \) or \( \text{I} \) repeatedly) to display the x-value you want. Then read on the screen the corresponding function value.

To digitize a point’s coordinates (to display the coordinates with full accuracy):

You can separately digitize an x-coordinate or a y-coordinate, or you can digitize a point.

1. Move the cursor to the desired x-value, y-value, or point.
2. Do one of the following (see display will not change):
   - Press \( \text{D} \) (or \( \text{E} \)) to digitize the x-value.
   - Press \( \text{F} \) (or \( \text{G} \)) to digitize the y-value.
   - Press both \( \text{D} \) (or \( \text{E} \)) and \( \text{F} \) (or \( \text{G} \)), in turn, to digitize a point.

**Using the Solver and Function Plotting**
To solve for the roots of a function graphically:

1. Draw the graph (see the earlier "Drawing the Graph").
2. Do one of the following:
   - Move the cursor to an XVAR value close to a root (where the curve crosses the x-axis). This locates an initial guess for the root. Often zooming out helps to find all roots.
   - (Optional for cases where the root is not as easily found) Press \( \text{F}2 \) to mark ( \( \ast \) ) the first guess, then move the cursor to another XVAR value to define a second guess. These two guesses should be on either side of the expected location of the root.
3. Press ( \( \text{Graph} \) ) to display the value of the root. If a "questionable solution" is found (a gap, pole, etc.), the top line will display a message to that effect followed by the x and y coordinates.
4. Repeat the last two steps to solve for any additional roots.

To study the behavior of a function:

1. Enter the function you wish to study into the equation list.
2. Press ( \( \text{Graph} \) ) to display the first function plotting screen.
3. Analyze the function graphically using the procedures in this Function Plotting section and the keys active is the interactive graphics screen (described earlier table).

To find the coordinates of an extremum (maximum or minimum):

An extremum is a point on a graph where the sign of the curve's first derivative changes (where a graph shows a local maximum or minimum). This procedure shows you how to zoom in repeatedly on the screen containing the extremum until your measurements of its coordinates achieve the desired accuracy.

1. Draw the graph (see the earlier "Drawing the Graph").
2. Display the extremum on the graph if it is not already visible. Use the keys described in the earlier table "Keys active in the Function Plotting / Interactive Graphics Screen" to display the section of the graph containing the extremum. Zooming out on the graph one or...
more times (press [2] or [3]) is often a good way to start if the
extension is not visible.

3. Press [4] one or more times to select trace mode.

4. Move the cursor to the point of the extremum to display its
coordinates.

5. Define a tight x, auto-scale y zoom box around the extremum (move
the cursor just to the left of the extremum, press [4], then move
the cursor horizontally just to the right of the extremum to define the
new x-range. The smaller the x-range containing the extremum, the
greater room you’ll create. Finally, press [5] to enlarge the
defined x-range to the entire width of the screen and to auto-scale
the y-axis.

6. Move the cursor to the point of the extremum.

7. If these coordinates show the accuracy you want, you can move
the coordinates of the extremum to the calc line with x [ENTER] y
[ENTER] that is, digitize—see the earlier procedure “To digitize a
point’s coordinates (to display the coordinates with full accuracy).”
If you want more accurate coordinates, zoom in again (repeat steps
5 and 6) until they are accurate enough.

Note

If the number of places used to display the coordinates prevents you from seeing the accuracy
you want, you can usually show between 6 and 8
decimal places for each coordinate, depending on the
sign of the maximum and extremum. Select [MENU]
Options Format Scientific, then select 6, 7, or 8 and
redraw. If still more places are needed, digitize and
compare on the stack.
Writing Solver Equations

Introduction

Sometimes an equation printed in a book or written out longhand has to be adapted before it can be typed into the equation list. For example, examine the following equation for calculating the annual percent yield on a T-bill, given the purchase price. This price is in terms of full units of $10,000.

\[
\text{Percent annual yield} = \frac{100 \times (10,000 - \text{Price})}{\text{Price}} \times \frac{360 \text{ days}}{\text{Days to maturity}}
\]

This equation requires several changes before the Solver can understand it. In addition, an enhancement can be added to make the calculation easier: a Solver function can be included to calculate Days to maturity. The following section discusses how these changes are incorporated into the equation.

Rules for Writing Equations

The rules for writing equations use several terms:
- Variables are the named items for which you store or calculate values.
- Constants are numbers—for example, $10,000, 360 days.
- Operators perform arithmetic—for example, *, and –.
- Functions do calculations using mathematical capabilities built into the Solver—for example SQRT(x), CSSV(15, a), and D DAYS(41, 32, cal).
Length of Equations

An equation cannot exceed 2279 characters and cannot contain more than 256 different variables. There are no other limits as long as there is sufficient memory to store it.

Variable Names

Solver variable names can be a maximum of 15 characters long and must be all one word (no spaces allowed). The following characters are not allowed in variable names: +, -, *, /, ;, (, ), <, >, =, :, {, }, [, ], and |. Also, the character currently defined as argument separator (; in US mode and : in European mode) is not allowed in variable names. You cannot use NOT, AND, OR, or XOR as variable names, nor can you use the names of functions that have no arguments as variable names. A variable name cannot begin with a number.

For example, you could rewrite the T-bill equation as:

$$\%Yield = \frac{10,000 - Price}{\frac{Price}{360 \text{ days}} - DTM}$$

Note the shortened names using both uppercase and lowercase letters:

$$\%Yield, Price, DTM.$$  

| Note | Variable names are case sensitive. For example, the variable $\%Yield$ is not the same as another variable named $\%YIELD$. |

The first four or five characters of the variable names become function key labels. Therefore, make sure no two variables have the same first four or five characters.

Constants

Constants must be keyed in as numbers without digit separators or other characters. For example:

$$\frac{\%Yield}{100} = \frac{10000 - Price}{Price \times \frac{360}{DTM}}$$

Note the properly written numbers: 10000, 360.

19-2 Writing Solver Equations
Functions

An equation can contain any of the functions shown in the "Solver Functions" table later in this chapter. For example, rather than computing \( \frac{D\%}{M} \) yourself, you can use the Solver function DDAYS with arguments \( \text{STATE} \) (settlement date), \( MDATE \) (maturity date), and \( 3 \) (designating the 360-day calendar):

\[
\%\text{Yield} = \frac{1000 - \text{Price}}{\text{Price}} \times \frac{360}{\text{DDAYS(STATE,MDATE,3)}}
\]

Operators, Parentheses, and the Order of Calculations

When necessary, use parentheses to control the order of calculations. Without parentheses, the Solver does calculations using the same rules as those used by an algebraic calculator. These rules are:

**Functions First.** For example, when solving for \( D \) in the equation \( 500 + \text{SOLR}(2+C)=0 \), the Solver calculates \( \sqrt{(B+C)} \) and then multiplies the answer by \( A \).

**Exponentiation before Multiplication and Division.** For example, an equation typed as \( A\%^{B}=C \) is interpreted as \( A \times B^C = C \). \( B \) is raised to the \( 3rd \) power and then multiplied by \( A \). To raise \( A \) by the \( 3rd \) power, write the equation: \( (A\%^{B})=C \).

**Multiplication and division before addition and subtraction.** For example, an equation typed as \( A\times B\div C=12 \) is interpreted as:

\[
A \div \frac{B}{C} = 12
\]

To divide the sum \( A + B \) by \( C \), type the equation: \( (A+B)\div C=12 \).

The \( T \)-bill equation can be written:

\[
\%\text{Yield}/100 = \left( \frac{10000 - \text{Price}}{\text{Price}} \right) \times \frac{360}{\text{DDAYS(STATE,MDATE,3)}}
\]

A good rule is: when in doubt, use parentheses. So, if you were unsure of how the \( T \)-bill equation written above would be interpreted, you could type it as:

\[
\%\text{Yield}/100 = \left( \left( \frac{10000 - \text{Price}}{\text{Price}} \right) \times \frac{360}{\text{DDAYS(STATE,MDATE,3)}} \right)
\]

Writing Solver Equations 26-3
The extra parentheses don’t change the meaning of the equation, but they may make it easier to understand.

You cannot use parentheses for “implied” multiplication. For example, an equation printed in a book as \( P_{SF} = P_{OF}(1 - F) \) can be typed into the Solver as \( P_{SF} \times P_{OF} (1 - F) \). The \( \times \) sign must be inserted between \( P_{SF} \) and the parenthesis.

**Spaces and Line Breaks**

You can use spaces to make the equation more readable as long as there are no spaces inside variable names and function names. The following version of the T-bill equation is easier to read:

\[
\frac{\text{Yield}}{100} = \frac{10000 - \text{Price}}{\text{Price}} \times \frac{360}{\text{DDAYS} (\text{SDATE, MDATE, 3})}
\]

You can also create a line break in an equation using the tab key (\( \rightarrow \)).

### Conditional Expressions and Logical Operators

The Solver IF function, in combination with the logical operators in the table “Operators Used in Conditional Expressions” later in this chapter, allow equations to do certain decision-making operations (see the section “Conditional Expressions (IF Function)” later in this chapter. You cannot use logical operators as variable names. For example, you cannot name a variable ASD, but CANDY and LAND are acceptable variable names.

### Date Formats

The functions CDAY, DATE, and DDAYS (defined in the Solver Functions table in the next section) either return a date or use one or more dates as arguments. The format in which these dates are expressed depends on the date format set in the Setup Utility (see “Setting the Date and Time” in chapter 21). The Setup Utility date formats shown in the second and third columns give the Calculator date formats shown in the first column.
## Date Formats: Calculator vs. Setup Utility

<table>
<thead>
<tr>
<th>Calculator</th>
<th>Setup Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD.MM.YYYY</td>
<td>1(DD-MMM YY)</td>
</tr>
<tr>
<td></td>
<td>2(DD-MMM)</td>
</tr>
<tr>
<td></td>
<td>3(MMM-YY)</td>
</tr>
<tr>
<td></td>
<td>4(DD/MM/YY)</td>
</tr>
<tr>
<td></td>
<td>5(DD/MM)</td>
</tr>
<tr>
<td>MM.DD.YYYY</td>
<td>6(DD/MM/YY)</td>
</tr>
<tr>
<td>YYYY-MM-DD</td>
<td>7(YY-MM-DD)</td>
</tr>
<tr>
<td>YYYY.MM-DD</td>
<td>8(MM-DD)</td>
</tr>
</tbody>
</table>

## Solver Functions

The following table lists the Solver functions. Lower-case characters in parentheses stand for numbers, variable names, or numeric expressions that the functions use to do their calculations.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS(x)</td>
<td>Absolute value.</td>
</tr>
<tr>
<td>ACOS(x)</td>
<td>Arc cosine.1</td>
</tr>
<tr>
<td>ALOG(x)</td>
<td>Common (base 10) antilogarithm; 10^x</td>
</tr>
<tr>
<td>ANGLE(x,y)</td>
<td>Returns polar coordinate angle x given (x,y) for rectangular coordinates.1</td>
</tr>
<tr>
<td>ASIN(x)</td>
<td>Arc sine.1</td>
</tr>
<tr>
<td>ATAN(x)</td>
<td>Arc tangent.1</td>
</tr>
<tr>
<td>CELLS</td>
<td>You can specify row, col, just row, or neither. Input list is zero or more inputs to the worksheet of the form: [expr, range, row, col]. For each input, the expression is evaluated and stored in the appropriate cell in the worksheet. Then the worksheet is recalculated, and the value of the output cell is returned.2</td>
</tr>
<tr>
<td>CDATE</td>
<td>Current date.3</td>
</tr>
<tr>
<td>COMB(r,p)</td>
<td>Number of combinations of r items taken p at a time.</td>
</tr>
<tr>
<td>COS(x)</td>
<td>Cosine.1</td>
</tr>
<tr>
<td>CPOW</td>
<td>Returns the worksheet column number of the current cell pointer.2</td>
</tr>
<tr>
<td>CRTRW</td>
<td>Returns the worksheet row number of the current cell pointer.2</td>
</tr>
</tbody>
</table>

1 Uses the current angle mode—degrees, radians, or grads. To change the angle mode, select [MENU Options].
2 See the section “Solver Functions that Access 1-3-3 Worksheets” near the end of this chapter.
3 Uses the current date format, DD/MM/YYYY, MM/DD/YYYY, or YYYY/MM/DD. See the earlier section “Date Formats”.

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<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTIME</td>
<td>Current time in HH.MM.SS, 24-hour format.</td>
</tr>
<tr>
<td>DATE(date, n)</td>
<td>The date n days after (when n is positive) or before (when n is negative) the specified date.</td>
</tr>
<tr>
<td>DDAYS(dt, dl, cal)</td>
<td>The number of days between dates dt and dl. cal designates the calendar:</td>
</tr>
<tr>
<td></td>
<td>• cal=1 for the actual calendar, which recognizes leap years.</td>
</tr>
<tr>
<td></td>
<td>• cal=2 for the 365-day calendar, which ignores leap years.</td>
</tr>
<tr>
<td></td>
<td>• cal=3 for the 360-day calendar, which uses 12, 30-day months.</td>
</tr>
<tr>
<td>DEG(x)</td>
<td>Converts x in radians to decimal degrees.</td>
</tr>
<tr>
<td>EXP(x)</td>
<td>Natural antilogarithm; $e^x$.</td>
</tr>
<tr>
<td>EXPML(x)</td>
<td>$e^x - 1$.</td>
</tr>
<tr>
<td>FACT(x)</td>
<td>Factorial; x is an integer $\geq 0$.</td>
</tr>
<tr>
<td>FP(x)</td>
<td>Fractional part.</td>
</tr>
<tr>
<td>FV(n, i, yr, pv; pmt, y/p, m)</td>
<td>TVM function for FV.</td>
</tr>
</tbody>
</table>

1 See the section “The TVM Functions” later in this chapter.
2 See the section “The TVM Functions” later in this chapter.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G(x)</td>
<td>The GET function returns the contents of x.</td>
</tr>
<tr>
<td>HMS(x)</td>
<td>Converts x in decimal hours (degrees) to H.M.M.S.S (D.M.M.M.S.S) format.</td>
</tr>
<tr>
<td>HR(x)</td>
<td>Converts x in H.M.M.S.S (D.M.M.M.S.S) format to decimal format.</td>
</tr>
<tr>
<td>IDIV(x,y)</td>
<td>Integer part of the quotient x/y.</td>
</tr>
<tr>
<td>IF(cov,alg1,alg2)</td>
<td>If conditional expression cov is true, use algebraic expression alg1; otherwise, use alg2. (IF is discussed later in this chapter.)</td>
</tr>
<tr>
<td>INT(x)</td>
<td>The greatest integer less than or equal to x.</td>
</tr>
<tr>
<td>INV(x)</td>
<td>Reciprocal, 1/x.</td>
</tr>
<tr>
<td>IP(x)</td>
<td>Integer part.</td>
</tr>
<tr>
<td>ITEM(range, rev, col)</td>
<td>Returns the value of the designated worksheet cell. Identical to RCLCELL. ITEM is included for compatibility with the HP 19BII.1</td>
</tr>
<tr>
<td>MVR(n, p, p1, f, p2, yr, m)</td>
<td>TVM function for MVR.2</td>
</tr>
<tr>
<td>L(x, alg)</td>
<td>The LET function evaluates the algebraic expression alg, stores the result in x, and also returns that result as the value of the L function.</td>
</tr>
<tr>
<td>LENGTH(range)</td>
<td>Returns the number of worksheet rows in the given range. Identical to SGES.1</td>
</tr>
<tr>
<td>LN(x)</td>
<td>Natural (base e) log of x.</td>
</tr>
<tr>
<td>LNPI(x)</td>
<td>ln (1 + x).</td>
</tr>
<tr>
<td>LOG(x)</td>
<td>Common (base 10) log of x.</td>
</tr>
</tbody>
</table>

1 See the section "Solver Functions that Access 1-2-3 Worksheets" later in this chapter.
2 See the section "The TVM Functions" later in this chapter.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX(x,y)</td>
<td>Larger of x and y.</td>
</tr>
<tr>
<td>MIN(x,y)</td>
<td>Smaller of x and y.</td>
</tr>
<tr>
<td>MOD(x,y)</td>
<td>The remainder of the division x÷y; MOD(x,y) = x−y*INT(x÷y).</td>
</tr>
<tr>
<td>N( (x,y; pm) )</td>
<td>TYM function for N.(^1)</td>
</tr>
<tr>
<td>FERM(x,y)</td>
<td>Permutations of x items taken y at a time.</td>
</tr>
<tr>
<td>PI</td>
<td>π; 2.141592653589793 (16 digits).</td>
</tr>
<tr>
<td>PM(x,y;x,y; pm)</td>
<td>TYM function for PM(^x).(^1)</td>
</tr>
<tr>
<td>PV(x,y;x,y; pm)</td>
<td>TYM function for PV(^x).(^3)</td>
</tr>
<tr>
<td>RAD(x)</td>
<td>Converts x in decimal degrees to radians.</td>
</tr>
<tr>
<td>RAD(US(x,y) )</td>
<td>Returns polar coordinate radius R given (x,y) rectangular coordinates.</td>
</tr>
<tr>
<td>RAN# or RAND</td>
<td>Pseudo-random number (0≤R&lt;1).</td>
</tr>
<tr>
<td>RCLCELL</td>
<td>You can specify row and col, just row, or neither.</td>
</tr>
<tr>
<td></td>
<td>Returns the value of the designated worksheet cell. Identical to ITEM.(^2)</td>
</tr>
<tr>
<td>RND(x,y)</td>
<td>x is rounded to y decimal places (when 0≤x≤15) or to [y] significant digits (when −16≤x≤−1).</td>
</tr>
<tr>
<td></td>
<td>When y equals 16, x is rounded to the number of decimal places given by the current display setting.</td>
</tr>
<tr>
<td>S(nr)</td>
<td>nr is a variable; S(nr) is used with the IF function to create a set of function keys from more than one equation. (S is discussed later in this chapter.)</td>
</tr>
</tbody>
</table>

1 See the section "The TYM Functions" later in this chapter.
2 See the section "Solver Functions that Access 1-2-3 Worksheets" later in this chapter.

Writing Solver Equations 29-9
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGN(x)</td>
<td>Sign of x (+1 if x&gt;0, 0 if x=0, -1 if x&lt;0).</td>
</tr>
<tr>
<td>SIGMA</td>
<td>Sum values of the algebraic expression (alg) for values of the counter variable (cv). cv starts with value c1 and is incremented in steps of s, to a final value of c2. (SIGMA is discussed later in this chapter.)</td>
</tr>
<tr>
<td>SIN(x)</td>
<td>Sinc.¹</td>
</tr>
<tr>
<td>SIZE(S(range))</td>
<td>Returns the number of worksheet rows in the given range. Identical to LENGTH. SIZE(S) is included for compatibility with the HP 1971.²</td>
</tr>
<tr>
<td>SPFV(i%,n)</td>
<td>Future value of a single $1.00 payment; equivalent to $(1+i%)^n$. n is the number of compounding periods, i% is the interest rate per compounding period, expressed as a percentage.</td>
</tr>
<tr>
<td>SPYV(i%,n)</td>
<td>Present value of a single $1.00 payment; equivalent to $1/SPFV(i%,n)$. n is the number of compounding periods. i% is the interest rate per compounding period, expressed as a percentage.</td>
</tr>
<tr>
<td>SQ(x)</td>
<td>x²</td>
</tr>
<tr>
<td>SQRT(x)</td>
<td>√x</td>
</tr>
<tr>
<td>STOCELL(rw,rc,rw,rc)</td>
<td>Evaluates the expression and stores the result in the designated worksheet cell. The worksheet is not recalculated.²</td>
</tr>
<tr>
<td>TAN(x)</td>
<td>Tangent.¹</td>
</tr>
</tbody>
</table>

¹ uses the current angle mode—degrees, radians, or grads. To change the angle mode, select [MENUB] Options.
² See the section “Solver Functions that Access 1-2-3 Worksheets” later in this chapter.

29-10 Writing Solver Equations
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRN(x, p)</td>
<td>$x$ is truncated to $p$ decimal places (when $0 \leq p \leq 15$) or to $</td>
</tr>
<tr>
<td>USFV(%, n)</td>
<td>Future value of a uniform series of $1.00$ payments; equivalent to $(\text{SPFV}(% \cdot n) - % \cdot 100) / n$. $n$ is the number of payments. $%$ is the periodic interest rate, expressed as a percentage.</td>
</tr>
<tr>
<td>USPV(%, n)</td>
<td>Present value of a uniform series of $1.00$ payments; equivalent to $(\text{SPFV}(% \cdot n) \cdot n) / %$. $n$ is the number of payments. $%$ is the periodic interest rate, expressed as a percentage.</td>
</tr>
<tr>
<td>WIDTH(range)</td>
<td>Returns the number of worksheet columns in the given range.</td>
</tr>
<tr>
<td>XCOORD(R, A)</td>
<td>X-coordinate of polar coordinates. (Uses the current angle mode—degrees or radians.)</td>
</tr>
<tr>
<td>YCOORD(R, A)</td>
<td>Y-coordinate of polar coordinates. (Uses the current angle mode—degrees or radians.)</td>
</tr>
</tbody>
</table>

1 See the section “Solver Functions” that appears 1-2-3 Workshop later in this chapter.

Example: Calculating Purchasing Power After Inflation. The following equation, written as it might appear in a book, calculates the future value (FVAL) of a sum (PVAL) after any number of years (YEARS), given a constant percentage rate of inflation (INFL).

$$FVAL = \frac{PVAL}{(1 + \text{INFL} \cdot \text{YEARS})}$$
Compare the denominator of the equation with the equation for the SPFV function in the preceding table. (The SPFV function calculates the future value of a single $1 payment.) Notice that if you replace $x$ and $n$ in the SPFV equation with $INFL\%$ and $YEARS$, the two are identical. Thus, the Solver equation can be written:

$$FVAL = \frac{\text{PVAL}}{\text{SPFV}(\text{INFL}\%, \text{YEARS})}$$

Part 1. Calculate the purchasing power of $10,000 after 10 years of 7% inflation per year.

**Keys**

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>P</code></td>
<td>Starts the Calculator application.</td>
</tr>
<tr>
<td><code>COPY</code></td>
<td>(Press <code>ESC</code> one or more times if necessary.)</td>
</tr>
<tr>
<td></td>
<td>Displays the Solve Catalog.</td>
</tr>
<tr>
<td><code>D</code></td>
<td>Ensures that the highlight is in the equation field, not the name field.</td>
</tr>
</tbody>
</table>

$FVAL \div PVAL \div SPFV(INFL\%, YEARS)$

Types the equation into the Solve Editor (the Editor is automatically displayed when you start typing).

$CALT$  

Verifies the equation, enters it into the equation list, selects the Solve Calc screen, and displays the function key labels.

10000 $FVAL$  

Stores the original amount.

7 $INFL$  

Stores the inflation rate.

10 $YEARS$  

Stores the number of years.

$FVAL$  

Calculates the purchasing power in 10 years.

$$FVAL = 5,000\, 49$$

$$\text{PVAL} = 10,000\, 00$$

$$\text{INFL}\% = 7\, 00$$

$$\text{YEARS} = 10\, 00$$

Part 2. What would the inflation rate have to be for the purchasing power to be reduced by only $2000 over the 10-year period?

29-12 Writing Solver Equations
### Conditional Expressions (IF Function)

Equations can include conditional expressions using the IF function. For example, the Solver accepts the equation:

\[ \text{BONUS} = \text{IF} \left( \text{SALES} > 3000, 0.01 \times \text{SALES}, 0.01 \times \text{SALES} \right) \]

The two commas inside the parentheses stand for "THEN" and "OR ELSE." According to this equation, if \( \text{SALES} \) is greater than 3000, then \( \text{BONUS} \) equals \( 0.01 \times \text{SALES} \); otherwise, \( BONUS = 0.01 \times \text{SALES} \)

In general, the form of the IF function is:

\[ \text{IF}(\text{conditional expression}, \text{algebraic expression}_1, \text{algebraic expression}_2) \]

A conditional expression can also be an algebraic expression. If the algebraic expression evaluates to zero, it is interpreted as false. Otherwise, true. For example, if \( A \) equals 1 in the algebraic expression \( A + 1 \), the expression is false. If \( A \) equals any other number, the expression is true.

The logical and relational operators that can be used in conditional expressions are described in the table below.
Operators Used in Conditional Expressions

<table>
<thead>
<tr>
<th>Logical Operators</th>
<th>Relational Operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT</td>
<td>&gt; Greater than</td>
</tr>
<tr>
<td>AND</td>
<td>&lt; Less than</td>
</tr>
<tr>
<td>OR</td>
<td>= Equal to</td>
</tr>
<tr>
<td>XOR</td>
<td>&gt;= Greater than or equal to</td>
</tr>
<tr>
<td></td>
<td>&lt;= Less than or equal to</td>
</tr>
<tr>
<td></td>
<td>&lt;&gt; Not equal to</td>
</tr>
</tbody>
</table>

Order of Logical Operations

Logical operations are done after arithmetic operations (addition, subtraction, etc.). For example, the expression

\( A + 1 \text{ OR } B = 5 \)

is true if \( A < 1 \) and/or \( B = 5 \). The expression is false only if \( A = -1 \) and \( B > 5 \).

When there are two or more logical operators, they are done in the order NOT first, then AND, and finally OR or XOR. Thus, the expression

\( A = 360 \text{ AND } B = 12 \text{ OR } A = 365 \)

is true if \( A \) equals 360 and \( B \) equals 12, or if \( A \) equals 365.

Example: An Equation With a Conditional Expression. Use the BONUS Solver equation to calculate the bonuses for a salesperson who generated $5000.00 in sales last month.

\[ 	ext{BONUS} = 30 \times \text{SALES} > 2000 \times 0.02 \times \text{SALES} + 0.05 \times \text{SALES} \]

Enter the equation (press \( \text{calc} \), if necessary, to display the solve catalog screen), then press \( \text{calc} \) \( \Rightarrow \) \( \text{F2} \).

Note that the symbol following \( \text{SALES} \) is the “greater than” symbol \( > \).

29-14 Writing Solver Equations
Here are several additional examples of equations using conditional expressions:

Equation: \( 8 = IF(1; (9 + 10); 15); 2 + 5; 6; 2 + 0 + 10) + C \)

Meaning: If \( A \) is greater than 7 and less than or equal to 15, then
\( 8 = (2xA + 0) + C \). Otherwise, \( 8 = (3xA + 10) + C \).

Equation: \( VALUE = FIRST + IF(\text{NOT FIRST} = 0, 1; FIRST, 0) \)

Meaning: If \( FIRST \) is unequal to 0, then \( VALUE = FIRST + (1 \cdot FIRST) \). If \( FIRST = 0 \), then \( VALUE = FIRST \).

Equation: \( T = IF(A = 0, 0; 0 + 0, 0 + 0, 0) \)

Meaning: \( T = W \cdot x \cdot A \cdot B \). In other words,
when \( A = 0 \) and \( B \neq 0 \), \( T = W \cdot x \cdot B \)
when \( A \neq 0 \) and \( B = 0 \), \( T = W \cdot x \cdot A \)
when \( A = 0 \) and \( B = 0 \), \( T = 0 \)
when \( A \neq 0 \) and \( B \neq 0 \), \( T = W \cdot x \cdot A \cdot B \)

Example: Using One IF Function Inside Another. An IF function can be used as the argument of another IF function. For example, suppose a corporation uses a rating system to determine salary. Employees are rated on a scale 1 through 5, and are given the following annual percent hike based on their rating:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Percent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>3</td>
<td>10%</td>
</tr>
</tbody>
</table>

Writing Solver Equations 29:15
The following equation calculates a new salary based on the previous salary and rating:

\[ \text{NSAL} = \text{OSAL} \times (1 + \text{IF} (\text{R} = 1, 0.03, \text{IF} (\text{R} \geq 2, 0.06, 1))) \]

where

- \( \text{NSAL} \) = the new salary.
- \( \text{OSAL} \) = the previous salary.
- \( \text{R} \) = the rating, 1, 2, or 3.

If \( R = 1 \), the equation uses 0.03.
If \( R = 2 \), the equation uses 0.06.
If \( R \neq 1 \) or 2, the equation uses 1.

Calculate the new annual salary for an employee with rating 2 who currently earns $27,500 annually.

Enter the equation (press [SOLVE] if necessary, to display the solve catalog screen) then press [SOLVE].

Keys:  
27900 \( \text{OSAL} \)  
2 \( \text{R} \)  
⇒ \( \text{NSAL} \)  

Calculates the new salary.

\[ \text{NSAL} = 27,900 \times (1 + \text{IF} (2 = 1, 0.03, \text{IF} (2 \geq 2, 0.06, 1))) = 28,150.00 \]

\[ \text{R} = 2,000 \]

Creating Function Keys for Multiple Equations (S Function)

The \$ (Solve for) function is used with the IF function to group equations and to specify the conditions under which one or the other is used. For example, consider these two equations for calculating gross pay:

29.16 Writing Solver Equations
Wage pay based on an hourly wage: Salary pay based on a fixed salary plus a 5% sales commission:

\[ WPAY = \text{WAGE} \times HRS \]
\[ SLPAY = \text{SALARY} + 0.05 \times \text{REVENUE} \]

where:
where:

\[ WPAY = \text{gross wage pay} \]
\[ SLPAY = \text{gross salary pay} \]
\[ \text{WAGE} = \text{hourly wage} \]
\[ \text{SALARY} = \text{the fixed salary} \]
\[ \text{HRS} = \text{hours worked} \]
\[ \text{REVENUE} = \text{sales} \]

To use the S function, the equations must first be rearranged to place 0 on one side of each equation:

\[ WPAY = \text{WAGE} \times HRS - 0 \]
\[ SLPAY = \text{SALARY} + 0.05 \times \text{REVENUE} - 0 \]

To create one set of function keys that can be used for either equation:

\[ \text{IF} \left( \text{V1} < \text{V2} \right) \]
\[ \text{V1} = \text{WAGE} \times \text{HRS}, \ 	ext{V2} = \text{SALARY} + 0.05 \times \text{REVENUE} \]

\[ \text{IF} \left( \text{V1} < \text{V2} \right) \text{ prints:} \]
\[ \text{WPAY = WAGE \times HRS, SLPAY = SALARY + 0.05 \times REVENUE} \]

If the answer is "yes" (true), the expression \( WPAY = \text{WAGE} \times \text{HRS} \) is used.
If the answer is "no" (false), the expression \( SLPAY = \text{SALARY} + 0.05 \times \text{REVENUE} \) is used.
The \( =0 \) ending to this equation is optional. If it's omitted, \( =0 \) is implied.

The \( S \) function appears within the IF function in the conditional expression. In this case, the conditional expression is true if you solve for WPAY, and false if you solve for anything else. The algebraic expressions in the IF function are the two equations, rewritten to gather all the terms on one side of the equation, so that each expression is equal to 0.

The IF function can be set equal to an expression common to both equations. For example, the equations \( A + B < C \) and \( 0 < (A - B) - T \) can be combined to \( \text{IF} (A > B) \text{ OR } S < Y \text{ OR } S < Z, A + B - C < -10 / R, A + B < C \text{, otherwise} \). Note that the Solver uses the second equation when solving for \( Q, R, T, \text{ or } A \).

Writing Solver Equations 29-17
Example: Using the \( S \) function. Part 1. Enter the combined equation discussed earlier: \( IF(SUM(RS)+\text{IFRS+SLR}+SLE)\geq 8 \) and then press \( \text{Calc} \). The HP \( 75 \) displays:

![Calculator Display]

Calculate the weekly pay for an employee working 35 hours for $6.75 per hour.

**Keys:**

- [6.75] \( \text{IFRS} \)
- [35] \( \text{SLR} \)
- [8] \( \text{Calc} \)

**Description:**

- \( \text{IFRS} \): Stores wages and hours.
- \( \text{Calc} \): Calculates wage pay.

\[
\begin{align*}
\text{IFRS} &= 226.25 \\
\text{WAGE} &= 6.75 \\
\text{SLRE} &= 85.00
\end{align*}
\]

Part 2. Calculate the monthly pay for an employee with a base salary of $1,800 who generated $5,000 in sales.

29 18 Writing Solver Equations
The TVM Functions

The five solve TVM functions allow you to write equations that do calculations analogous to the calculations done in the TVM Calculator application:

\[
N(\ i\%yr, \ pv, \ pmt, \ fr, \ p/yr, \ m ) \\
F \%YR(\ n, \ pv, \ pmt, \ fr, \ p/yr, \ m ) \\
P \%V(\ n, \ i\%yr, \ pmt, \ fr, \ p/yr, \ n ) \\
PMT(\ n, \ i\%yr, \ pv, \ fr, \ p/yr, \ m ) \\
FV(\ n, \ i\%yr, \ pmt, \ p/yr, \ n )
\]

Each function calculates one TVM value, given the values for all the others. The parameters of the functions (the contents of the parentheses) are defined identically (with one exception) to the Calculator application's TVM variables described in the table "The TVM Function Keys" near the front of chapter 25. The exception is that \( m \) stands for the Begin/End mode (\( B/E \)), described in the table in chapter 25. \( B/E = 1 \) for Begin mode, \( B/E = 0 \) for End mode.

For example, the first function calculates \( N \) (the total number of payments or compounding periods), given the annual percentage interest rate, present value, payment amount, future value, number of payments per year, and the Begin/End mode.

You can give the parameters any legal variable name; for example, you can use \( LCAN \) in place of \( pv \). Parameters can also be algebraic.
expressions. For example, the following equation calculates the monthly payment for a car loan.

\[ \text{PMT} = \text{PRICE} \times \text{MONTHS} \times \text{RATES} \times 12 \times 0.12 \]

\( \text{MONTHS} \) is the number of monthly periods (a).
\( \text{PRICE} \) is the purchase price.
\( \text{RATES} \) is the rate per period.
\( 12 \) is the number of payments/year (p/yr).

The final 0 specifies End mode.

Notice that PMT is not a variable in the equation—it is the name of the function.

The Solver TVM variables are not shared with the variables in the Calculator's TVM application. For example, the variable \( \text{RATES} \) in the \( \text{FUNCTION} \) equation is separate from the TVM variable \( \text{RATES} \).

Example. Homeowner's Monthly Payment Estimator. Monthly house payments often include payments for taxes and insurance. The following Solver equation calculates the payment, assuming that the assessed value of the house equals its purchase price.

\[ \text{PAYMT} = \text{PRICE} \times 0.12 \times 0.12 \times 0.12 \]

where
\( \text{PAYMT} \) = monthly house payment.
\( N \) = total number of payments to repay the mortgage.
\( \text{RATES} \) = annual interest rate.
\( \text{PRICE} \) = purchase price of the house.
\( \text{DOWN} \) = down payment.
\( \text{TAX} \) = tax rate per $1,000 assessed value.
\( \text{INSUR} \) = cost of insurance per year.

The minus signs before \( \text{TAX} \) and \( \text{INSUR} \) are necessary in order for the taxes and insurance to increase the payment amount (\( \text{PAYMT} \)), since the value calculated by the PMT function is a negative number (see "Making Cash Flow Diagrams" near the front of chapter 25).

For example, suppose you put 10% down on a $85,000 house, and take out a 30% 35-year loan. If the tax rate is $25 per thousand, and insurance is $600 per year, what are your monthly payments?

19-20 Writing Solver Equations
Enter the equation and press [SOLVE]: 

**Example: Using the Solver to Calculate APR of a Loan With Fees.**

The following equation uses a TVM Solver function to calculate the APR (annual percentage rate) of a loan with fees. (Using the TVM Calculator application to calculate APR is covered in the section “Loans with Fees” near the end of chapter 23).

\[ \text{APR = 12 
Y 
R 
C 
H 
L O A N 
- 
F E E S} \]

\[ \text{PMT}(N, I/YR, LOAN, 0, 12, 0, 0, 12, 0) \]

where

- \( N \) = the total number of payments for the loan.
- \( LOAN \) = the loan amount.
- \( FEES \) = the sum of all the fees for the loan.
- \( I/YR \) = the annual interest rate.

Notice that \( I/YR \) appears twice in the equation—once the TVM function, and as a variable. The two occurrences are independent of one another.
Use the APR Solver equation to calculate APR for a $60,000, 30-year mortgage. The annual interest rate is 11.76%, and the borrower is charged two points (9% of the mortgage amount) in fees.

Enter the equation and press **Calc**.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Stores number of payments.</td>
</tr>
<tr>
<td>06000</td>
<td>Stores mortgage amount.</td>
</tr>
<tr>
<td>2</td>
<td>Calculates and stores the fee.</td>
</tr>
<tr>
<td>11.76</td>
<td>Stores the annual interest rate.</td>
</tr>
<tr>
<td>APR</td>
<td>Calculates APR.</td>
</tr>
</tbody>
</table>

\[ APR = 11.76 \]
\[ N = 360, 09 \]
\[ LOAN = 60, 000.00 \]
\[ FEES = 1, 200.00 \]
\[ I\% = 11.76 \]

**The Summing Function (SIGMA)**

The SIGMA function provides the ability to do a variety of summing operations. The function has the form:

\[ SIGMA(counter\ variable, starting\ value, ending\ value, step\ size, algebraic\ expression) \]

The **counter variable** takes on a series of values, beginning with the **starting value** and incrementing according to the **step size**, until it reaches the **ending value**. For each value of the counter, the **algebraic expression** is evaluated, and the value is added to the previous value. The function returns the final sumation. The **counter variable** is not represented by a function key.

The following equation contains a counter I and two other variables, \( x \) and \( THERM \):\n
\[ THERM = SIGMA(1, 1, 6, 1, I^4) \]

29-22 **Writing Solver Equations**
The counter \( I \) runs from 1 through 6 in steps of 1—that is, 1, 2, 3, 4, 5, 6. For each value \( I \), \( I \times X \) is calculated and added to the sum. If you store 3 in \( X \) and then solve for THESUM, the Solver calculates \( \text{THESUM} = 63 \); that is, \( 3 + 6 + 9 + 12 + 15 + 18 \).

Creating Solver Files on a PC or Another Editor

An equation list may be created using an editor outside of the Solve application. Each name/equation line entry is bounded by curly brackets. The vertical line (press \( \| \)) that is, \( \| \) \( \| \) is used to separate the name from the equation. If the line entry consists of a name only, the vertical line follows the name. If the line entry consists of an equation only, no vertical line is used.

Consider the following to be the contents of a word processor or editor file. This file defines four lines of an equation list.

\[
\begin{align*}
\text{(Graph} & \#1) \Rightarrow ^3-5x+\text{e}^{x-10x^2} \& \text{(Note Price)} \Rightarrow \\
(y=\sin(x)) & \Rightarrow \text{(Graph} \#1) \Rightarrow ^4-60x+\text{e}^{x-1770x^2-x-1} \leq 56 \\
\end{align*}
\]

(The spaces are inserted for clarity only.) When this file is retrieved or inserted into the equation list (see “Saving and Retrieving Equations” in chapter 28), the four added lines will look like this:

\begin{align*}
\text{Graph} \#1 \Rightarrow x-x^3-5x+\text{e}^{x-10x^2}+z \\
\text{Note Price} \Rightarrow y=\sin(x) \\
\text{Graph} \#2 \Rightarrow x-x^4-60x+\text{e}^{x-1770x^2-x-1} \leq 56 \\
\end{align*}
Solver Functions that Access 1-2-3 Worksheets

The seven solver 1-2-3 functions allow communication between the Solver and 1-2-3 worksheets, giving the Solver new powers. The worksheet must be the current worksheet (the one displayed when HELP is pressed) and the worksheet must be in ready mode (F5F5 must be displayed in the upper-right corner of the worksheet screen).

The example following the explanations illustrates the use of CALCOE Li.

The parameters used by these functions are:

'expr' = a value, variable name, or mathematical expression whose calculated value is acted upon by the function.

'range' = a 1-2-3 range name or cell address (like B7).

'row', 'col' = the offsets (relative cell addresses) from the upper left corner of the given range. Non-integer values for row and col are rounded to the nearest integer and negative values are allowed.

Some examples:
(B3, 1, 1) refers to cell B3
(B3, 0, 0) refers to cell A2
(B3, -1, 0) refers to cell A1
(G3, 2, 3) refers to cell B4

An error is reported if the resulting cell reference is not within the bounds of the worksheet. If col is not specified, column 1 is assumed. If neither row nor col are specified, they are both assumed to be 1.

Press HELP Solve Edit Other to see the typing-aid function keys for these functions. The names and key numbers for the typing aids are shown by each solver 1-2-3 function below.

STOCCELL (expr, range, row, col) $STOCCELL: (29)

You can specify row, col, just row, or neither. Evaluates the expression and stores the result in the designated worksheet cell. The worksheet is not recalculated.
RCLCELL(range, row, col) \rightarrow RCLCELL

You can specify row and col, just row, or neither. Returns the value of the designated worksheet cell. Identical to ITEM, which is included for compatibility with the HP Business Consultant II (the HP 10BII Financial Calculator). (The Business Consultant II uses its SUM list rather than a 1-2-3 worksheet.)

CALCCELL(input list, output range, row, col) \rightarrow CALCCELL

You can specify row, col, just row, or neither. input list is zero or more inputs to the worksheet of the form: [step, range, row, col]. For each input, the expression is evaluated and stored in the appropriate cell in the worksheet. Then the worksheet is recalculated, and the value of the output cell is returned.

LENGTH(range) \rightarrow LENGTH

Returns the number of worksheet rows in the given range. Identical to SIZES, which is included for compatibility with the HP Business Consultant II.

WIDTH(range) \rightarrow WIDTH

Returns the number of worksheet columns in the given range.

CPROW \rightarrow CPROW

Returns the worksheet row number of the current cell pointer.

CPCOL \rightarrow CPCOL

Returns the worksheet column number of the current cell pointer.

Example. Depreciation. CALCCELL can be used to tap the power of 1-2-3 in a Solver equation. For example, suppose you want to compute depreciation (sum of years digits) in Solver. You can use CALCCELL to access the @SYD function in 1-2-3.

1. Create the 1-2-3 worksheet shown in the figure below. The ERR message in cell B6 when you enter the @SYD function in that cell is normal in this case. The @SYD function is not valid when all its variables equal zero.

Writing Solver Equations 29-25
2. Display the Solver equation list and enter this equation:

CALCCELL([COST,$B1$], [SALVAGE,$B2$], [LIFE,$B3$], [PERIOD,$B4$], $B6$) = SOYD

This use of CALCCELL is explained at the end of this example.

3. Press [Calc] and enter:

1000 into COST ($B2$)
2000 into SALVAGE ($B3$)
5 into LIFE ($B4$)
2 into PERIOD ($B5$)

4. Press [SOYD] to get the solution.

SOYD = 2133.33

You now have a depreciation application in Solver. As with any Solver equation, you can solve for any of the variables, not just SOYD. Look at the worksheet and see that whatever results are computed in Solver also appear in 1-3-3.

Here is an explanation of this example's use of CALCCELL; that is, what are the meanings of the various elements of CALCCELL([COST,$B1$], [SALVAGE,$B2$], [LIFE,$B3$], [PERIOD,$B4$], $B6$)?

As stated above, the elements of CALCCELL are (input list, output range, row, col).

The input list is [COST,$B1$], [SALVAGE,$B2$], [LIFE,$B3$], [PERIOD,$B4$].

25-26 Writing Solver Equations
The output range is B6. The output range can be either a range name or a cell address, like B6.

The row, or entry, is not needed, since there is no offset from the cell address. If neither row nor col are specified, both are assumed to be 1 (no offset).

To explain further the inputs to the worksheet that make up the input list, consider one of those inputs, [COST:B1]. The elements of one input are {expr, range, row, col}. In this case, the expression is a variable name, COST. The range is a cell address, B1. Since no row nor column is specified, the offsets for both are 1; that is, there are no offsets. Cell B1 will contain the value for COST.
### Solver Examples

#### Introduction

This table lists the example equations in this chapter and the functions they use.

<table>
<thead>
<tr>
<th>Example</th>
<th>Solver Functions Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Annual Interest</td>
<td>DDDAYS, IF</td>
</tr>
<tr>
<td>Loan With an Odd (Partial) First Period</td>
<td>PV, FP, IF</td>
</tr>
<tr>
<td>Canadian Mortgages</td>
<td>PV</td>
</tr>
<tr>
<td>Advance Payments (Leasing)</td>
<td>USPV, SPPV</td>
</tr>
<tr>
<td>Price of an Insurance Policy</td>
<td></td>
</tr>
<tr>
<td>Discounted Notes</td>
<td>DDDAYS</td>
</tr>
<tr>
<td>Moving Average</td>
<td>SIGMA, RCLC3, MAX, MIN</td>
</tr>
<tr>
<td>Chi-Squared (1^2) Statistics</td>
<td>SIGMA, RCLC3, LENGTH</td>
</tr>
<tr>
<td>Economic Ordering Quantity</td>
<td>SQRT</td>
</tr>
<tr>
<td>Simulating a Toss of Dice</td>
<td>IP, RAN#</td>
</tr>
<tr>
<td>Distance Between Two Locations</td>
<td>ACOS, SIN, IR, COS</td>
</tr>
</tbody>
</table>
Simple Annual Interest

The following equation calculates the amount due for a loan with simple annual interest, given the duration of the loan. Both the principal and interest are paid in a lump sum at the end of the loan period. This \( \text{LOAN.DAYS} \) equation assumes a 360-day calendar basis.

\[
\text{DEBT} = \text{LOAN} + \text{LOAN} \times \frac{\%}{100} \times \text{DAYS} / 365
\]

where:
- \( \text{DEBT} \) = the total owed at the end of the loan period.
- \( \text{LOAN} \) = the original amount (principal) lent.
- \( \% \) = the annual interest rate as a percent.
- \( \text{DAYS} \) = the number of days of the loan.

If you know the dates for the course of the loan, rather than the number of days, use this \( \text{LOAN.DATE5} \) equation:

\[
\text{DEBT} = \text{LOAN} + \text{LOAN} \times \frac{\%}{100} \times \text{DAYS} \times \text{DATE1;DATE2;IF;GASIS=365,1,3>}/365
\]

where:
- \( \text{DATE1} \) = the date the loan commences.
- \( \text{DATE2} \) = the date the loan ends.
- \( \text{BASIS} = 360 \) for a 360-day basis.
- \( \text{BASIS} = 365 \) for a 365-day basis.

Example: Simple Interest for a Specified Number of Days. You lend a friend $450 for 60 days, charging 7% simple annual interest (calculated on a 365-day basis). What is the total amount she will owe you in 60 days?
Starting from the solve calc screen for the LOAN,DAYS equation:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>LOAN:</td>
</tr>
<tr>
<td>7</td>
<td>INTER:</td>
</tr>
<tr>
<td>60</td>
<td>DAYS:</td>
</tr>
<tr>
<td>DEBT</td>
<td></td>
</tr>
</tbody>
</table>

Stores loan amount.
Stores interest rate.
Stores term of loan.
Calculates amount due in 60 days.

\[
\text{DEBT} = 450,10 \\
\text{LOAN} = 450,00 \\
1\% = 7.50 \\
\text{DAYS} = 60,00
\]

Example: Simple Interest From the Date of the Loan. On March 26, 1992, you borrow $1,200 from a relative. You promise to repay the loan, with 8% simple interest (to be calculated on a 365-day basis) on June 11, 1993. How much will you owe?

Starting from the solve calc screen for the LOAN,DATES equation:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>LOAN:</td>
</tr>
<tr>
<td>8</td>
<td>INTER:</td>
</tr>
<tr>
<td>3.261992</td>
<td>DATE1</td>
</tr>
<tr>
<td>6.121993</td>
<td>DATE2</td>
</tr>
<tr>
<td>365</td>
<td>BASIS:</td>
</tr>
<tr>
<td>DEBT</td>
<td></td>
</tr>
</tbody>
</table>

Stores loan amount.
Stores interest rate.
Stores date of loan.
Stores repayment date.
Stores calendar basis.
Calculates amount to be repaid.

\[
\text{DEBT} = 1,916.52 \\
\text{LOAN} = 1,200.00 \\
1\% = 8.00 \\
\text{DATE1} = 3.26 \\
\text{DATE2} = 6.12 \\
\text{BASIS} = 365.00
\]

Solver examples 30-3
Loans With an Odd (Partial) First Period

The Calculator's TVM application requires all payment periods to be the same length. However, situations exist where the first payment period does not equal the remaining periods. That period (from the date that interest begins accruing to the date of the first payment) is sometimes called an odd or partial first period.

The following Solver equation named ODDPER does calculations involving an odd first period, using simple interest for the odd period. The equation is valid for 0 to 59 days from inception to first payment, and assumes a 30-day month.

You do not need to specify Begin or End mode. If the odd period is less than 30 days, Begin mode is assumed. If the odd period is between 30 and 59 days, inclusive, End mode is assumed.

\[
\text{ODDPER} = \frac{\text{PV} \times (1 + \text{INT}_\text{R} \times \text{DAYS}/360) + \text{DAYS} \times \text{INT}_\text{R}}{\text{N} \times \text{INT}_\text{R}}
\]

where

- \(\text{INT}_\text{R}\) = the nominal annual interest rate, as a percentage.
- \(\text{DAYS}\) = the number of payment periods per year.
- \(\text{PV}\) = the loan amount.
- \(\text{N}\) = the total number of payment periods.
- \(\text{INT}_\text{R}\) = the periodic payment.
- \(\text{FV}\) = the balloon payment.

Example: Loan With an Odd First Period. A 36-month loan for $4,000 has an annual interest rate of 15%. If the first payment is made in 46 days, what is the monthly payment amount?

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>(\text{INT}_\text{R})</td>
</tr>
<tr>
<td>12</td>
<td>(\text{N})</td>
</tr>
<tr>
<td>6</td>
<td>(\text{DAYS})</td>
</tr>
<tr>
<td>4000</td>
<td>(\text{PV})</td>
</tr>
</tbody>
</table>

30-4 Solver Examples
Stores 26 payment periods.

Stores no balloon payment (no final value).

Calculates monthly payment amount.

\[
\begin{align*}
\text{I/YR} &= 15.00 \\
\text{P.YR} &= 12.00 \\
\text{DAYS} &= 46.00 \\
\text{PV} &= 4,500.00 \\
N &= 36.00 \\
\text{PMT} &= -157.05 \\
\text{FV} &= 0.00
\end{align*}
\]

**Example:** Loan With an Odd First Period Plus Balloon. A $10,000 loan has 24 monthly payments of $400, plus a balloon payment of $1,000 at the end of the 24th month. If the payments begin in 8 days, what annual interest rate is being charged?

Starting from the solve calc screen for the same ODDFRM equation:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>P.YR: Stores number of payments per year.</td>
</tr>
<tr>
<td>8</td>
<td>DAYS: Stores days until first payment.</td>
</tr>
<tr>
<td>10000</td>
<td>PV: Stores loan amount.</td>
</tr>
<tr>
<td>24</td>
<td>N: Stores 24 payment periods.</td>
</tr>
<tr>
<td>400</td>
<td>PMT: Stores periodic payment.</td>
</tr>
<tr>
<td>0</td>
<td>FV: Stores balloon payment.</td>
</tr>
<tr>
<td>15,67</td>
<td>I/YR: Iterative solution for annual interest rate.</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{I/YR} &= 15.67 \\
\text{P.YR} &= 12.00 \\
\text{DAYS} &= 0.00 \\
\text{PV} &= 10,000.00 \\
N &= 24.00 \\
\text{PMT} &= -400.00 \\
\text{FV} &= -1,000.00
\end{align*}
\]
Canadian Mortgages

In Canadian mortgages, interest is compounded semi-annually while payments are made monthly. The following Solver equation named CAN can be used to calculate Canadian mortgage.

Canadian mortgages can also be calculated using the Calculator's TVM application. See the section "Compounding Periods Different from Payment Periods" in chapter 25 for an example.

\[ FV(N, ((1+CI\%YR/200)^{(1/6)} - 1) \times s1200),PV,PMT,12,0) = FV \]

where
- \( N \) = total number of payment periods for the life of the loan.
- \( CI\%YR \) = annual (Canadian) interest rate as a percent.
- \( PV \) = the loan amount, or present value.
- \( PMT \) = periodic payment amount.
- \( FV \) = remaining balance, or future value.

Example: Calculating the Payment for a Canadian Mortgage. What is the monthly payment required to fully amortise a 30-year, $50,000 Canadian mortgage if the interest rate is 9%?

Starting from the solve calc screen for the example's equation:

**Keys:**
- 30 :12 = N
- 9 :CI\%YR
- 50000 = PV
- 0 = FV
- \( \#PMT \) = Calculates the payment.

<table>
<thead>
<tr>
<th>Description</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N )</td>
<td>360.00</td>
</tr>
<tr>
<td>( CI%YR )</td>
<td>9.00</td>
</tr>
<tr>
<td>( PV )</td>
<td>50,000.00</td>
</tr>
<tr>
<td>( PMT )</td>
<td>$366.42</td>
</tr>
<tr>
<td>( FV )</td>
<td>0.00</td>
</tr>
</tbody>
</table>

30-4 Solver Examples
Example: Calculating the Interest Rate for a Canadian Mortgage. A Canadian mortgage has monthly payments of $612.77 with a maturity of 25 years. The principal amount is $75,500. What is the annual interest rate?

Keys: Description:

612.77 [D] [PMT]  Stores known value.
75500 [PV]  Calculates annual interest rate.
25 [O] [12] [N]  Stores known value.
0 [FV]  \( \bar{N} \) = 300.00
\( \frac{\text{C/YR}}{\text{C/YR}} \) = 8.75
\( FV \) = 75,500.00
\( PMT \) = -612.77
\( PV \) = 0.09

Advance Payments (Leasing)

Occasionally payments are made in advance, such as in leasing. Leasing agreements sometimes call for the extra payments to be made when the transaction is closed. A residual value (salvage value) can also exist at the end of the normal term.

The following equation named ADV calculates the monthly payment and the annual yield when one or more payments are made in advance. It can be modified to accommodate periods other than monthly by changing the number 12 to the appropriate number of payments per year.

\[
PMT = \frac{(PV + (FV \times (PMT/(1+R/12))^N))}{(1+R/12)^{N-1}}
\]

Solve Examples 40.7
where

\[ \text{PMT} = \text{the monthly payment amount.} \]
\[ \text{PV} = \text{the value of the equipment.} \]
\[ \text{FV} = \text{the residual value.} \]
\[ i \text{\{\%YR\}} = \text{the annual interest rate as a percent.} \]
\[ N = \text{the total number of payments.} \]
\[ \#ADV = \text{the number of advance payments.} \]

Example: Leasing With Advance Payments. Equipment worth $750 is leased to you for 12 months. The equipment is assumed to have no salvage value at the end of the lease. You agree to make three payments at the time of closing. What is the monthly payment if the annual interest rate is 15%?

Starting from the solve view screen for this example’s equation:

Keys: Description:

750 \[ \text{\{\{\text{PMT}\}\}} \quad \text{Stores known values.} \]
12 \[ \text{\{\{\text{N}\}\}} \quad \text{Calculates monthly payment.} \]
0 \[ \text{\{\{\text{FV}\}\}} \]
3 \[ \text{\{\{\text{i\{\%YR\}}\}\}} \]
10 \[ \text{\{\{\text{ADV}\}\}} \]

\[ \text{PM1} = -64.45 \]
\[ \text{PV} = 750.00 \]
\[ \text{FV} = 0.00 \]
\[ i \text{\{\%YR\}} = 10.00 \]
\[ N = 12.00 \]
\[ \#ADV = 3.00 \]
Price of an Insurance Policy

The price of an insurance policy, other than term life insurance, is rarely apparent at first glance. The price should include not only the premium payments, but also the interest that could have been earned on the cash value or savings portion of the policy.

The following equation, named POLICY, calculates the price per $1,000 of protection for one policy year and the interest rate earned on the savings portion of the policy.


\[
INS = \left( \frac{\text{PREM} + \text{VAL}}{1 + \text{R}%} \right) \times \text{VAL} - \text{DIV} \times .001 \times (\text{FACE} - \text{VAL})
\]

where

- \( INS \) = the price per $1,000 of protection in one policy year.
- \( \text{PREM} \) = the annual premium amount.
- \( \text{VAL} \) = the value of the policy at the end of last year.
- \( \text{R}% \) = the rate of return, as a percent.
- \( \text{DIV} \) = the dollar value of the dividend for one year.
- \( \text{FACE} \) = the face value of the policy for one year.

To calculate the price, assume some value for interest—for example, the interest rate you could earn on a one-year savings certificate after tax. Similarly, to calculate interest, assume a price per $1,000 of protection per year for alternative insurance, for example, a low-cost term policy of the one-year renewable type.

Even complex policies like minimum-deposit plans can be analyzed with this procedure. Use policy surrender values for cash values and the actual (after-tax) amounts for payments (premiums) and dividends.

Example: Price of an Insurance Policy. Part 1. You are evaluating your $50,000 insurance policy. The premium of $1,010 is due at the beginning of the year, and a dividend of $65 is received at the end of the policy year. The cash value of the policy is $3,303 at the beginning of the year, and it will grow to $4,104 by the end of the year. You can earn 6% on a savings account. What is the price per $1,000 protection per year?
Starting from the solve-calc screen for the POLICY equation:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1010 PREM</td>
<td>Stores annual premium.</td>
</tr>
<tr>
<td>3302 LVVAL</td>
<td>Stores value of policy at end of last year.</td>
</tr>
<tr>
<td>6 INS</td>
<td>Stores interest rate you could get elsewhere.</td>
</tr>
<tr>
<td>4104 VAL</td>
<td>Stores value of policy at end of this year.</td>
</tr>
<tr>
<td>165 DIV</td>
<td>Stores annual dividend.</td>
</tr>
<tr>
<td>50000 FACE</td>
<td>Stores face value of policy.</td>
</tr>
<tr>
<td>INS</td>
<td>Your protection cost. $6.57 per $1,000 face (protection) value.</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{INS} & = 6.57 \\
\text{PREM} & = 1,010.00 \\
\text{LVVAL} & = 3,382.00 \\
\text{INS} & = 6.00 \\
\text{VAL} & = 4,104.00 \\
\text{DIV} & = 165.00 \\
\text{FACE} & = 50,000.00
\end{align*}
\]

Part 2: Insurance protection could be purchased for $3 per $1,000 face value. Calculate the rate of return on your savings, using the same equation:

\[
\begin{align*}
\text{INS} & = 3.00 \\
\text{PREM} & = 1,010.00 \\
\text{LVVAL} & = 3,382.00 \\
\% & = 2.20 \\
\text{VAL} & = 4,104.00 \\
\text{DIV} & = 165.00 \\
\text{FACE} & = 50,000.00
\end{align*}
\]

30.10 Solve Examples
Discounted Notes

A note is a written agreement to pay the buyer of the note a sum of money plus interest. Notes do not have periodic coupons since all interest is paid at maturity. A discounted note is a note that is purchased below its face value. In the following two equations, the calendar basis is actual/360. To find the price given the discount rate, use the following NOTE.PRICEx equation:

\[
\text{PRICE} = \text{RV} - (\text{DISC} \times \text{DAYS} \times \text{SETT}, \text{MAT}, 1) / 360000
\]

To find the yield given the price (or to find the price given the yield), use the NOTE.YIELD equation:

\[
\text{YIELD} = (\text{RV} - \text{PRICE}) / \text{PRICE} 	imes 360000 - \text{DAYS} \times \text{SETT}, \text{MAT}, 1
\]

where

- \( \text{PRICE} \) = the purchase price per $100 face value.
- \( \text{YIELD} \) = the yield as an annual percentage.
- \( \text{RV} \) = the redemption value per $100.
- \( \text{DISC} \) = the discount rate as a percent.
- \( \text{SETT} \) = the settlement date (in current date format)
- \( \text{MAT} \) = the maturity date (in current date format).

Examples: Price and Yield of a Discounted Note. What are the price and yield of the following U.S. Treasury Bill settlement date July 10, 1991, maturity date December 17, 1991, discount rate 8.7\%? (Assume month/day/year format.)

Starting from the solve mode screen for the NOTE.PRICEx equation:

Keys: Description:

7.16991 \text{ SETT} \\
12.171991 \text{ MAT} \\
8.7 \text{ DISC} \\
100 \text{ RV} \\
Stores known values.
PRICE
Calculates price.

\[
\text{PRICE} = 96.20 \\
\text{RV} = 100.00 \\
\text{DISC} = 2.70 \\
\text{SETT} = 7.16 \\
\text{MRT} = 12.17
\]

Starting from the solve calc screen for the NOTE.YIELD equation:

YIELD Calculates yield.

\[
\text{YIELD} = 5.04
\]

30 Moving Average

Moving averages are often used to predict trends in data over time. In moving average calculations, a specified number of values are averaged. Each time a new value is acquired, the oldest is discarded.

The following Solver equation named MOVAVG calculates the moving average of data stored in a 1-2-3 worksheet.

\[
\text{MOVAVG} = \text{SUM(1:N),MAX(1:N-1),MIN(1:N-1),A1:RCLCELL C12+2:N+2:N+1)}, \\
\text{where}
\]

- \(N\) = the number of values averaged in each calculation.
- \(A1\) = the entry number of the most recent value to be averaged.
- \(C12\) = the page name of the first data cell.

Example: Moving Average. Calculate a three-month moving average for the number of units manufactured during the first half of the year. Manufacturing volumes were:

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
</tr>
</thead>
<tbody>
<tr>
<td>440</td>
<td>5300</td>
<td>2900</td>
<td>3670</td>
<td>4040</td>
<td>3200</td>
</tr>
</tbody>
</table>

If you want to preserve the current worksheet, save it to a file before exiting.

30-T Solver Examples
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td>Starts 1-2-3.</td>
</tr>
<tr>
<td>M</td>
<td>WESW</td>
</tr>
<tr>
<td>M</td>
<td>RNVCOL</td>
</tr>
<tr>
<td>ENTER</td>
<td></td>
</tr>
<tr>
<td>4400</td>
<td></td>
</tr>
<tr>
<td>5300</td>
<td></td>
</tr>
<tr>
<td>2900</td>
<td></td>
</tr>
<tr>
<td>3670</td>
<td></td>
</tr>
<tr>
<td>4040</td>
<td></td>
</tr>
<tr>
<td>3200</td>
<td></td>
</tr>
<tr>
<td>( M</td>
<td>S</td>
</tr>
<tr>
<td></td>
<td>END</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Type the equation, substituting VOL for name, and press (LAT:)
(ENG) to display the solve catalog. Then:

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 M</td>
<td>Stored number of points.</td>
</tr>
<tr>
<td>3 M</td>
<td>Stored entry number of last entry to be</td>
</tr>
<tr>
<td>M</td>
<td>stored.</td>
</tr>
<tr>
<td>M</td>
<td>Calculates average of 4,220.00 for months</td>
</tr>
<tr>
<td></td>
<td>1, 2, and 3.</td>
</tr>
<tr>
<td>4 M</td>
<td>“Moves” LAST down one entry.</td>
</tr>
<tr>
<td>M</td>
<td>Calculates an average of 2,976.67 for months</td>
</tr>
<tr>
<td></td>
<td>2, 3, and 4.</td>
</tr>
</tbody>
</table>

**Solver Examples 30-13**
Chi-Squared Statistics

The Chi-squared statistic is a measure of the goodness of fit between data and an assumed distribution. The statistic can be assumed to be Chi-squared distributed with $n - 1$ degrees of freedom if $n$ or some of the $E_i$ values are large. It is used to test whether a set of observed frequencies differs from a set of expected frequencies sufficiently to reject the hypothesis under which the expected frequencies were obtained. In other words, you are testing whether discrepancies between the observed frequencies ($O_i$) and the expected frequencies ($E_i$) are significant, or whether they may reasonably be attributed to chance. The equation is:

$$
\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}
$$

If there is close agreement between the observed and expected frequencies, $\chi^2$ is small; if the agreement is poor, $\chi^2$ is large.

The following Solver equations calculate $\chi^2$ using data in a 1-2-3 worksheet.

If the expected values vary:

CH12=SUMPRODUCT({1,1},LEN(name),1,RCLCOL(name,1)
-RCLCOL(name,1,2)/2/RCROW(name,1,2))

If the expected value is a constant:

CH12=SUMPRODUCT({1,1},LEN(name),1,RCLCOL(name,1)
-EXPT/2/EXPT)}

30.14 Solver Examples
where:

\[ CHI^2 = \sum \frac{(O - E)^2}{E} \]

\( O \) = the range name of the data containing the observed values in one column and (for the second equation), the expected values in an adjacent column to the right.

\( E \) = the expected value, if constant.

**Example:** Consider a 6-sided die. To determine whether a suspect die is biased, you toss it 120 times and observe the following results. (Since the expected frequency is the same for each number, 120/6, you'll analyze your data using the second equation.)

<table>
<thead>
<tr>
<th>Number</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
</tbody>
</table>

If you want to preserve the current worksheet, save it to a file before exiting.

**Keys:**

- F1: Starts 1,2,3.
- MENU: WKEY Erases the worksheet and moves to cell A1.
- 56: Enters data.
- 17, 15, 23, 24: Enters data.

**Solver Examples** 30-15
Names the range.

Displays solve catalog and highlights bottom of equation list. If the solve catalog screen is not displayed, press [Esc] once or more times.

Type the second equation, substituting 0.079 for same, and press [Esc] ([Esc] to display the solve calc screen. Then:

**Keys:**

120 = 5 [Expt]

Calculates $\chi^2$. If the Solver doesn’t display SOLVE, press [Ctrl] again.

$OH12 = 5.60$

$EXFT = 20.96$

The number of degrees of freedom is $(n-1) = 5$. Consult statistical tables to find $\chi^2$ to a significance level of 0.05 with 5 degrees of freedom. The table shows that $\chi^2_{0.05,5} = 11.07$. Since the computed value (5.60) is less than 11.07, you can conclude that, at a 0.05 significance level (5% probability), the die is fair.

---

**Economic Ordering Quantity**

The **economic ordering quantity** is the optimum quantity to order each time an order is placed. It is based on the cost of placing and receiving an order, annual sales, carrying costs (including warehousing costs, interest on funds tied up in inventory, insurance, and obsolescence), and the purchase price of the goods.

The following Solver equation calculates economic order quantity:

```
E00=SORT(2*F1/S0+SALES/(CARRY+100+PRICE))
```

---

**30-16 Solver Examples**
where

\( EOQ \) = the economic ordering quantity.
\( FKXO \) = the fixed costs of placing and receiving an order.
\( SALES \) = the annual unit sales.
\( CARRY\% \) = the carrying cost as a percentage of inventory.
\( PRICE \) = the purchase price per unit of inventory.

Examples: Economic Ordering Quantity. Your annual sales are 10,000 units. The purchase price per unit is $4.73. Carrying cost is 20% of inventory value and the cost of placing and receiving an order is $25. Calculate the economic ordering quantity.

Starting from the solve calc screen for this example’s equation:

Keys: Description:
35 FKXO Stores fixed cost of placing order.
10000 SALES Stores annual unit sales.
20 CARRY\% Stores carrying cost.
4.73 PRICE Stores price per unit.

Calculates economic ordering quantity.

\[
EOQ = \frac{860.21}{25} = 34.41
\]

Simulating a Toss of Dice

The Solver random number function \( RAN\# \) can simulate the toss of one or more six-sided dice. The equation:

\( \text{TOSs}=\text{IP}(\text{RAN}\#*6+1) \)

generates integers in the range 1 through 6. Similarly,

\( \text{TOSs}=\text{IP}(\text{RAN}\#*6+1)+\text{IP}(\text{RAN}\#*6+1) \)

simulates the toss of two dice and gives the sum of both.
1. Type the equation for the appropriate number of dice and press
    <ENTER> (E2).
2. Press <ENTER> as many times as desired to see the results of the
    tosses.

Distance Between Two Locations

The following Solver equation calculates the approximate statute
miles between two places, given their longitudes and latitudes. The
longitudes and latitudes are entered in degree-minutes-seconds format
(D:MM:SS); South Latitude and East Longitude are negative numbers.
The HP 9175 must be in Degree mode.

\[
\text{DISTANCE} = \sqrt{(0.00694466 \times \sin(\text{HR}(\text{LT1})))^2 + 
(\sin(\text{HR}(\text{LT2})) \times \cos(\text{HR}(\text{LT1}))))^2 + 
(\cos(\text{HR}(\text{LT2})) \times \cos(\text{HR}(\text{LT1}))) \times \cos(\text{HR}(\text{LG1}) - \text{HR}(\text{LG2})))
\]

where

- \( \text{LG1}, \text{LT1} \) = the longitude and latitude of the first place.
- \( \text{LG2}, \text{LT2} \) = the longitude and latitude of the second place.

Example: Calculating the Distance Between Two Places. Find the
statute miles between Philadelphia, Pennsylvania (40°36'N, 75°10'W)
and Corvallis, Oregon (44°35'N, 123°16'W).

If the RAD or GRAD annunciator is displayed, select <MATH> Options
Degrees in set Degrees mode.

Starting from the solve calc screen for this example’s equation:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.36</td>
<td>Stores latitude and longitude for</td>
</tr>
<tr>
<td>75.16</td>
<td>Philadelphia.</td>
</tr>
</tbody>
</table>

50-18  Solver Examples
Number of Days Until a Special Day

The following equation named WHEN? calculates the number of days between today’s date and some other meaningful date within one year from today—for example, Christmas. For accurate results, the system clock must be set to today’s date (see “Setting the Time and Date” in chapter 21).

\[ \text{WHEN} = \text{DOY} \times \text{DATE} \times 12.25 \times \text{.01} \times \text{.001} \times \text{IF} (\text{DATE} \geq 12.25 \times \text{.01} \times \text{.001} \times \text{IF} (\text{DATE} \leq 12.25 \times \text{.01} \times \text{.001} \times 1)) \]

Note that 12.25 represents Christmas. For other special days, replace 12.25 with the special day, expressed in MM-DD format.

Example: Number of Days to Christmas. If today is April 30, 1992, how many days remain until Christmas?

Starting from the solve mode screen for this example’s equation:

**Keys:**

1. **WHEN**
2. **DOY**
3. **DATE**
4. **IF**

**Description:**


WHEN = 249.06
Finding Several Solutions to an Equation

Example: Solving a Cubic Equation. The equation $x^3 - 5x^2 = 10x - z$ can have more than one solution for $z$. The Solver can find each solution or root using function plotting. The procedure below shows one way to do this. (Function plotting is covered near the end of chapter 28.)

You’ll plot this equation for a particular value of $z$.

1. Select [MATH] Solve to display the solve catalog. If necessary, press [ESC] one or more times.
2. Type $<^3-5^2+10^x-z$ into the solve editor.
3. Press [2nd] [x] (EDIT) to enter the expressions into the equation list and display function key labels for $x$ and $z$.
4. Type 20 and press [ENTER] (ENTER) to assign the value 20 to $z$.
5. Press [F3] to display the solve catalog.
6. Press Graph [F3] to display the function plotting screen.
7. Select [MATH] Erase Data to set the function-plotting conditions to initial value.
8. Press y=x (F1) to auto-plot the equation. YMIN and YMAX will be chosen to ensure that the curve is shown on the screen.

Function plotting accepts both equations and expressions, but it converts equations into expressions before plotting by subtracting the right side of the equation from the left side. So the graph you see is actually a plot of $x^3 - 5x^2 - 10x + 20$ against values of $z$.

Your screen should look like this:

30.21 Solve Examples
9. Press to zoom out five times and to show the curve crossing the x-axis three times (to show the three x-values where the expression equals zero).

10. Start the definition of a zoom box by moving the cursor to the upper-left corner of an imaginary box that includes all three x-axis crossings (all three roots). To move the cursor by jumps, press an arrow key. To move the cursor by individual dots (pixels) on the screen, press and hold while pressing an arrow key.

11. Press to fix this upper-left corner.

12. Move the cursor to locate the lower-right corner of the zoom box. Your screen should look something like this:

13. Press to enlarge the boxed area to full-screen size.
14. Move the cursor near the left root. Your screen should look something like this:

![Function Plotting Diagram]

15. Press [Solve]. You'll see displayed the root:

\[ x = -2.44 \]

16. Find the other two roots in a similar way—move the cursor near each root and press [Solve]. You'll see each of these roots displayed in turn:

\[ x = 1.34 \]
\[ x = 6.10 \]

17. Press [2nd] [CAT] to return to the solve catalog.
Part 5

Data Communications
The Datacomm application turns your HP 95LX into a computer terminal and lets you:

- Access electronic information services, such as CompuServe™ and GENie.
- Access information networks, such as your company’s electronic mail system.
- Transfer files using Kermit or XMODEM protocols, or as straight ASCII text.

In addition to these features, the Datacomm application gives you the abilities to save information you receive in a capture file, to translate characters from a different character set using a translation file, and to automate logons using a script file.

Here’s the general procedure for using your HP 95LX Datacomm:

1. Press [ESC] to start the Datacomm application.
2. Select [F4] Settings and configure your HP 95LX to match the host-system requirements.
3. Prepare the hardware for connection. For this step you need the HP 9222A Serial Interface Cable (available as part of the HP F180A Connectivity Pack or separately from your HP dealer) and most likely a modem and corresponding cable adapters.
4. Select [F8] Connect to make the connection to the host system, and then access whatever information you need.
5. If you’re using a modem, logout of the host and end the modem connection by pressing [F4] [ESC] [F12].

The steps in the above procedure are covered in greater detail throughout the rest of this chapter.

The function keys in Datacomm are reserved for programmable VT-100 keys. Therefore, the HP 95LX Datacomm functions are accessed via [CTRL] key sequences. For example, Datacomm help is accessed by pressing [CTRL] [H].

Use [ESC] to exit a menu that you don’t want to complete or use. Select [F4] Quit, on the other hand, to terminate the connection with the remote computer and get out of Datacomm altogether.

Quitting Datacomm when it’s not in use, rather than just leaving it by starting another application, helps extend HP 95LX battery life. (Note that quitting Datacomm does not mean a modem hangup command. If necessary, that must be done before exiting Datacomm.)
Configuring for Datacomm

Before you configure your HP 95LX for Datacomm, you need to know:

- What terminal type you want to emulate—ASCII, VT-100, no emulation (None), or no emulation with displayable control characters (Map).
- Whether you want the HP 95LX screen to automatically wrap text within the 40-column screen display or to act as a window into an 80-column terminal screen.
- What the host system requirements are for the serial communication parameters (baud, parity, number of stop bits, etc.).
- If you are using a modem, what the host system phone number is as well as whether you'll use pulse or tone dialing.
- Any other special host system requirements, such as Em-Ack or XON-XOFF flow control.

Within Datacomm you can view the settings sheet for the current configuration by pressing [SET] (CTRL-)). Here are the default settings for the HP 95LX:

When you've used [SET] to view the current configuration, pressing any key returns you to your previous display.

Configurations for certain information services are built into the HP 95LX in the form of configuration files. "Choosing a Configuration File" later in this chapter describes how to activate these configurations.

Datacomm 31-3
Setting the Terminal Type

Here are the four settings you have to choose from:

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT100</td>
<td>Emulates a VT-100 terminal</td>
</tr>
<tr>
<td>ANSI</td>
<td>Emulates an ANSI terminal</td>
</tr>
<tr>
<td>None</td>
<td>Emulates a &quot;dumb&quot; terminal (sometimes called &quot;glass sty&quot; or just &quot;tty&quot;)</td>
</tr>
<tr>
<td>Map</td>
<td>Emulates a &quot;dumb&quot; terminal, but control codes for other than CR (carriage return), BS (backspace), DEL (delete), HTAB (hard tab), and LF (line feed) are ignored.</td>
</tr>
</tbody>
</table>

To choose a terminal setting:

1. Select [MENU] Settings Config Terminal Emulation to display the configuration settings sheet and, in the top line of the display, the list of terminal choices.

2. Highlight the terminal type you want to emulate.

3. Press [ENTER]. The configuration settings sheet changes to reflect the new choice.

If you’re not sure what terminal type to emulate for a given task, try the commonly accepted VT-100 setting.

Changing the Definition of Backspace for ANSI and VT-100 Emulation

By default, [Backspace] (the backspace key) operates as a normal backspace key during terminal emulation—it moves the cursor one character to the left. If you selected ANSI or VT-100 emulation, you may want to change how this works.
Select Settings Config Terminal Backspace, and then at the prompt do one of the following:

- Select Delete to define <DELETE> to erase the current character (like the <DEL> key).
- Select Backspace to define <BS> to act like the usual backspace key.

The configuration settings sheet shows the current definition of the backspace key.

**Wrapping the Received Text**

Unless you change the setting, the VP 95LX automatically acts as a 40-column window into an 80-column terminal screen. This means that you are seeing about \(\frac{1}{4}\) of the full terminal display at any given time.

This mode allows the VP 95LX to work with systems that require a full 80-character by 25-line screen—for example, some order-entry and electronic-mail applications that paint forms across all 80 columns.

Datacomm 31-5
Here are the keys you use to move the HP 95LX window around the larger screen:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moves the window up one line.</td>
</tr>
<tr>
<td>5</td>
<td>Moves the window down one line.</td>
</tr>
<tr>
<td>3</td>
<td>Moves the window right one column.</td>
</tr>
<tr>
<td>2</td>
<td>Moves the window left one column.</td>
</tr>
<tr>
<td>LEFT</td>
<td>Moves the window right one frame (49 columns).</td>
</tr>
<tr>
<td>LEFT</td>
<td>Moves the window left one frame.</td>
</tr>
<tr>
<td>HOME</td>
<td>Returns to the current cursor position.</td>
</tr>
<tr>
<td>PG DN</td>
<td>Moves the window down one frame (16 rows).</td>
</tr>
<tr>
<td>PG UP</td>
<td>Moves the window up one frame.</td>
</tr>
</tbody>
</table>

If, however, you are working with a system that does not require use of all 80 columns, you can select line wrapping, which causes all incoming data to be wrapped at column 49 and scrolled at line 16. In this mode the HP 95LX window can be moved using the up-and-down keys in the previous table (the right-and-left keys are inactive).

Select [MENU] Settings Config Terminal Wrap Enable to turn on line wrapping. Select [MENU] Settings Config Terminal Wrap Disable to turn it off.

The configuration settings sheet displays the current state of line wrapping.

**Setting the Serial Communication Parameters**

The serial-port configuration parameters are accessed by selecting [MENU] Settings Config Port. The configuration settings sheet is displayed with the current settings.
The menu at the top of the display contains the commands representing the serial port parameters:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>Sets the communication port (Com1, Com2, or Infrared). Com1 and Com2 both select Com1 in the HP 9ILX, while Infrared forces the other parameters to be compatible with infrared hardware.</td>
</tr>
<tr>
<td>Baud</td>
<td>Sets the transmission speed (300, 1200, 2400, 4800, 9600, 19200, or Direct—57600).</td>
</tr>
<tr>
<td>Stop</td>
<td>Sets the number of stop bits (1 or 2).</td>
</tr>
<tr>
<td>Parity</td>
<td>Sets the parity (None, Even, Odd, Mark, or Space).</td>
</tr>
<tr>
<td>Char</td>
<td>Sets the number of bits in a character (7 or 8).</td>
</tr>
</tbody>
</table>

To change a setting:

1. Select a command (for example, Baud).
2. Use the cursor keys to highlight the desired value (for example, 1200).
3. Press ENTER.

Repeat these steps as necessary for all the parameters you need to set for the given host.
Setting the Modem Dialing Parameters

If you’re using a modem, you need to specify the phone number for the host system and the telephone dialing type (Pulse or Tone).

1. Select **[MENU]** Settings Config Dial Number.
2. Type in the phone number and press **ENTER**.
3. Do one of the following:
   - Select Dial Pulse for pulse dialing.
   - Select Dial Tone for tone dialing.

After you select the dialing type, you are returned to the Settings Config menu. The configuration settings sheet reflects the changes you make.

Setting Other Configuration Parameters

Under certain conditions you may want to use these commands to set one or more of the HP 95LX's Other configuration parameters:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echo</td>
<td>Enables or disables local character echoing.</td>
</tr>
<tr>
<td>Flow</td>
<td>Sets the communication line flow control. Select XON-XOFF, Enq-ACK, or none.</td>
</tr>
<tr>
<td>Duplex</td>
<td>Sets the duplex transmission. Select Full or Half.</td>
</tr>
</tbody>
</table>

To set these parameters select **[MENU]** Settings Config Other, followed by the commands for the settings you desire. The configuration settings sheet changes to reflect the settings you make.
Using Datacomm Configuration Files

Once you've set all the parameters to the settings you want, you're ready to back up your hardware. However, you may want to save your configuration settings in a file, first, so that the next time you need that particular configuration, you can simply load the file and avoid all the resetting procedure. This section explains how to do that.

Saving a Configuration in a File

When you save a Datacomm configuration in a file, all settings are saved—including the terminal type, the line wrapping setting, the serial communication settings, the modem dialing instructions, etc. Unless another path or file extension is specified, a saved file automatically resides in the C:\DAT subdirectory and is given a .DCF (Datacomm Configuration File) extension.

1. Configure your HP 851X as desired for Datacomm.
2. Select [MENU] Settings Save.
3. At the prompt, do one of the following:
   - Accept the default name by pressing [ENTER].
   - Use the cursor keys to highlight one of the file names shown near the top of the display and select it by pressing [ENTER].
   - Type a new name (maximum eight characters with no extension) and press [ENTER].

Note

If the file name you choose to use already exists, you will be asked whether or not you want to overwrite its contents with the current settings, losing the old contents. If you respond no to that prompt, you can then select another file name.

Choosing a Configuration File

You can make a previously-saved configuration the current configuration by using the Settings Use command.

1. Select [MENU] Settings Use.
2. Type in the file name, or highlight the desired file name in the list shown near the top of display.
3. Press [ENTER] to make that configuration current.
In addition to configuration files you create, the HP 95LX has several files built in for popular information services. These files exist in the C:\DAT subdirectory with .DCF extensions, so they are part of the list described in step 2 above. The files are recognizable by their names—COMPUSERVICE.DCF for CompuServe—so you can search through the list to find the one you want. Before you use one of these files, you must have an account with the information service, and you must add the appropriate phone number to the file.

Preparing the Hardware

Once your HP 95LX is configured for Datacomm, you are ready to hook up the hardware needed for a connection.

You can use the HP 82222A Serial Interface Cable to connect directly to the host system, or you can use the cable, a null modem adapter, and a Hayes-compatible modem to connect to the host. Attach the 4-pin end of the serial cable to the HP 95LX and the other end of the cable to the other device.

**Note**

Hooking up cables, adapters, and peripheral devices can be a tricky procedure because the required adapters can vary with different peripherals. If you need help with this process, contact a local electronics dealer or the manufacturer of the equipment you’re trying to connect.

The following table shows the pin assignments for the peripheral end of the serial cable. This information is important if you need to get help connecting to a host system or other device.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Used for</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not used</td>
</tr>
<tr>
<td>2</td>
<td>Transmit data (from the HP 95LX)</td>
</tr>
<tr>
<td>3</td>
<td>Receive data (to the HP 95LX)</td>
</tr>
<tr>
<td>4</td>
<td>Not used</td>
</tr>
<tr>
<td>5</td>
<td>Signal ground</td>
</tr>
<tr>
<td>6-9</td>
<td>Not used</td>
</tr>
</tbody>
</table>

31-10 Datacomm
There are two limitations to keep in mind when connecting the HP 95LX to a another device:

- The HP 95LX supports only software handshaking, not hardware handshaking. If the other device requires hardware handshaking, contact the manufacturer to see if there is a method to work around this limitation.
- The HP 95LX is designed to use the HP 82227A serial cable. If you try to use a longer serial cable, you may get poor data transmission to the other device.

Accessing Information from a Host System

Once your HP 95LX is properly configured and the hardware is properly set up, you are ready to make the Datacomm connection to the host system and get the information you need.

Making the Connection

Select [SEND] Connect to initiate data communications.

- If the current configuration contains a phone number, Datacomm assumes that the connection is via modem and executes the modem command to dial the number.
- If the current configuration does not contain a number, Datacomm attempts to establish a direct connection.

When the connection to the host system is made, any script file specified in the current configuration is run. (For information on script files, see “Automating Logons with a Script File” later in this chapter.)

If no script file exists, press [ENTER] and proceed to log on and then get whatever information you need from the host system. (If you want to transfer files, see “Transferring Files” later in this chapter.)
Capturing Data in a File

Datasync gives you the ability to capture received data in a file, as well as the ability to filter out the capture file certain control codes.

Turning Capture On and Off

Press Capture (CTRL+Z) to turn capturing on. When you turn it on, you are prompted for the name of the file in which to put the received data—either highlight a file name from the displayed list and press ENTER, or type in a new name and press ENTER.

Note

Unless you type in a specific file extension, files used to capture data are automatically given the extension ".cap" for easy identification. Also, unless you type in a different path with the file name, a capture file is automatically saved in the C:\DAT subdirectory.

If the file you choose for capturing already exists, new data is appended to the end of that file.

When you're done capturing data, press Capture (CTRL+Z) again to turn capturing off and close the capture file.

Filtering Captured Data

Select Settings Config Capture to specify how you want received data to be filtered. Here are the three options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
<td>ASCII control codes are not written to the capture file—they are filtered out.</td>
</tr>
<tr>
<td>Map</td>
<td>Control codes are mapped to displayable characters in the capture file. For example, control code 1 is written as &quot;A&quot;, 2 as &quot;B&quot;, 3 as &quot;C&quot;, and so on.</td>
</tr>
<tr>
<td>None</td>
<td>No filtering. All characters received are written to the capture file.</td>
</tr>
</tbody>
</table>

None is the default state for filtering captured data. If you make another choice, it becomes part of the current Datasync configuration and is preserved until you change it again.

31-12 Datasync
Ending a Datacomm Session

Neither of the following actions logs you off the remote system. So, if it's necessary to do so, log off the remote system before doing one of the following:

- If you're connected via modem and are ready to end the session, press Hangup (CTRL-E) to issue the modem hangup command.
- If you have a direct connection and want to end the session, no special action is necessary—just disconnect the cable when it's convenient.

To actually exit the Datacomm application, select (META) Quit.

Caution

The Quit command does not issue the modem phone hangup command, so before you select Quit you should break a modem connection by pressing Hangup (CTRL-E).

You can run other HP 9SX applications without exiting Datacomm, preserving your current configuration settings for later. If you decide to quit Datacomm using the Quit command, any unsaved configuration changes will be lost and you'll have to reconfigure the next time you press Ctrl-E.

Also, if you start the Files while data is being received, the data will probably be lost.

Transferring Files

With an established connection to another computer, you can transfer files between your HP 9SX and that computer using XMODEM or Kermit protocols, or as straight ASCII text.

Note

If you are connected to a PC that has the HP Connectivity Pack software, a simpler file-transfer method involves using the Files application. See chapter 20 for information.
Using XMODEM Protocol

When you select (MENU) Transfer XMODEM you see the two XMODEM commands.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send</td>
<td>Sends a file to the remote host.</td>
</tr>
<tr>
<td>Receive</td>
<td>Receives a file from the remote host.</td>
</tr>
</tbody>
</table>

To transfer a file using XMODEM protocol:

1. Set the HP 95LX configuration parameters as required by the host system. (See "Configuring for Datacomm" earlier in this chapter.)

Note

XMODEM protocol requires systems to be set to transfer 8-bit characters, so select Settings Config Port Char 8 when you set the configuration parameters. If the Char parameter is set to 5, the transfer will fail. All other settings should be the same as set on the host system. Also, 57600 baud is not recommended for XMODEM transfers.

2. Make the connection to the host system via modem or direct connection. (See "Preparing the Hardware" earlier in the chapter.)
3. Select (MENU) Connect and then, if necessary, log on to the host.
4. Run the program on the host that contains XMODEM protocol.
5. Execute the host Send command (if you’re transferring a file to the HP 95LX) or Receive command (if you’re transferring a file from the HP 95LX).
6. Select (MENU) Transfer XMODEM Send (if you’re transferring a file to the HP 95LX) or (MENU) Transfer XMODEM Receive (if you’re transferring a file from the HP 95LX). While the transfer is underway, a status screen displays and continuously updates a byte counter for how much of the file has been transferred. When the transfer is complete, press any key to clear the status screen.
7. When you’re done transferring files, end the Datacomm session. (See "Ending the Datacomm Session" earlier in this chapter.)
Using Kermit Protocol

When you select **File** Transfer Kermit, you see the Kermit menu.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get</td>
<td>Gets a file from a remote server. Accepts wildcards to get a group of files.</td>
</tr>
<tr>
<td>Receive</td>
<td>Receives a file from the remote host.</td>
</tr>
<tr>
<td>Send</td>
<td>Sends a file to the remote host (whether it's a server or not). Does not accept wildcards to send a group of files.</td>
</tr>
<tr>
<td>Login</td>
<td>Logs a remote Kermit server to log the BP SP/LX user out. (A Hangup command is not executed for a modem attached to the BP SP/LX, but may be executed for a modem attached to the remote host.)</td>
</tr>
<tr>
<td>Options</td>
<td>Accesses the Kermit parameters File and Block. (See the next table for information.)</td>
</tr>
<tr>
<td>K-Server</td>
<td>Puts the BP SP/LX in Kermit server mode. (Pressing ESC on the BP SP/LX exits server mode.)</td>
</tr>
</tbody>
</table>

The Options command specifies the Kermit File and Block options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>File</td>
<td>Selects the type of file to be transferred: Binary or Text.</td>
</tr>
<tr>
<td>Block</td>
<td>Selects the block check type to use: 8-bit checksum, 16-bit checksum, or 16-bit CCITT CRC.</td>
</tr>
</tbody>
</table>

To transfer a file using Kermit protocol:

1. Set the BP SP/LX configuration parameters to match the host system. (See "Configuring for Datacomm" earlier in this chapter.)
   **Hints:** If you set parity to None, also select 8-bit characters in the BP SP/LX; if you set parity to Even, Odd, Mark, or Space, select 7-bit characters in the BP SP/LX. Also, 57600 baud is not recommended for Kermit transfers.

2. Make the hardware connection to the host system via modem or direct connection. (See "Preparing the Hardware" earlier in this chapter.)

3. Select **File** Connect and then log on to the host.

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4. Run the program on the host (which could be another HP 95LX) that contains Kermit protocol.
5. Execute the host server command to make the remote system the server.
6. Select (SEND) Transfer Kermit Send (if you’re transferring a file from the HP 95LX) or (SEND) Transfer Kermit Get (if you’re transferring a file to the HP 95LX). While the transfer is underway, a status screen displays and continuously updates a byte counter for how much of the file has been transferred. When the transfer is complete, press any key to clear the status screen.
7. When you’re done transferring files, select (SEND) Transfer Kermit Logout to log out of the remote server.
8. End the Datacomm session. (See “Ending a Datacomm Session” earlier in this chapter.)

Transferring Without a Protocol

This feature enables your HP 95LX to send an ASCII file to a remote host that does not have the HP Connectivity Pack software or does not support Kermit or XMODEM protocols. The Flow settings (SEND Settings Config Other Flow) can be used to control the handshaking of data to the host system. Also, note that 37600 baud is not recommended for this type of transfer.

When you select (SEND) Transfer Text you see the menu of commands for sending a file as ASCII text without any special protocol.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send</td>
<td>Transmits a file to the remote host.</td>
</tr>
<tr>
<td>Options</td>
<td>Accesses the Throttling and Pacing settings for the text transfer. (See the next table for information.)</td>
</tr>
</tbody>
</table>
The Options command lets you specify the Throttling and Pacing for the text transfer:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttling</td>
<td>Sets the time delay between transmitted characters in milliseconds (0-1000). Throttling is used to slow transmission so that the HP 95LX does not overrun a “slow” host. The default value is 0 (no delay between characters). The Throttling setting is unaffected by the Pacing setting.</td>
</tr>
<tr>
<td>Pacing</td>
<td>Sets the pace of the transmission by causing the HP 95LX to wait for a pacing sequence from the host every time a new line character is sent. The Pacing settings to choose from are:</td>
</tr>
<tr>
<td></td>
<td>• None. No pacing—the HP 95LX transmits lines as fast as possible</td>
</tr>
<tr>
<td></td>
<td>• CR (Carriage Return). The HP 95LX waits for a carriage return from the host before sending the next line.</td>
</tr>
<tr>
<td></td>
<td>• Strag. The HP 95LX waits for the specified string from the host before sending the next line.</td>
</tr>
<tr>
<td></td>
<td>• Timed. The HP 95LX waits the specified number of milliseconds (0-1000) before sending the next line.</td>
</tr>
</tbody>
</table>

Throttling and Pacing work together in that characters are transferred at the throttling rate until a new line character is sent, at which point the next line of characters is not sent until the Pacing conditions are met.

The Throttling and Pacing settings do not affect any Flow hardware that’s enabled (either XON-XOFF or RTS-CTS).

To transmit a file from the HP 95LX as ASCII text:

1. Set the HP 95LX configuration parameters as required by the host system. (See “Configuring for Datacomms” earlier in this chapter.)
2. Make the hardware connection to the host system via modem or direct connection. (See “Preparing the Hardware” earlier in this chapter.)

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3. Select **[Menu]** Connect and then log on to the host.
4. Redirect the host's input from its keyboard to its serial port.
5. Optionally select **[Menu]** Transfer Text Options to set the Thrashing and Pacing for the transfer.
6. Select **[Menu]** Transfer Text Send to transmit a file to the host. While the transfer is underway, a status screen displays and continuously updates a byte counter for how much of the file has been transferred. When the transfer is complete, press any key to clear the status screen.
7. When you're done transferring files, redirect the host's input back to its keyboard.
8. End the Datacomm session. (See "Ending a Datacomm Session" earlier in this chapter.)

**Automating Logon with a Script File**

A script file enables you to automate the procedure for logging on to a host that you frequently use. When you include the name of a script file as part of your current configuration, the script is executed as soon as a connection is made to the host system.

Here is a sample script file that would log Clark Mordich on to his electronic mail system:

```
Hello!
(Enter your login name)
C.Mordich!
(Enter your password)
Jaguar!
```

Once you know the host procedure and requirements for logging on, you can create a script file using the Menu Editor, saving the file in the C:\DMS subdirectory. Here are the special script characters you can use when creating a script file:

31 Datacomm
<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ ... }</td>
<td>The left and right curly braces are used to enclose a string of characters that comes from the host. A string in curly braces instructs the HP 35LX to wait until an exact match of that string is received and then continue with the script. If a matching string is not received within 30 seconds, the script quits execution.</td>
</tr>
<tr>
<td>^</td>
<td>Indicates that the uppercase character following it is a control character. For example, &quot;A&quot; represents control-A. If you want to represent the character '<del>', use '``</del>''. If you want to represent control-^, use <code>^1E</code>.</td>
</tr>
<tr>
<td>#</td>
<td>Interprets the two characters following it as the hex number to represent the corresponding 8-bit character. For example, <code>^1E</code> represents control-^~. (If you want to represent the character #, use <code>^##</code>.)</td>
</tr>
<tr>
<td>{</td>
<td>Represents a carriage return.</td>
</tr>
<tr>
<td>~</td>
<td>Causes a 1-second pause.</td>
</tr>
<tr>
<td>@e</td>
<td>Turns echo pacing on. (Echo pacing requires the host to &quot;echo&quot; back each sent character before another one is sent.)</td>
</tr>
<tr>
<td>@m</td>
<td>Turns echo pacing off.</td>
</tr>
<tr>
<td>@b</td>
<td>Sends a break signal for 1 second.</td>
</tr>
<tr>
<td>@@</td>
<td>Sends a single @ character.</td>
</tr>
<tr>
<td>$[path]</td>
<td>Sends the file identified by the DOS path as is—no characters are translated, including control characters. You must include the square brackets around the path, which includes the file name.</td>
</tr>
</tbody>
</table>

**Note**

If you are communicating by modem, the first entries you put in the script should be a series of pauses to allow time for the host system to answer the phone.
To write and save a script file:

1. Press [F3] to start the Memo Editor.
3. Type the script file for logging on to the particular system.
4. Select [MENU] File Save and type the C:\DAT\path followed by a file name with a .LCF file extension. An example of the path and a file name is C:\DAT\TEST01\LOG.LCF.
5. Press [ENTER].

To add a script file to the current Datacomm configuration:

2. Use the arrow keys to highlight the desired file name. (If you prefer, you can type the name of the script file.)
3. Press [ENTER].

Once [ENTER] is pressed, the Script parameter in the configuration settings sheet shows the script file name.

As part of the current configuration, the script file can become part of a saved configuration file for later use with a particular remote system. (See “Saving a Configuration in a File” earlier in this chapter for information.)

To remove a script file from the current Datacomm configuration:

2. Use [F4] to erase the entire default path name (including the C:).
3. Press [ENTER]. The settings sheet is updated to reflect the change.

Script files can be used for procedures other than logging on. To use one for a specific procedure after the RP 96LX is connected to the host, press [RUN] ([F5]), type the file name of the script file to run, and press [ENTER]. (You don't need to type the path as long as the script file is located in the C:\DAT subdirectory.)

31-20 Datacomm
Using the Character Translation Facility

If a remote system you are communicating with doesn’t use the code page 850 character set (the character set in the HP 95LX), you may need to translate some misinterpreted characters into the characters they’re meant to be. For example, suppose the remote system uses decimal code 199 to represent the character ø. When that character is transferred to the HP 95LX, you’ll see À (the HP 96LX character for decimal code 199). A Character Translation Facility (CTF) file enables you to translate misinterpreted characters like this into the correct characters.

You need to create a CTF file and then make it a part of your current Datasmart configuration to make it active.

To Create a CTF File:

1. Identify the characters causing the problem and determine their decimal or hexadecimal character numbers on both the HP 95LX and the remote system. (Appendix E contains the HP 96LX character set.)
2. Use the Memo Editor to create the CTF file—refer to the following example file and command table.
3. When you’re finished, save the file with a descriptive name and a .CTF file extension in the C:\DAT subdirectory. An example of the path and file name is C:\DAT\9596CTF.CTF.

The following is a sample CTF file:
# This is a partial codepage 850 to 860 translation.
# Values from codes 128 to 149 that need translation
# will be performed
# Codes received will display exact character matches
RORDX 18
RCONV 132 198
RCONV 134 181
RCONV 137 210
RCONV 139 214
RCONV 140 226
RCONV 142 199
RCONV 143 182
# Codes transmitted are nearest equivalent characters
TCONV 132 168
TCONV 134 131
TCONV 137 136
TCONV 139 161
TCONV 140 141
# End of example Character Translation File

Note

The above sample file exists in your IFF 85LX
and can be edited to create a CTX file for
your specific needs. To do this, load the file:
C: \ LAT \ SAMPLE.CTF into the Memo Editor and
make the necessary changes. Then, save and rename
the file as described in step 3 above.

Some formatting rules to notice from the above sample file are:

- You must start the file with the RORDX command.
- Each command must be on a line by itself. (Blank lines are ignored,
  so you can add them between commands to enhance readability.)
- At least one space is necessary between the command and each
  input. (Multiple blank spaces are ignored, so they can be added for
  readability, too.)
- Lines with just numbers assume the previous command.
- Lines starting with # are ignored and treated as comment lines.

Here are descriptions of the commands available to use in a CTX file:

31-22 Datacomm
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#</td>
<td>Indicates a comment line, which is ignored in the file.</td>
</tr>
<tr>
<td>RADIX</td>
<td>Indicates whether the numbers used as input for the rest of the commands are interpreted as decimal codes or hexadecimal codes. You must use either RADIX 10 (decimal) or RADIX 16 (hexadecimal). (The examples in this table assume RADIX 10.)</td>
</tr>
<tr>
<td>RCONV</td>
<td>Specifies that a character received by the HP 95LX is to be converted to another character. It takes two inputs: the first number is the character code that should be translated, and the second is the code to be substituted. For example, RCONV 36 175 causes character code 36 to be translated to 175 (the ' ' character in code page 850) when it's received.</td>
</tr>
<tr>
<td>TCONV</td>
<td>Specifies that an HP 95LX character is to be translated before it is transferred. It takes two inputs: the first number is the character code to be translated, and the second is the code to be substituted. For example, TCONV 124 132 causes the HP 95LX</td>
</tr>
<tr>
<td>RTCNV</td>
<td>Continues related RCONV and TCONV commands by specifying both the receive and transmit conversions in a single command. It takes three inputs: the first number is the character code to translate when it's received by the HP 95LX; the second is the code to substitute for that character; and the third is the HP 95LX character to translate into the first number for transmission. For example, RTCNV 131 148 and TCONV 148 131 can be combined into RTCNV 131 148 148. This command causes character code 131 to be translated into code 148 whenever it's received by HP 95LX, and whenever the HP 95LX code 148 a to be transmitted, it is first converted back to code 131 for the remote system.</td>
</tr>
</tbody>
</table>
Before the settings in a CTF file become active, the file must be made part of the current configuration.

To add a CTF file to the current Datacomm configuration:
1. Select **[MENU]** Settings Config X-list.
2. Use the arrow keys to highlight the desired file name. (If you prefer, you can type the name of the CTF file.)
3. Press **[ENTER]**

Once **[ENTER]** is pressed, the X-list parameter in the configuration settings sheet shows the CTF file name.

As part of the current configuration, the character translation settings can become part of a saved configuration file for later use with a particular remote system. (See "Saving a Configuration in a File" earlier in this chapter for information.)

**Note**

If a command or syntax error exists in a CTF file, the file will be rejected when it's run, and the HP 90LX will revert to a state of no character translation.

To remove a CTF file from the current Datacomm configuration:
1. Select **[MENU]** Settings Config X-list.
2. Use **[ ]** to erase the entire default path name (including the C:).
3. Press **[ENTER]**. The settings sheet is updated to reflect the change.

31-24 Datacomm
Support, Batteries, and Service

Customer Support

If you have questions about how to use your HP 95LX, first use this User's Guide by checking the contents and index to guide you to the right page for an answer. If you can't find an answer in the manual, you can contact Hewlett-Packard's Customer Support department at the address or phone number on the inside back cover of this manual.

When to Replace Batteries

When a low-battery condition exists, your work will be interrupted with a warning message telling you that the plug-in RAM card battery, the HP 95LX backup battery, or the main HP 95LX batteries need replacing. Replace the indicated batteries as soon as possible after the message first appears.

Battery life can be prolonged by quitting File and Datacomm after each use and utilizing the AC adapter whenever possible, especially during data transfers. A 9-volt AC adapter is available from your Hewlett-Packard dealer (model number HP 82241A).

Caution

If the main batteries run completely down, the unit will draw power from the backup battery. In this condition the backup battery, depending on its charge, may only last a few days. Therefore, it's important to replace low batteries as soon as possible to avoid data loss.

Even if a low-battery message doesn't appear, you should replace the HP 95LX backup battery and any RAM card batteries a year after...
you install them. When you install a fresh battery, you might want to set an appointment using the Appointment Book for 1 year from that date to remind you to replace it.

### Changing Batteries

#### Battery Types

**HP 95LX Batteries.** Any brand of 1.5-volt, size AA batteries. Be sure that both batteries are of the same brand and type. Fresh batteries should last 1 to 2 months with typical use.

The use of rechargeable batteries is not recommended.

**HP 95LX Backup Battery.** 3-volt CR2032 coin cell. If fresh main batteries are maintained, the backup battery should last a year before you replace it.

**2AM Card Battery.** 3-volt CR2025 coin cell. A fresh RAM card battery should last a year before you replace it.

### Changing HP 95LX Batteries

These instructions are for changing the HP 95LX main and backup batteries. The instructions for replacing a RAM card battery are found later in this appendix under "Changing a RAM Card Battery."

<table>
<thead>
<tr>
<th>Caution</th>
<th>Do not remove both the main batteries and the backup battery at the same time—and do not remove the main batteries if the backup battery is dead—complete HP 95LX memory loss would likely result.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning</td>
<td>Do not mutilate, puncture, or dispose of batteries in fire. The batteries can burst or explode, releasing hazardous chemicals. Discard used batteries according to the manufacturer's instructions.</td>
</tr>
</tbody>
</table>

A-2  Support, Batteries, and Service
Changing the Main HP 95LX Batteries

1. Turn the HP 95LX off and close the case.
2. Remove the battery cover on the bottom of the HP 95LX.

3. Remove the old batteries.
4. Install two fresh AA batteries, orienting them as shown by the symbols in the battery compartment.
5. Replace the cover.

If the low-battery message still appears when you turn the HP 95LX on, go back over the procedure and check the orientation of the batteries as shown in step 4—you may have put the batteries in backwards.

Changing the HP 95LX Backup Battery

Caution

Do not remove both the main batteries and the backup battery at the same time—complete HP 95LX memory loss would likely result.

1. Turn the HP 95LX off.
2. Remove the backup battery cover and pull out the battery tray.

3. Remove the old battery from the tray and insert a fresh, 3-volt CR2032 coin cell. Be sure the "+" on the battery is facing down in the tray.

4. Insert the battery tray back into the HP 95LX and replace the cover.

5. Turn the HP 95LX on. If the battery-low message is still present in the display, go back over the procedure and check the battery orientation as shown in step 3—you may have put the battery in the tray upside down.

A 4 Support, Batteries, and Service
Changing a RAM Card Battery

Under typical use, a RAM card’s battery should last about 1 year. Be sure to mark the card with the battery-installation date, and, in case the RAM card is not in your HP 95LX when the battery needs replacement, set an alarm using the Appointment Book application for about 10 months from this date to remind you to install a fresh battery.

To change a RAM card battery:

1. With the RAM card in the plug-in card slot, turn your HP 95LX off.

   **Caution**
   RAM card memory may be lost when you remove a RAM card battery unless the card is in an HP 95LX that is turned on.

2. Locate the battery tray lock on the RAM card.

![Diagram of RAM card with battery tray lock and write protect switch](image)
3. Unlock the RAM card battery tray.

4. Using a fingernail, pull the battery tray out of the card.

5. Remove the old battery and insert a fresh, 3-volt CR2025 coin cell. Be sure the “+” on the battery is on the same side as the “+” on the battery tray.
6. Insert the battery tray back into the card. Be sure the "+" side faces up.

7. Re-lock the battery tray.

Once the fresh battery is in the RAM card and your HP 95LX is turned off, you can remove the card temporarily to mark it with the battery installation date. It's also a good idea to set an alarm for 1 year from that date to remind you to change the battery again.
Environmental Limits for the HP 95LX and Plug-In Cards

To maintain product reliability, avoid getting the equipment wet and observe the following temperature and humidity limits for the HP 95LX and Z8200 and Z8202 Plug-In cards:

- Operating temperature: 0° to 40°C (32° to 104°F).
- Storage temperature with data retention: 0° to 60°C (32° to 140°F).
- Operating and storage humidity: 90% relative humidity at 40°C (104°F) maximum.

You will likely lose data below 0°C (32°F), but you can have storage temperatures down to -20°C (-4°F) without damaging the hardware.

Noise Declaration. In the operator position under normal operation (per ISO 7779): LpA < 70dBA.

Testing HP 95LX Operation

If the display can be turned on, yet you suspect that your HP 95LX is not working properly, you should first install fresh batteries as described earlier in this appendix. Then, if the problem still exists, try resetting the machine as described in "Resetting Your HP 95LX" in chapter 1. If both of these procedures fail to alleviate the problem, you should run a series of diagnostic tests called the self test.

Before you run the self test, close all applications, saving any changes you’ve made. The self test causes a system reset to occur, so files or changes to files not already saved will be lost when you run it.

To run the self test:
1. Press [OFF] to turn the unit off.
2. Hold down the [ESC] key, press and release [ON], and then release [ESC]. This displays the self test screen.

A-8 Support, Batteries, and Service
3. Start the series of tests by pressing the spacebar followed by 0 (zero). Do not press any keys during the tests. Your HP SLX will cycle through all the tests listed in the display except the Keyboard test.
   • Except for the Serial Port test and possibly the Plug-in test, OK will appear next to each test as it is passed. The Plug-in test will display No Error if one is not present, and the Serial Port test will display No Error.
   • If the term Fail appears next to any of the tests, repeat steps 1 through 3 above to see if the message is duplicated. If the failure message is duplicated, your unit probably requires service. See "If Your HP SLX Requires Service" later in this appendix for instructions.

4. When the tests are finished, exit the self-test screen by pressing ESC

Limited One-Year Warranty

What Is Covered

The HP SLX (except for the batteries, or damage caused by the batteries) and HP SLX accessories are warranted by Hewlett-Packard against defects in materials and workmanship for one year from the date of original purchase. If you sell your unit or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to a Hewlett-Packard service center. (Replacement may be made with a newer model of equal or better functionality.)

Support, Batteries, and Service A-5
This warranty gives you specific legal rights, and you may also have other rights that vary from state to state, province to province, or country to country.

What Is Not Covered

Batteries, and damage caused by the batteries, are not covered by the Hewlett-Packard warranty. Check with the battery manufacturer about battery and battery leakage warranties.

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than an authorized Hewlett-Packard service center.

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE ONE-YEAR DURATION OF THIS WRITTEN WARRANTY. Some states, provinces, or countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. IN NO EVENT SHALL HEWLETT-PACKARD COMPANY BE LIABLE FOR CONSEQUENTIAL DAMAGES. Some states, provinces, or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Products are sold on the basis of specifications applicable at the time of manufacture. Hewlett-Packard shall have no obligation to modify or update products, once sold.

Consumer Transactions in the United Kingdom

This warranty shall not apply to consumer transactions and shall not affect the statutory rights of a consumer. In relation to such transactions, the rights and obligations of Seller and Buyer shall be determined by statute.
If Your HP 95LX Requires Service

Hewlett-Packard maintains service centers in many countries. These centers will repair a unit, or replace it with the same model or one of equal or better functionality, whether it is under warranty or not. There is a service charge for service after the warranty period. Units normally are serviced and reshipped within 3 working days.

Note

If the contents of your HP 95LX’s memory are important, you should back up the memory on a plug-in RAM card, another EP 95LX, or a PC before sending the unit in for repair.

In the United States, send the unit to the Corvallis Service Center listed on the inside of the back cover.

In Europe, contact your Hewlett-Packard sales office or dealer, or Hewlett-Packard’s European headquarters (address below) for the location of the nearest service center. Do not ship the unit for service without first contacting a Hewlett-Packard office.

Hewlett-Packard S.A.
150. Route du Nant-d’Avril
P.O. Box CN 1217 Meyrin 2
Geneva, Switzerland
Telephone: 022 789.81.11

In Other Countries, contact your Hewlett-Packard sales office or dealer, or write to the Corvallis Service Center (listed on the inside of the back cover) for the location of other service centers. If local service is unavailable, you can ship the unit to the Corvallis Service Center for repair.

All shipping, re-importation arrangements, and customs costs are your responsibility.

Support, Batteries, and Service  A-11
Service Charge

Contact the Corvallis Service Center (inside back cover) for the standard out-of-warranty repair charges. This charge is subject to the customer’s local sales or value-added tax whenever applicable.

Products damaged by accident or misuse are not covered by the fixed charges. These charges are individually determined based on time and material.

Shipping Instructions

If your HP 95LX requires service, ship it to the nearest authorized service center or collection point.

- Include your return address and a description of the problem.
- Include proof of purchase date if the warranty has not expired.
- Include a purchase order, check, or credit card number plus expiration date (VISA or MasterCard) to cover the standard repair charge.
- Ship your unit postage prepaid in adequate protective packaging to prevent damage. Shipping damage is not covered by the warranty, so we recommend that you insure the shipment.

Warranty on Service

Service is warranted against defects in materials and workmanship for 90 days from the date of service.

Service Agreements

In the U.S., a support agreement is available for repair and service. For additional information, contact the Corvallis Service Center (see the inside of the back cover).

A-12 Support, Batteries, and Service
Accessing MS-DOS

You can access the MS-DOS prompt through the Finder by selecting MS-DOS System. All other built-in applications must be closed before you can get to the MS-DOS prompt. The default prompt in the HP 95LX is >.

The HP 95LX display shows you part of the full MS-DOS screen, which is 80 characters wide. Whenever the cursor moves out of the HP 95LX portion of the screen, the HP 95LX window adjusts to show the portion of the MS-DOS screen that the cursor moved into. That way, the cursor is never out of the HP 95LX display. This feature is called cursor tracking. If you prefer, you can disable it by using the DISPCTL command, described in “Special HP 95LX DOS Commands” later in this appendix.

You can move the HP 95LX window around the MS-DOS screen without regard to the cursor position by using ALT-arrow key combinations. For example, pressing (ALT) (D) moves the HP 95LX window one character to the right. The shifted arrow keys can also be used with the ALT key. For example, pressing (ALT) (CS) (ALT) (D) moves the HP 95LX window to the far right of the MS-DOS screen. You can disable ALT-arrow key movement by using the DISPCTL command, described in “Special HP 95LX DOS Commands” later in this appendix.

Experiment with these features to get a good feel for how they work.
Files and Directories

Naming Files
A filename has from one to eight characters. An extension to a file name is one to three additional characters separated from the file name by a period. For example:

```
YOURFILE.NEW
```

There is no distinction between uppercase and lowercase characters in file names and extensions.

Invalid Characters
File names and extensions cannot include these characters:

- (denotes extension)  [ ]
- / or \  | (vertical bar)
- " or *  
- : or ;  < or >
- space or (comma)

Reserved File Names
Avoid using the following file names. They are already used by the operating system: AUX, CLOCK8, COM1, COM2, COM3, COM4, CON, LPT1, LPT2, LPT3, PRN.
Reserved Extensions
The following extensions are reserved. You can use them if you’re creating any of the indicated file types:

.BAK  Backup files.
.BAT  MS-DOS batch files.
.CBK  Assigned to files recovered by CHRDOS.
.COM, .EXE  Program files.
.MAP  Default extension for list files created by MS-LINK.
.OVL  MS-DOS uses this extension for overlay files.
.REC  MS-DOS uses this extension for RDCOVERed files.
.SYS  Used for device drivers.
.$$$  MS-DOS uses this extension for temporary files.

Special HP 95LX Extensions
The following extensions are used by certain types of files associated with the built-in applications. They are discussed in more detail in the chapters for those applications.

.ABK  Appointment Book files (chapter 17).
.CTF  Character translation files for Datacomm (chapter 31).
.DCF  Datacomm configuration files (chapter 31).
.EQN  Solver equation files (chapter 28).
.FCF  File configuration files (chapter 20).
.LCF  Script (logon configuration) files for Datacomm (chapter 31).
.PBK  Phone Book files (chapter 18).
.PCF  Printer configuration files (chapter 21).
.PCX  Graphics (business card) files (chapter 21).
.TXT  Memo files (chapter 19).

MS-DOS in the HP 95LX  B-3
Wildcards

The wildcard symbols are * and ?. Use * to substitute for an entire file name or extension, or for one or more consecutive characters at the end of a file name or extension.

Use ? to substitute for a single character anywhere in a file name or extension. (You can use up to eight ? symbols in a file name and up to three in an extension.)

<table>
<thead>
<tr>
<th>Option</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>**</td>
<td>All file names.</td>
</tr>
<tr>
<td>*.AAA</td>
<td>All file names that have AAA for an extension.</td>
</tr>
<tr>
<td>MYFILE?</td>
<td>Any file name(s) beginning with MYFILE followed by any other single character (but with no extension).</td>
</tr>
<tr>
<td>MYFILE*??</td>
<td>Any file name(s) beginning with MYFILE followed by any other characters and a two-character extension.</td>
</tr>
<tr>
<td>??FILE*ABC</td>
<td>Any file name(s) beginning with any two characters followed by FILE and any other character(s) and an extension of ABC.</td>
</tr>
</tbody>
</table>
Directories

The following table contains definitions of terms used in the subsequent sections on directories.

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>drive designator</td>
<td>The letter assigned to a disk drive followed by a colon; for example, A:, C:, etc.</td>
</tr>
<tr>
<td>root directory</td>
<td>The “main” directory on any disk created by the MS-DOS operating system. The root directory is indicated by a drive designator and a backslash. For example, A:\ is the root directory on drive A.</td>
</tr>
<tr>
<td>subdirectory</td>
<td>Any directory that is nested in another directory.</td>
</tr>
<tr>
<td>parent directory</td>
<td>Any directory that contains subdirectories.</td>
</tr>
<tr>
<td>path</td>
<td>The list of directories that MS-DOS has to go through to reach a specific file.</td>
</tr>
</tbody>
</table>

Limitations

A directory can contain any mixture of files and other directories. The path from the root directory to a file can contain up to 64 characters.

The characters you cannot use in a directory name are the same as those shown in the “Invalid Characters” listing earlier in this chapter.

Creating Directories

The root directory is automatically created when you format a disk. To create other directories, use the MS-DOS MKDIR (or MD) command.

The Active Drive

This is the drive that MS-DOS accesses for commands and file names unless you specify otherwise. Change from one drive to another by typing the desired drive designator (such as A: or C:) at the MS-DOS prompt.
The Current Directory
This is the directory (or subdirectory) in the active drive that MS-DOS searches for commands and file names unless you specify otherwise. To change from one directory to another, use the MS-DOS CD/DIR (or CD) command.

The built-in HP 95LX applications do not use the MS-DOS active drive and current directory. The active drive and current directory are used only when you execute commands from the MS-DOS prompt.

MS-DOS Commands in the HP 95LX

MS-DOS commands are always executed from the MS-DOS prompt. The standard prompt identifies the active drive and is followed by the flashing cursor. To execute a command, just type the command name. Any command can be typed in any combination of uppercase or lowercase characters. Pressing [ENTER] executes a typed command.

The syntax symbols used in this section are explained in the following table.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>\</td>
<td>Drive designator.</td>
</tr>
<tr>
<td>path</td>
<td>List of directories that MS-DOS must go through to get to a specific file or directory.</td>
</tr>
<tr>
<td>filename</td>
<td>Name of a file, including extension.</td>
</tr>
<tr>
<td>[ ]</td>
<td>Word enclosed in brackets is optional.</td>
</tr>
<tr>
<td>&lt; &gt;</td>
<td>Data enclosed in angle brackets must be entered.</td>
</tr>
<tr>
<td>{ }</td>
<td>Indicates a choice between two or more entries.</td>
</tr>
<tr>
<td></td>
<td>Indicates a choice must be made between two entries (ON/OFF).</td>
</tr>
<tr>
<td>. . .</td>
<td>Indicate an entry may be repeated.</td>
</tr>
</tbody>
</table>
Command arguments and options that appear in uppercase must be typed using the exact letters shown—however, either uppercase or lowercase letters are acceptable. For example, the syntax for the DIR command is DIR [<d>][<path>][<filename>][P][/N]. The option /P, since it is shown in uppercase, must be typed using the letter P or p. Thus, the following are all acceptable:

```
DIR /P
Dir /P
DIR /p
```

Although the syntax statements in this manual are sometimes shown on several lines, they should be typed on a single line.

**BREAK**

**BREAK [ON|OFF]**

Extend `CTRL-BREAK` and `CTRL-C` checking to include disk operations, disk swappers, memory management, etc. If a program bypasses MS-DOS for characters and disk operations, BREAK ON may not enable you to interrupt the program.

To determine break status, execute BREAK without ON or OFF.

**CHDIR or CD**

**CHDIR [<d>][<path>]**

Changes the current directory on the active or specified drive.

- `CHDIR <drive>` returns you to the root directory.
- `CHDIR [<drive>][<path>]` displays the path to the current directory.
- `CHDIR <drive>` displays the current directory on drive `<drive>`.
- `CHDIR <drive>` returns you to the parent directory of the current subdirectory.

**MS-DOS in the HP 95LX**

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CHKDSK [c:\d:\]<path>\<filename> [/F] [/V]

/F If CHKDSK finds errors it can fix, it prompts you to specify whether to correct the errors. (Don't use /F when you're redirecting CHKDSK output to a device or file for later use.)

/V Results in a display of all file and subdirectory names on the disc.

CHKDSK tests the integrity of a disk or file and displays a status report.

To check the entire contents of a single subdirectory use a wildcard (*). A path without a file name or wildcard will be interpreted as a file name and result in the File not found message.

CHKDSK is an external command that resides in the root directory of the C: drive. Therefore, you need to specify C:\CHKDSK (or include C:\ in your PATH) to execute it.

CLS

CLS

Moves the cursor to the upper left corner and clears the screen.
COMMAND


device  The name of a character device to be used instead of CON for command processor input and output.

/P  Causes the second version of COMMAND.COM to be permanent. That is, prevents EXIT from returning you to any other command processor. To nullify the effect of /P, execute a system reset (press CTRL-ALT and DEL at the same time).

/E  Causes MS-DOS to set the size of the environment, <command>, as a 10 integer in the range 150 to 32768, rounded up to the nearest paragraph boundary. The default is 150.

/C  Causes the new command processor to execute the specified <command> then return to the original command processor.

Installs a second version of the COMMAND.COM (MS-DOS) command processor.

If you specify /P and /C in the same command, /P is ignored.

Note

The command processor on the HP 90LX runs from ROM, and if it is referenced by the name COMMAND (without an extension), it will be found by a special ROM search without any program being loaded off disk. To support references to the same COMMAND.COM (with an extension), an interface program with this name is included in the root directory of the C: drive.
COPY (Accepts Wildcards)

COPY [/A] [/B] [<device>] [<filename>] [/A] [/B]

/A  Copies the file as ASCII, up to the first end-of-file mark. Any remaining part of the file is not copied. When /A is used with a target file, an end-of-file marker is appended to the file.

/B  Copies the file as Binary. When specified for a source file, copies the entire file (based on the directory file size), including all end-of-file markers. For a target file, no end-of-file marker is appended to the file.

/V  Verifies the copy of the file in the same way as the VERIFY command.

Used to copy one or more files from one disk or directory to another. Also can be used to make a copy in the same directory with a different name. COPY can be used to transfer data between system devices by substituting a device name for <filename> as appropriate. (For example, CON is the console device and PRN is the system printer.) If the target file already exists, its contents will be replaced by a copy of the source file.

The position of the /A and /B options on the command line determines the files affected by them. The /A and /B options affect the file immediately preceding them and any files following them until another /A or /B is encountered.

To concatenate two or more files into one, use +. For example:

COPY sample1+sample2+sample3 A:\demodisk

concatenates the three files into one file named sample1, which is placed in the demodisk directory on the A drive.

When using COPY with wildcards, the target file will be destroyed if it is selected by a wildcard in the source specifier.

B-10 MS-DOS in the HP 91XL
CTTY

CTTY <device>

CTTY enables you to change the standard I/O device to another valid I/O device. <device> can be any standard MS-DOS I/O device, or an optional character device driver you indicate by the DEVICE command in the CONFIG.SYS file.

The assigned device must be a character I/O device capable of both input and output. Also, programs that access the hardware directly or use BIOS I/O routines are not affected by CTTY.

To return command input to the console execute CTTY CON.

DATE

DATE [setdate]<edt><pp>

Displays or sets the current system date. When you want to view the system date without resetting it, ignore the Enter new date prompt and press ENTER.

The date format may be changed by the COUNTRY command in the CONFIG.SYS file.

DEL (Accepts Wildcards)

DEL [c:][\]<filename>

Erases one or more files from a disk. If you don’t specify a file name or a wildcard, DEL assumes that you want to delete all files in the specified directory or subdirectory.

DEL cannot delete files with hidden or read-only attributes.

DIR

DIR [c:][\]<filename> [/P] [/W]

/P Shows the directory one page at a time.
/W Lists only the file names and subdirectories in a directory, three names to a line. (Excludes time, date, and subdirectory indication.)
LISTS the current or specified directory contents and the amount of free space on the corresponding drive. Accepts wildcards.

Note that in the HP 95LX the /P and /W options have been modified to work with the HP 95LX screen.

DIR does not list "hidden" files.

ERASE (see DEL)

EXIT

EXIT

Lets you change from the present command processor to the previous command processor. If COMMAND.COM was executed from the Filer, EXIT returns you to the Filer. It does not execute if no previous command processor is active.

FORMAT

**Caution** FORMAT destroys all data on the card or disk being formatted.

```
```

Prepare a plug-in RAM card for use, or reinitializes the RAM disk (drive C). You must specify a drive designation (<d>).
/N Prompt you for a volume label.
/P Formats a disk as a "pseudo-logical" (no PClCIA G1S information). Does an extra sector on the card for data storage, but may cause the formatted card not to be compatible with non-HP computers that adhere to the PClCIA format standard. Has no effect on drive C.
/R:<no> Formats with the specified number of sectors allocated for the root directory. The default is 4 sectors, which allows for up to 64 files in the root directory (16 files per sector); this option enables you to change that number of sectors.
/E Formats while erasing all the data on drive (sets them to zero). Does not allow for any possible data recovery after formatting.
/Q Formats while suppressing all prompts and outputs.

MKDIR or MD

MKDIR [<dir>]<path>[<filename>]

Creates a new subdirectory or a dir. MKDIR assumes that the path starts with the current directory unless you specify otherwise. Specifying \ at the beginning of the path tells MKDIR to begin the path at the root directory. Any path from the root directory is limited to 64 characters, including the drive designation.

PATH

PATH [[<dir>]<path>][<dir>]<path> ...]

Identifies additional directories for MS-DOS to search if it cannot find a command program, or batch file in the current directory.

Executing PATH ; cancels an existing search path. Executing PATH alone displays the current search path.

MS-DOS in the HP 95LX  B-13
PROMPT

PROMPT [<text>]

Changes the MS-DOS prompt. You can use text with or in addition to the following:

<table>
<thead>
<tr>
<th>Character</th>
<th>Prompt</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S</td>
<td>The &quot;$&quot; character.</td>
</tr>
<tr>
<td>$L</td>
<td>A carriage return/line feed sequence.</td>
</tr>
<tr>
<td>$H</td>
<td>The &quot;@&quot; character.</td>
</tr>
<tr>
<td>$D</td>
<td>Current system date.</td>
</tr>
<tr>
<td>$E</td>
<td>ASCII escape code (1Bh).</td>
</tr>
<tr>
<td>$G</td>
<td>The &quot;&gt;&quot; character.</td>
</tr>
<tr>
<td>$H</td>
<td>The hash character.</td>
</tr>
<tr>
<td>$L</td>
<td>The &quot;&lt;&quot; character.</td>
</tr>
<tr>
<td>$N</td>
<td>Active drive.</td>
</tr>
<tr>
<td>$P</td>
<td>Current directory.</td>
</tr>
<tr>
<td>$Q</td>
<td>The &quot;=&quot; character.</td>
</tr>
<tr>
<td>$T</td>
<td>Current system time.</td>
</tr>
<tr>
<td>$V</td>
<td>MS-DOS version number.</td>
</tr>
</tbody>
</table>

To return to the MS-DOS default prompt, execute PROMPT without any parameters.

RENAME or REN (Accepts Wildcards)

RENAME [<dir>|]<path>|<filename> <filename>

Changes the name of a file. Only the source file can have the (optional) drive designator and/or path.

RMDIR or RD

RMDIR [<dir>|]<path>|<dirname>

Removes an empty subdirectory from a disk. Does not remove the root or current directory.

A subdirectory is not empty if it contains "hidden" files.

B-14 MS-DOS in the HP 95LX
SET

SET [<name>=<value>]

Adds or deletes strings from the MS-DOS environment. Executing SET without any parameters displays the current MS-DOS environment.

To delete a string, execute SET <name> = (followed by no parameters).

Executing SET with a new <value> for an existing <name> replaces the <value> for that <name>.

TIME

TIME [ch:m:d]<am/pm>[<mm>:<ss>][.zzz]]

Displays or sets the system time. When you want to view the system time without resetting it, ignore the Enter new time prompt and press ENTER.

TIME uses 24-hour time format to set the time. The time format may be changed by the COUNTRY command in the CONFIG.SYS file.

TYPE

TYPE

TYPE [<file>][<path>]<filename>

Displays the contents of a file. To pause the display, press CTRL-BREAK.

TYPE does not accept wildcards.

VER

VER

Displays the version number of the MS-DOS operating system installed in your HP 95LX.
VERIFY

VERIFY [ON/OFF]

Displays the current status of the MS-DOS disk write-verify switch, or turns the switch on or off. (Resetting the system turns the VERIFY switch off.) VERIFY may be turned on or off by a system call in an application program.

VOL

VOL [<d> [:]]

Displays the volume label of the specified or active drive.

---

Special HP 95LX DOS Commands

There are three commands in the HP 95LX that are not part of standard MS-DOS 3.2.

DISPCTL

DISPCTL [+C] [-C] [+K] [-K]

Enables or disables the ALT-arrow key movement and/or the automatic cursor tracking while in the MS-DOS command processor.

+ C Enables cursor tracking.
-C Disables cursor tracking.
+ K Enables ALT-arrow key movement.
-K Disables ALT-arrow key movement.

Both options can be used together, but you must use at least one of them with the command.

For more information on cursor tracking and ALT-arrow key movement, see "Accessing MS-DOS" at the beginning of this appendix.

B-16 MS-DOS in the HP 95LX
PASSWORD

PASSW0RD [/A]/[M]/[D]

/A Sets auto-lock mode. If a password has been set, makes password protection active whenever the HP 95LX is turned on.

/M Sets manual lock mode. If a password has been set, makes password protection active only when the HP 95LX was turned off by [Esc].

/D Deactivates password protection.

When PASSWORD is selected without an option, it starts the procedure for setting or changing a password. For a description of that procedure, see "Activating Password Protection" at the end of chapter 1.

SERCTL

SERCTL [/O][/W][/I]

Controls power to the infrared (I/R) and wired serial ports. This command is for use when running programs from the MS-DOS prompt; the built-in applications handle powering the ports automatically.

/O Turns off power to the active port. Turning off the I/O ports while in the MS-DOS command processor results in significant power savings, thus extending battery life.

/W Powers up and activates the wired serial port. Does not affect the baud setting.

/I Powers up and activates the infrared (I/R) port. Changes the baud setting to 2400.

MS-DOS in the HP 95LX  B-17
Batch Processing

A batch file is a series of MS-DOS commands, batch commands, and/or executable file names, placed in a single file and executed with one command. The response to any command prompt generated by a batch file must be typed from the keyboard. (The response cannot be included in the batch file.)

A batch file must have a .BAT extension.

Creating and Using a Batch File

Use either a text processor that stores text in ASCII format (like the Memo Editor) or use the COPY command.

To create a batch file with COPY:
1. From the MS-DOS prompt, execute
   
   COPY CON <filename>.bat

   2. Type each batch file command on a separate line. (Press ENTER after each command.)

   3. Press CTRL-Z and then ENTER to close and save the file.

To execute a batch file, type the batch file name from the MS-DOS prompt and press ENTER.

To terminate a batch file, press CTRL-BREAK or CTRL-C.

Automatic Execution

To automatically execute MS-DOS commands during the startup process:

1. Change the shell to COMMAND (see the SHELL command under "System Configuration" later in this appendix).

2. Create a batch file named AUTOEXEC.BAT that contains the MS-DOS commands you want executed.

3. Make sure the AUTOEXEC.BAT file is located in the root directory of the default drive (see "System Configuration" later in this appendix for a discussion of the default drive).
Caution: If you use AUTOEXEC.BAT in this way, the HP 95LX built-in applications become unavailable. For more information on this, refer to the description of the SHELL command later in this appendix.

Replaceable Parameters
The ten positional parameters are %0 through %9. The name of the batch file you’re executing always replaces %0; the first parameter after the batch file name replaces %1; the second parameter replaces %2; and so on. For example, consider the following batch file named SAMPLE.BAT:

```
TYPE %0.bat
DIR %1
CHKDSK %2
COPY %4.* %2
```

If you use the command SAMPLE A: B: to execute the file, the following matches occur:

- %0 = SAMPLE
- %1 = A:
- %2 = B:

Batch Command Descriptions
Except for the FOR, ECHO, and REM commands, batch commands can be used only within batch files.

**ECHO**

```
ECHO [ON][OFF]<message>[
```

The optional *message* text, when included, is always displayed regardless of the ON/OFF setting. Most other messages will not be displayed while the ECHO OFF mode is active. To echo a blank line, use `ECHO OFF` for `<message>`.

Executing ECHO without any parameter displays the current ECHO state (ON or OFF).
FOR ... IN ... DO
FOR %%<variable> IN (<set>) DO <command>

<variable> Can be any single character (other than 0 through 9).
<set> Represents a series of values such as file names separated by spaces or a file name with wildcard characters.
<command> A single MS-DOS command or executable file, sometimes followed by a blank space and the %%<variable> data.

If you execute FOR from the MS-DOS prompt instead of in a batch file, use only one % in front of the variable.

GOTO
GOTO <label>
Transfer execution to the line following the line containing the specified label. Can be used with IF for conditional branching.

For a conditional branch, the label must begin with a colon and have from one to eight additional characters. For example, the following batch file executes ECHO ON.

GOTO BRANCH
BRANCH1
ECHO OFF
BRANCH2
ECHO ON

B-20 MS-DOS in the HP 91LX
IF [NOT] <condition> <command>

Enables conditional execution of MS-DOS commands in batch files. IF can be used to test for the following conditions:

- ERRORLEVEL <number> is true if the last program finished with exit code ≥ <number>.
- <string1>==<string2> is true if two strings are identical.
- EXIST [<driv>:] [<path> [<filename>]] is true if <filename> exists.

PAUSE

PAUSE [<message>]

The message can have up to 121 characters. If ECHO OFF has been invoked, PAUSE and the <message> will not be displayed. However, the Strikethrough key when reada... prompt will still appear.

REM

REM [<message>]

The <message> can have up to 122 characters. If ECHO OFF has been invoked, REM and the <message> will not be displayed.

SHIFT

SHIFT

Each of the values assigned to a replaceable parameter is shifted to the next lowest parameter:

< P1 > < P2 > < P3 > < P4 > ... < P10 > < P11 >

%0  %1  %2  ...  %8  %9

MS-DOS is the HF 8HXX  B-21
System Configuration

The HP 95LX first searches the A: drive and then the C: drive for a CONFIG.SYS file. If a CONFIG.SYS file is found on drive A, that drive becomes the default drive. Otherwise, C: is the default drive (whether or not it contains a CONFIG.SYS file).

The system configuration commands (except BREAK) are used only in the CONFIG.SYS file.

Configuration Command Descriptions

BREAK

BREAK = ON
or
BREAK = OFF

This command is functionally identical to the MS-DOS BREAK command. The standard setting is OFF. You can use this command in either the CONFIG.SYS file or as an MS-DOS command. To check the status of BREAK, execute BREAK.

BUFFERS

BUFFERS = <#>

MS-DOS automatically sets the number of buffers to a default determined by the HP 95LX unless there is a BUFFERS command in your CONFIG.SYS file. You can specify from 1 to 99 buffers.
COUNTRY

COUNTRY = <code>

Affects only the format for the system time and date, currency symbol, and decimal separator.

<table>
<thead>
<tr>
<th>Country</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>001</td>
</tr>
<tr>
<td>Belgium</td>
<td>032</td>
</tr>
<tr>
<td>Canadian French</td>
<td>002</td>
</tr>
<tr>
<td>Denmark</td>
<td>045</td>
</tr>
<tr>
<td>Finland</td>
<td>358</td>
</tr>
<tr>
<td>France</td>
<td>033</td>
</tr>
<tr>
<td>Germany</td>
<td>049</td>
</tr>
<tr>
<td>Israel</td>
<td>972</td>
</tr>
<tr>
<td>Italy</td>
<td>049</td>
</tr>
<tr>
<td>Middle East</td>
<td>785</td>
</tr>
<tr>
<td>Netherlands</td>
<td>031</td>
</tr>
<tr>
<td>Norway</td>
<td>047</td>
</tr>
<tr>
<td>Portugal</td>
<td>351</td>
</tr>
<tr>
<td>Spain</td>
<td>034</td>
</tr>
<tr>
<td>Sweden</td>
<td>046</td>
</tr>
<tr>
<td>Switzerland</td>
<td>541</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>044</td>
</tr>
<tr>
<td>United States</td>
<td>001</td>
</tr>
</tbody>
</table>

These country settings are not used by the HP 95LX built-in applications, which instead use the settings from the Setup Utility. See chapter 21 for more information.

DEVICE

DEVICE = [<drive>][<path>]<filename> [<params> ...]

The DEVICE command loads an installable device driver onto the system by specifying the file that contains it.
FILES (File Handles)

FILES = <a>

<a> is the number of files that can be open concurrently via handles for the entire system. (The maximum for a process is 20.) The range is from 5 to 255. MS-DOS default is 20.

LASTDRIVE = <d>

<d> is the last valid drive designator. Valid drives are A to Z. The default is F.

SHELL

SHELL = [<d>][]<path>><filename> [<param>] ... ,

SHELL enables you to specify an alternate command processor.

The HP 95LX does not use the MS-DOS command processor (COMMAND.COM) as its default shell. Instead, it uses $SYSMGR, which is the controlling program for the built-in applications. To change the shell to COMMAND, insert the line SHELL = COMMAND /P in your CONFIG.W System file. Then the HP 95LX will start after a system reset using COMMAND—however, the built-in applications will not be available. To make them available, you must type $SYSMGR in the command line and press Enter. (Once you execute $SYSMGR, you cannot exit it to return to the command processor. However, you can use the System command in the Files to invoke another copy of COMMAND.) If you want to execute some MS-DOS commands on shut up and then invoke the built-in applications, you can put the commands, followed by the $SYSMGR command, in an AUTOEXEC.BAT file.

B-34 MS-DOS in the HP 95LX
STACKS

STACKS = <n>, <s>

STACKS enables you to override the default number of stack frames and their sizes.

<n> The number of stack frames. Valid values are 8 to 64. The default is 8.
<s> The size (in bytes) of each stack frame. Valid values are 32 to 512. The default is 128.

MS-DOS uses a stack frame from the stack pool each time a hardware interrupt occurs, then returns the stack frame to the pool.

Caution
Do not decrease the number or size of the stack frames below the default values. Doing so could cause a system failure.
## Reference Tables

### MS-DOS Function Key Descriptions

In the table below, `<>` represents any character.

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>F1</code> or <code>D</code></td>
<td>Character pointed to by template pointer copied to command line, pointer advances one character.</td>
</tr>
<tr>
<td><code>F2</code>&lt;c&gt;</td>
<td>Starting at template pointer, characters copied from template to command line until specified character is found.</td>
</tr>
<tr>
<td><code>F3</code></td>
<td>Starting at template pointer, characters copied from template to command line until last character in template is reached.</td>
</tr>
<tr>
<td><code>F4</code>&lt;c&gt;</td>
<td>Moves template pointer forward to the specified character. Pointer does not move if character not found.</td>
</tr>
<tr>
<td><code>F6</code></td>
<td>Moves command line contents to template. (Format template contents are last.)</td>
</tr>
<tr>
<td><code>F7</code></td>
<td>End-of-file marker.</td>
</tr>
<tr>
<td><code>C</code>&lt;c&gt;<code>&lt;c&gt;</code></td>
<td>Turns insert mode on or off.</td>
</tr>
<tr>
<td><code>C</code>&lt;c&gt;</td>
<td>Deletes character indicated by template pointer.</td>
</tr>
<tr>
<td><code>ESC</code>&lt;c&gt;</td>
<td>Cancels current command. (No change to template.)</td>
</tr>
<tr>
<td><code>D</code></td>
<td>Moves cursor and template pointer one character to the left.</td>
</tr>
</tbody>
</table>
### Control Characters

<table>
<thead>
<tr>
<th>Keys</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctrl+B</td>
<td>Causes current command or current command line (before Ctrl+D) is pressed.</td>
</tr>
<tr>
<td>Ctrl+C</td>
<td>Stops current process or terminates current command line.</td>
</tr>
<tr>
<td>Ctrl+D</td>
<td>Deletes last characters from command line and terminal screen.</td>
</tr>
<tr>
<td>Ctrl+E</td>
<td>Inserts end of line without clearing command line.</td>
</tr>
<tr>
<td>Ctrl+F</td>
<td>Turns output from terminal to line printer on or off.</td>
</tr>
<tr>
<td>Ctrl+G</td>
<td>Suspends output display on terminal; press any key to resume.</td>
</tr>
<tr>
<td>Ctrl+O</td>
<td>End of file indicator.</td>
</tr>
</tbody>
</table>
There are two limitations to keep in mind when connecting the HP 95LX to a serial printer:

- The HP 95LX supports only software handshaking, not hardware handshaking. If your printer requires hardware handshaking, contact the printer manufacturer to see if there is a method to work around this limitation.
- The HP 95LX is designed to use the HP 82222A serial cable. If you try to use a longer serial cable, you may get poor data transmission to the printer.

At the time of this writing, there are no IR printers available for the HP 95LX, although there is an IR port available.

**Printer Configuration Settings**

The Setup Utility specifies the type (or name) of the printer, the interface type, and the baud rate you are using. The default settings are Epson FX80, COM1 (serial), and 9600 baud. (See “The Printer Configuration Settings” in chapter 21 for more information.)

Setup automatically assumes your printer uses 8 bits/character, 1 stop bit, no parity, and XON/XOFF handshaking enabled. If you...
printer does not agree, you must change its settings (according to specifications in the printer’s owner’s manual).

**Printing the Display Screen**

The easiest way to get a print-out from any application is to print the screen. From (Print) (Output).

This method works for text but not for graphics images, such as a graph or a customized graphics image for your Business Card.

**Printing Information from an Application**

To print out something other than the full screen (such as a range within a 1-2-3 worksheet or a file created by the Memo Editor), select Print Printer in that application.

**The Filer Uses the Print Command**

The Filer displays directories of files and can be used to print any ASCII files within the displayed directory. You can highlight a single file or tag a group of files, and then select Print once. See "Printing Files and Directories" near the end of chapter 20.

**1-2-3 Uses the Print Command**

You can define a range and print it using /Print Printer Go, or copy multiple ranges to a text file using /Print File. You can then print out the text file using the Filer. See chapter 9 for more information.

To establish the page format for print-outs, use /Worksheet Global Default Printer Auto LF, Left, Right, Top, Bottom, Pg-Size, and Unit. See chapter 13.

PrintGraph is not provided with the HP 91XL. However, you can save a graph in a .PIC file, transfer the file to a PC with 1-2-3 PrintGraph (or to another application that prints .PIC files), and print it there.
The Appointment Book and the Phone Book Use the Print Command

You specify the date(s) of appointments or To-Do items, or specify desired phone records, and print them out using Print Printer. You can also copy multiple appointments, records, and items to a text file using Print File. You can then print out the text file using the File or the Memo Editor. See "Printing Appointments and To-Do Items" in chapter 17 and "Printing Phone Book Records" in chapter 18.

The Memo Editor Uses the Print Command

You can print out a text file or marked portions of it using Print Printer. To establish the page margins for your output, use Print Options. See "Printing a Document" in chapter 19.

The Calculator Uses the Print Command

You can print out the complete application area, even if it extends over several pages of function keys. See chapter 27.
Using RPN with the Calculator

Introduction

The Calculator application in the HP 95LX operates in either algebraic or RPN mode. This appendix is for those who want to review or learn how to use RPN. Reverse Polish Notation (RPN) is based on an unambiguous, parentheses-free mathematical logic known as "Polish Notation," developed by the Polish logician Jan Łukasiewicz (1878-1956). While conventional algebraic notation places the operators between the relevant numbers or variables, Łukasiewicz's notation places them before the numbers or variables. For optimal efficiency of the stack, we have modified this notation to specify the operators after the numbers. Hence the term Reverse Polish Notation, or RPN.

Where to Learn More About RPN

There are several easy-to-follow books designed to explain RPN to the beginner. Here is one such book:

ENTER by Jean-Daniel Dodin

It's available at the time of this writing from:

EduCALC
27953 Cabot Road
Laguna Niguel, CA 92677 USA

Telephone: 800 033-2252 (Credit card orders only)
How to Use RPN

Switching Between Algebraic (Alg) and RPN Modes

1. Press MENU.
2. Select Options Alg/RPN to switch from one mode to the other. To indicate RPN mode, the RPN indicator is displayed at the lower left of the screen whenever the one-line is present. If this indicator is not displayed, algebraic mode is set.

Where the RPN Functions Are

<table>
<thead>
<tr>
<th>Function</th>
<th>Definition</th>
<th>Key to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER</td>
<td>Edits and separates one number from the next.</td>
<td>ENTER</td>
</tr>
<tr>
<td>LAST X</td>
<td>Recalls last number in X-register.</td>
<td>LAST</td>
</tr>
<tr>
<td>R↓</td>
<td>Rolls down stack contents.</td>
<td>↓</td>
</tr>
<tr>
<td>X ↔ Y</td>
<td>X-register exchanges with Y-register.</td>
<td>↔</td>
</tr>
<tr>
<td>CHS</td>
<td>Changes sign.</td>
<td>CHS</td>
</tr>
</tbody>
</table>

D-2 Using RPN with the Calculator
Arithmetic Topics Affected by RPN

Only the following operators work differently in RPN than in Algebraic mode:

- Two-number arithmetic (\(+, -, \times, \div\)).
- The percent function (\(\%\)).
- The LAST X function (\(\text{\texttt{\textsc{\textasteriskcentered}} X} \)).

If you enter a number in the edit line (the bottom available line in the display) in one of the ways listed above, the order you type keys will depend on whether you’re in RPN or Algebraic mode.

It makes no difference whether you type that number into the HP 38L’s edit line or whether you recall it from a storage register. The keystrokes you use to act on that number will depend only on the mode you’re using, Algebraic or RPN, not on whether the number is typed or recalled.

Two-Number Arithmetic

Here are some examples of two-number arithmetic. Notice that:

- \(\text{\texttt{\textasteriskcentered}}\) separates numbers that you key in.
- The operator (\(+, -, \times, \div\)) completes the calculation.

Note that one-number functions (such as \(\sqrt{x}\)) work the same in Algebraic and RPN modes.

If RPN is not displayed at the lower left of the screen, set RPN mode by selecting \(\text{\texttt{\textasteriskcentered}}\) Options Alg/RPN.

Using RPN with the Calculator D-3
<table>
<thead>
<tr>
<th>To Calculate</th>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 + 3</td>
<td>12(ENT) 3(ENT)</td>
<td>15.00</td>
</tr>
<tr>
<td>12 - 3</td>
<td>12(ENT) 3(ENT)</td>
<td>9.00</td>
</tr>
<tr>
<td>12 × 2</td>
<td>12(ENT) 2(ENT)</td>
<td>36.00</td>
</tr>
<tr>
<td>12 ÷ 3</td>
<td>12(ENT) 3(ENT)</td>
<td>4.00</td>
</tr>
<tr>
<td>√11</td>
<td>11(ENT)</td>
<td>3.31</td>
</tr>
<tr>
<td>1/12</td>
<td>12(UP)</td>
<td>8.00</td>
</tr>
<tr>
<td>12³</td>
<td>12(ENT) 2(ENT)</td>
<td>144.00</td>
</tr>
<tr>
<td>12³/2 (cube root)</td>
<td>12(ENT) 3(ENT)</td>
<td>2.29</td>
</tr>
</tbody>
</table>

You do not need to use ENTER before an operator, only between operands. Key in both numbers (separated by ENTER) before pressing the operator key.

**Note**

You can use ▼ instead of ENTER as a number separator. It’s good practice to use ▼ when working in the Solver, since ENTER enters a value into a highlighted variable. (This is demonstrated in part 3 of the first solver example in chapter 28.)

Say you’re in RPN mode and you happen to have the variable X highlighted in the Solver’s solve-x display. You want to perform some arithmetic in the calc line unrelated to the highlighted variable. In calculating 22.5/3.7, for instance, you’d normally press 22.5(ENT) 3.7(ENT). In this case, ENTER not only separates 22.5 and 3.7, it also enters 22.5 into X.

To protect against entering unwanted values into Solver variables, use ▼ to separate two numbers rather than ENTER.
The Percent Function

The \( \times \) key calculates percentages without using the \( \div \) key.
Combined with \( + \) or \( - \), it adds or subtracts.

<table>
<thead>
<tr>
<th>To Calculator</th>
<th>Press:</th>
<th>Display:</th>
</tr>
</thead>
<tbody>
<tr>
<td>27% of 200</td>
<td>200 ( \text{ENTER} ) 27 ( % )</td>
<td>54.00</td>
</tr>
<tr>
<td>200 less 27%</td>
<td>200 ( \text{ENTER} ) 27 ( % ) ( \ominus )</td>
<td>146.00</td>
</tr>
<tr>
<td>12% greater than 25</td>
<td>25 ( \text{ENTER} ) 12 ( % ) ( \oplus )</td>
<td>28.00</td>
</tr>
</tbody>
</table>

Compare these keystrokes in RPN and Algebraic modes:

<table>
<thead>
<tr>
<th>RPN Mode</th>
<th>Algebraic Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>27% of 200</td>
<td>200 ( \text{ENTER} ) 27 ( % )</td>
</tr>
<tr>
<td>200 less 27%</td>
<td>200 ( \text{ENTER} ) 27 ( % ) ( \ominus )</td>
</tr>
</tbody>
</table>

No Parentheses Used for Chain Calculations

As you key in a calculation, intermediate results are stored until you need them. The earlier cube root \( (12^{1/3}) \) and percentage addition \( (12\% \text{ greater than 25}) \) examples are two simple examples of chain calculations.

For another example, calculate \( 7 \times (12 + 3) \).

Start the calculation by finding \( 12 + 3 \). Notice that you don’t need to press \( \text{ENTER} \) to save the intermediate result \((15)\) before proceeding.

Since it is a calculated result, it is saved automatically—without using parentheses.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 ( \text{ENTER} ) 3 ( \ominus )</td>
<td>15.00</td>
<td>Intermediate result.</td>
</tr>
<tr>
<td>7 ( \ominus )</td>
<td>107.00</td>
<td>Pressing the function key produces the answer.</td>
</tr>
</tbody>
</table>

Now study these two examples. Note the automatic storage and retrieval of intermediate results.

Using RPN with the Calculator D-5
To Calculate:  
360 \div (750 \times 12)  
\left(456 - 75\right) \div 16.5  
456 \div (75 \div 18.5) \div 68  
x \times (68 \div 1.9)  

Press:  
\text{ENTER} 190 \text{ENTER} 12 \text{ENTER} 75 \text{ENTER} 18.5 \text{ENTER} 68 \text{ENTER} 1.9 \text{ENTER} \text{RCL} \text{STO} \text{X}  

Display:  
0.04  
737.07  

The Stack  
The four-level stack is the key to the automatic storage of intermediate results, demonstrated in the examples above. Each level is a storage location, called a register. These four registers are "stacked" on top of each other, and comprise a work area for calculations. The registers—labeled X, Y, Z, and T—store and manipulate four current numbers. The "oldest" number is the one in the T-register (T for "top").

\[ \begin{array}{c}
\text{X:} \ 0.00 \\
\text{Y:} \ 0.00 \\
\text{Z:} \ 0.00 \\
\text{T:} \ \text{"Oldest" number}
\end{array} \]

The number you see in the display is in the X-register. The X-register contains the most "recent" number.

To watch the stack in action:  
From the Calculator application, select \text{MODE} Math to see the four levels of the stack on the Calculator Registers screen. The X-register is shown in the first line, while registers Y, Z, and T are displayed just above the first line. As you perform RPN calculations, you can see the stack in action by watching this screen.

To review the stack (roll down):  
The \text{R} \text{DOWN} (roll down) function (the primary function of \text{Y}) lets you review the entire contents of the stack by "rolling" the contents downward, one register at a time.

D-4. Using RPN with the Calculator
To roll a full stack:

Suppose the stack is filled with 1, 2, 3, 4 (press 1 ENTER, 2 ENTER, 3 ENTER, 4). Pressing (9) four times rolls the numbers all the way around and back to where they started:

T | 1 | 4 | 3 | 2 | 1
Z | 2 | 1 | 4 | 3 | 2
Y | 3 | 2 | 1 | 4 | 3
X | 4 | R↓ | 3 | R↓ | 2 | R↓ | 1 | R↓ | 4

When you press (9), the value in the X-register rotates around into the Y-register. Notice that the contents of the registers are rolled, while the registers themselves maintain their positions.

To exchange the X- and Y-registers in the stack:

The (A) function (in the Calculator application, press C) swaps the contents of the X- and Y-registers without affecting the rest of the stack. Pressing (A) again restores the original order of the contents.

The (A) function is used primarily to swap the order of numbers in a calculation. For example, an easy way to calculate \( 9 \div (15 \times 8) \) is to press \( 9 \text{ ENTER} \times \text{ ENTER} \div \text{ ENTER} \). (The answer: 0.09.)

Arithmetic—How the Stack Does it

The contents of the stack move up and down automatically as new numbers enter the X-register (filling the stack), and as operators combine two numbers to produce a new number in the X-register (dropping the stack). See how a full stack does, lifts, and drops its contents while calculating (s and t represent values already on the stack).

Using RPN with the Calculator 9-7
Notice that when the stack drops, it replicates the contents of the T-register and overwrites the Z-register.

When the stack lifts, it pushes the top contents out of the T-register, and that number is lost. This shows that the stack’s memory is limited to four numbers for calculation.

Because of the automatic movement of the stack, you do not need to clear the display before doing a new calculation.

To learn how ENTER works:

When ENTER separates two numbers, what happens in the stack? To find out, study the figure below to see what happens when 5 is added to 6:

To use a number twice in a row:

You can use the replicating feature of ENTER to other advantages. To add a number to itself, key in the number and press ENTER 2.
To fill the stack with a constant:

The replicating effect of \( \text{ENTER} \), together with the replicating effect (from \( T \) into \( Z \)) of stack drop, allows you to fill the stack with a numeric constant for calculations. To see how this works, calculate how $1000 will grow over 10 years at a 10%/year compound growth rate:

1. Press 1.1 \( \text{ENTER} \) \( \text{ENTER} \) \( \text{ENTER} \). This fills the stack with the number 1.1 (the factor by which your balance will grow each year).
2. Key in your beginning balance, 1000, but don’t press \( \text{ENTER} \).
3. Press \( \text{X} \) ten times and see your ending balance of 2593.74.

As the figure below shows, the first step filled all four stack levels with 1.1. The second step replaced the 1.1 in the X-register with 1000. Then, each time you pressed \( \text{X} \), the number in the X-register was multiplied by the 1.1 in the Y-register, the number in Z dropped to Y, and the value in T replicated to Z.

<table>
<thead>
<tr>
<th>T</th>
<th>1.10</th>
<th>1.10</th>
<th>1.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
</tr>
<tr>
<td>Y</td>
<td>1.10</td>
<td>1.10</td>
<td>Print</td>
</tr>
<tr>
<td>X</td>
<td>1000</td>
<td>1000</td>
<td>10 times 2593.74</td>
</tr>
</tbody>
</table>

To clear numbers:

To clear the calc line, press \( \text{DEL} \).
To clear all data from the stack, including the calc line, select \( \text{MTHS} \) Erase Stack.

The LAST X Register

The LAST X register is a companion to the stack: it stores the number that had been in the X-register just before the last numeric operation (such as a \( \text{X} \) operation). Pressing \( \text{LAST} \) returns this value to the X-register. This ability to recall the “last x” value has two main uses:

Using RPN with the Calculator   D-9
- Correcting errors: retrieving a number that was in the X-register just before an incorrect calculation.
- Reusing a number in a calculation, where that number is in the X-register just before executing the arithmetic operation.

**Example:** Using **LAST** to **Reuse a Number**. Calculate this expression:

\[
\begin{array}{c}
96.74 + 52.39 \\
\hline
149.13
\end{array}
\]

**Keys:**

- **MENU A**
  - Displays the calculator arithmetic screen. (If RPN is not displayed in the lower left of the screen, select **MATH** Options Alg/RPN).
- **96.74 ENTER**
  - Enters 96.74 into the calculator line.
- **52.39 LAST**
  - Adds 52.39 to 96.74. The calculator line now shows the sum, 149.13.
- **LAST**
  - Retrieves the number before the + operation, saved in LAST. The calculator line now shows 52.39.
- **1 ÷**
  - Divides 52.39 into 149.13. The 2.85 result is displayed.

**Chain Calculations**

The automatic lifting and dropping of the stack's contents let you retain intermediate results without storing or reentering them, and without using parentheses. This is an advantage that RPN stack has over algebraic calculator logic. Other features of RPN include the following:

- You never work with more than two numbers at a time.
- **ENTER** separates two numbers keyed in sequentially.
- Pressing an operator key executes that operation immediately.
- Intermediate results appear as they are calculated, so you can check each step as you go.
- Intermediate results are automatically stored. They reappear automatically as they are needed for the calculation—the last result stored is the first to come back out.

**D-10 Using RPN with the Calculator**
You can calculate in the same order as you would with pencil and paper—that is, from the innermost parentheses outward:

\[ 4 \div (14 \div (7 \times 3) - 2) = 0.12 \]

can be solved as \( 1 \text{ ENTER } 14 \div 12 \text{ ENTER } 7 \times 3 \text{ ENTER } 2 \) \( \div \) 2 \( \div \) 4 \( \div \) 2 \( \div \) 2

**Exercises**

Here are some extra problems that you can do to practice using RPN.

Calculate: \((14 + 12) \times (18 - 12) \div (9 - 7) = 78.00\)

A solution: \(14 \text{ ENTER } 12 \div \) \(18 \text{ ENTER } 12 \div \) \(9 \text{ ENTER } 7 \div \) \(\div \) \(\times \)

Calculate: \(23^2 - (12 \times 9) + (1 \div 7) = 412.14\)

A solution: \(23 \text{ ENTER } 2 \times \) \(12 \text{ ENTER } 9 \times \) \(1 \text{ ENTER } 7 \div \) \(\div \) \(\times \)

Calculate: \(\sqrt{(5.4 \times 0.8) \div (12.5 - 0.75)} = 0.60\)

A solution: \(5.4 \text{ ENTER } 0.8 \times \) \(12.5 \div \) \(0.75 \text{ ENTER } 1 \) \(\div \) \(\times \)

or

\(5.4 \text{ ENTER } 0.8 \times \) \(12.5 \div \) \(0.75 \text{ ENTER } 1 \) \(\div \) \(\times \)

Calculate: \(\sqrt{(5.36 \times 14 - 5.5 \times (5.36 - 7.62) \times 0.32)} = 4.57\)

A solution: \(5.36 \text{ ENTER } 14 \times \) \(5.5 \text{ ENTER } 5.36 \) \(\times \) \(7.62 \) \(\times \) \(0.32 \times \) \(\times \) \(0.32 \) \(\times \) \(0.32 \times \) \(\times \)

**Selected Examples**

The following examples have been converted to RPN keystrokes. They’ve been selected from “Additional TYNM Examples” in chapter 25.

These examples illustrate how to convert algebra to RPN keystrokes in less common situations with \(\text{S}\) and with \(\text{SCI}\).

Using RPN with the Calculator D-11
Example, APR of a Loan With Fees. Ernest Minnie is charged two points for the issuance of a mortgage. (One point is equal to 1% of the mortgage amount.) If the mortgage amount is $80,000 for 50 years and the interest rate is 11 1/2% annually with monthly payments, what APR is Ernest paying?

1. Calculate PMT, using \( PV = 80,000 \) and \( i/y = 11.5% \).
2. Adjust \( PV \) to reflect the amount of the loan minus the fees. Then, calculate the APR (\( i/y \)), using the PMT calculated in step 1 (all other values remain the same).

**Step 1. Calculate PMT**

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MENU T</strong></td>
<td>Displays the TVM function keys.</td>
</tr>
<tr>
<td><strong>MENU F D</strong></td>
<td>Erases previous values, sets 12 payments per year, and sets End mode. You don't need to erase previous values. We do it here to improve example clarity.</td>
</tr>
<tr>
<td>50 N</td>
<td>Stores 500, the number of monthly payments (displayed near the top-right corner of your screen).</td>
</tr>
<tr>
<td>11.5 I/YR</td>
<td>Stores interest rate.</td>
</tr>
<tr>
<td>60000 PV</td>
<td>Stores amount of loan.</td>
</tr>
<tr>
<td>0 FV</td>
<td>No balloon payment.</td>
</tr>
<tr>
<td><strong>PMT</strong></td>
<td>Calculates monthly payment.</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{Number of periods... } N & = 500.00 \\
\text{Annual interest... } I/Y & = 11.50 \\
\text{Present value... } PV & = 60,000.00 \\
\text{Payment... } PMT & = -594.17 \\
\text{Future value... } FV & = 0.00 \\
\text{Payments per year... } P/Y & = 12 \\
\text{Begin/End mode... } B/E & = \text{END}
\end{align*}
\]
Step 2. Adjust \( PV \) and calculate \( APY \).

\[ FV = PV \]

Reduces loan amount by the two points charged and shows actual amount received by borrower.

\[ 12 \times 12 = 144 \]

Calculates \( APY \).

Annual interest........ \( 12 \times 12 = 144 \)

Present value........ \( PV = 50,000 \times 0.00 \)

Example: Interest-Only Loan With Fees From the Lender’s Point of View. Bill Lender is making a $1,000,000 10-year, 10.5% (annual interest) interest-only loan with an origination fee of 3 points. What is the yield to Bill? Assume that the interest-only payments are made monthly. \( (PMT) \) is $1,000,000 \times 10.5\% + 12, \( FV \) is the entire loan amount, and \( PV \) is the loan amount minus the points.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU T</td>
<td>Displays the TVM function keys.</td>
</tr>
<tr>
<td>MDIS E D</td>
<td>Erases previous values, sets 12 payments per year, and sets End mode.</td>
</tr>
<tr>
<td>10</td>
<td>Sets 120, the total number of payments.</td>
</tr>
<tr>
<td>1000000 ENTER</td>
<td></td>
</tr>
<tr>
<td>10.5 12</td>
<td></td>
</tr>
<tr>
<td>PMT</td>
<td>Calculates and stores monthly payment.</td>
</tr>
</tbody>
</table>

Number of periods........ \( N = 120 \times 0.00 \)

Annual interest........ \( I/Y = 10.5\% \)

Present value........ \( PV = 0.00 \)

Payment................. \( PMT = 9,750 \times 0.00 \)

Future value............ \( FV = 0.00 \)

Payments per year........ \( P/Y = 12 \)

Begin/End mode........ \( B/E = EHO \)

Using RPN with the Calculator D-13
Stores entire loan amount as balloon payment.

Stores account borrowed (total minus points).

Calculates APR, the yield to lender.

Number of periods, \( N \) = 120.00
Annual interest... \( I/Y \) = 11.00
Present value..... \( PV \) = -970,000.00
Payment......... \( PMT \) = 8,750.00
Future value..... \( FV \) = 1,000,000.00


Les Tausak opens an individual retirement account with a dividend rate of 8.175%, and invests $2,000 at the beginning of each year for 25 years.

Part 1. Calculate the account balance at retirement.

**Keys:**

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Displays the TVM function keys.</td>
<td><strong>T</strong></td>
</tr>
<tr>
<td>Erases previous values and sets 12 payments per year.</td>
<td><strong>E D</strong></td>
</tr>
<tr>
<td>Sets Begin mode.</td>
<td><strong>D/E</strong></td>
</tr>
<tr>
<td>Sets 1 payment per year.</td>
<td><strong>1 P/YR</strong></td>
</tr>
<tr>
<td>Stores number of payment periods until retirement.</td>
<td><strong>35 N</strong></td>
</tr>
<tr>
<td>Stores dividend rate.</td>
<td><strong>6.175 I/YR</strong></td>
</tr>
<tr>
<td>Present value of account (before first payment) is zero.</td>
<td><strong>0 PV</strong></td>
</tr>
<tr>
<td>Stores annual deposit.</td>
<td><strong>2000 7/3 PMT</strong></td>
</tr>
</tbody>
</table>

D-14 Using RPN with the Calculator
Calculates amount in account at retirement.

\[
\begin{align*}
\text{Number of periods... } N &= 35.00 \\
\text{Annual interest... } I/YR &= 8.18 \\
\text{Present value... } PV &= 0.00 \\
\text{Payment... } PMT &= -2000.00 \\
\text{Future value... } FV &= 307,640.45 \\
\text{Payments per year... } P/YR &= 1 \\
\text{Begin/End node... } B/E &= \text{BEGIN}
\end{align*}
\]

**Part 2.** How much has Les paid into the account at retirement?

\[
\begin{align*}
PMT \times N
\end{align*}
\]

\[-70,000.00\]

**Part 3.** How much interest has the account earned? (The interest earned equals the difference between \(FV\) and the total amount deposited.)

\[
\begin{align*}
FV
\end{align*}
\]

\[317,640.45\]

**Part 4.** If his post-retirement tax rate is 15%, what is the after-tax future value of the account? Assume only interest is taxed.

\[
\begin{align*}
\text{Calculates } 15\% \text{ of total interest.}
\end{align*}
\]

\[47,646.07\]

Using RPN with the Calculator D-15
Part 5. Calculate the purchasing power of this amount in today’s dollars, assuming an 8% annual inflation rate.

PMT: 
For this calculation there are no periodic payments.

8 I/YR: 
Purchasing power is $22,995.36.

Number of periods... N = 35.00
Annual interest... I/YR = 8.00
Present value..... PV = -22,995.36
Payment............ PMT = 0.00
Future value..... FV = 339,994.39

Example: Future Value and Purchasing Power of a Taxable Retirement Account. Lazy Smart is considering investing his money with E. Norma Spayback Investment Company. They claim that if Lazy invests $3,000 with them each year for 35 years at a dividend rate of 8.175%, with dividends taxed as ordinary income, he’ll be ahh at retirement with close to $390,000. Exactly how much would Lazy have in the account at retirement? Assume a tax rate of 28%, and that payments begin today.

Part 1. Calculate the future value of the taxed retirement account.
Keys:  
[Menu] T  
[Menu] E D  
[B/E]  
1 [P/YR]  
35 [N]  
8.175 [ENTER]  
28 [R] [I/YR]  
0 [FV]  
3000 [PMT]  
[FV]  

Calculates and stores interest rate diminished by tax rate.
Stores f for present value.
Stores annual payment.
Calculates future value of the taxed retirement account.

Number of periods... N = 35.00
Annual interest.... I/YR = 5.60
Present value...... PV = 0.00
Payment.............. PMT = -3800.00
Future value........ FV = 345,505.41

Payments per year... P/YR = 1
Begin/End mode..... B/E = BEGIN

Part 2. What will be the purchasing power of that amount in today's dollars, assuming 8% annual inflation?

0 [PMT]  
5 [F/YR]  
[FV]  
Purchasing power is $23,368.11
FV = -23,368.11

Using RPN with the Calculator D-7
HP 95LX Character Set

This appendix contains a table defining your HP 95LX character set as well as instructions for generating special characters.

The HP 95LX character set is equivalent to code page 860, the IBM PC multilingual character set. (Note that your HP 95LX contains MS-DOS 3.22, which does not support code-page switching.) All the HP 95LX applications use this set except 1-2-3, which uses LICS, the Lotus International Character Set. Most LICS characters are included in code page 860; the few that are not will not display on the HP 94LX. For more information about LICS, including a table of LICS characters, see appendix F.

The Character Set Table

The following page contains the full HP 95LX character set.
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
</tr>
</tbody>
</table>

1-2  HP 951X Character Set
Generating Special Characters

There are two primary ways to generate special characters on your HP 95LX:

1. By using the [ALT] key in combination with a character code. For example, in the character set table on the previous page you can see that the character code for the ® symbol is 166 (decimal value 166 across plus decimal value 9 down). So, to generate ® on your HP 95LX, you would hold down [ALT] while you type 166.

2. By pressing the [CHAR] key and then another key. For example, pressing [CHAR] and then generates £. Many, but not all special characters in the HP 95LX character set can be generated using the [CHAR] key. Here is the keyboard with those available:

Note that a few keys have shifted [CHAR] definitions in addition to regular [CHAR] definitions. For example, pressing [CHAR] generates ç, while pressing [CHAR] generates a small number 1 (¹).

Generating Accented Characters. The keys , , , , and represent accent marks when used with the [CHAR] key. When you press one of these keys, it prepares the HP 95LX to generate an accented form of the next key you press. For example, pressing [CHAR] followed by [à] generates à.
Lotus International Character Set (LICS)

1-2-3 uses the Lotus International Character Set to display, store, and print characters. You can use LICS codes to enter text characters that are not on your keyboard.

There are 256 LICS codes (decimal codes 0 through 255) that are divided into three groups:

- Codes 0 through 31 represent control characters and not LICS characters. Although these control characters are used internally by 1-2-3, general use of these characters in the worksheet is not supported.
- Codes 32 through 127 represent the ASCII characters 32 through 127. They are shown in the first table in this appendix, "Standard ASCII Characters."
- Codes 128 through 255 represent various international characters and special symbols, such as £ (British pound) and ø (ø). These are listed in the second table in this appendix, "International Characters and Special Symbols."

Displaying and Printing LICS Characters

If your IBM 515X cannot display a LICS character, or if your printer cannot print a LICS character, the IBM 515X uses a fallback presentation for that character. The intention of the fallback presentation is to represent the LICS character as closely as possible using characters that are available on your monitor or printer. For example, if you use the © symbol and your printer cannot print it, the IBM 515X might display (c) or c as the fallback presentation (depending on the capabilities of your printer).
Entering LICS Characters

There are three ways to include a LICS character in a text entry. The method you use depends on the specific LICS character you want to enter:

- You can enter any LICS character using the 1-2-3 @CHAR function and the LICS code for the character, as described in the following section “Using @CHAR.”
- You can enter many LICS characters using compose sequences, as described later in this appendix in “Using Compose Sequences.”
- You can enter the LICS characters that represent standard ASCII characters (codes 31 through 127) by pressing the appropriate character key on your keyboard.

Using @CHAR

@CHAR(z) returns the character that the LICS code z produces. You can enter any LICS character in the worksheet using the @CHAR function and the LICS code for the character. For example, the LICS code for © in 169 (taken from the “International Characters and Special Symbols” table). To enter © in a worksheet, type @CHAR(169) and press ENTER.

If you want to combine a LICS character with other text, however, you must use the @CHAR function in a string formula. For more information on the @CHAR function, see @CHAR in chapter 14.

Using Compose Sequences

A compose sequence is a series of keystrokes you use in combination with the COMPOSE key (ALT-F1) in most HP 95LX applications to enter a LICS character. The tables in this appendix list the compose sequences for the characters that have them. You enter one of these characters by pressing COMPOSE (ALT-F1) and then typing the sequence of keystrokes listed for that character. For example, to enter the character £ (British pound) in a cell, look up the compose sequence for £ in the “International Characters and Special Symbols” table. You will find the compose sequence is £=. Press COMPOSE (ALT-F1), type £=, and press ENTER to complete the entry.
Printing Characters That Aren't in LICS

If your printer has full backspacing capability, you can use the merge character, COMPOSE ([ALT] [F6]) or, to print characters that are not in LICS. Essentially, a merge character tells 1-2-3 to overstrike one character on another. After printing the first character you specify, 1-2-3 prints a backspace (or the equivalent), and then prints the next character you specify. For example, to create a with an acute accent, you would type & press COMPOSE ([ALT] [F6]), and type &-'—mg is the merge character and ' (apostrophe) is the character you want 1-2-3 to overstrike on the &.

You can also use the merge character to underline a character. For example, suppose you want to enter the word LOTUS in a 1-2-3 cell and underline each letter:

1. Move the cell pointer to the cell where you want to enter the label.
2. Type L, press COMPOSE ([ALT] [F6]), and type ng...
3. Type o, press COMPOSE ([ALT] [F6]), and type ng...
4. Type t, press COMPOSE ([ALT] [F6]), and type ng...
5. Type U, press COMPOSE ([ALT] [F6]), and type ng...
6. Type S, press COMPOSE ([ALT] [F6]), and type ng...
7. Press [ENTER] to complete the label.

Note Although you can overstrike any printable character with any other, the result may not always look the way you expected.
LICS Tables

Standard ASCII Characters

The following table defines LICS codes 32 through 127, which represent standard ASCII characters. It also lists all possible compose sequences. (For information on compose sequences, see “Entering LICS Characters” earlier in this appendix.)

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<th>LICS Code</th>
<th>Character</th>
<th>Compose Sequence</th>
<th>LICS Code</th>
<th>Character</th>
<th>Compose Sequence</th>
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<td>g</td>
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<td>delete</td>
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**International Characters and Special Symbols**

The following table defines LICS codes 128 through 255, which represent international characters and special symbols. It also lists all possible compose sequences. (For information on compose sequences, see "Entering LICS Characters" earlier in this appendix.)

**Note**

Certain characters in the table are either uppercase or lowercase—(UC) or (LC)—added to denote case where appropriate. Also, unknown characters are shown as *.*
<table>
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<td>192</td>
<td>A (UC)</td>
<td>A&quot;</td>
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<tr>
<td>193</td>
<td>A (UC)</td>
<td>A&quot;</td>
</tr>
<tr>
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<td>A (UC)</td>
<td>A&quot;</td>
</tr>
<tr>
<td>195</td>
<td>A (UC)</td>
<td>A&quot;</td>
</tr>
<tr>
<td>196</td>
<td>A (UC)</td>
<td>A&quot;</td>
</tr>
<tr>
<td>197</td>
<td>A (UC)</td>
<td>A&quot;</td>
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<tr>
<td>198</td>
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<tr>
<td>199</td>
<td>A (UC)</td>
<td>A&quot;</td>
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</table>
TigerFox

TigerFox is a game built into the HP 95LA. The best way to learn it is to play it, experimenting with different strategies and styles. This appendix contains information to get you started.

The Object of the Game

In TigerFox you move about in a maze pursuing a fox while a tiger is pursuing you! You get points for erasing the fox's trail and for catching the fox after all his trail is erased. You lose points for catching the fox when some of his trail remains, and the tiger gets points for catching you. The object of the game is simply to score as many points as you can. The game ends when the tiger's score is higher than yours:

- You get 1 point per dot for erasing the fox's trail.
- You get 100 points for catching the fox with no trail left.
- You lose 250 points for catching the fox without erasing all his trail.
- The tiger gets 250 points for catching you.
Preparing to Play

To start TigerFox do the following:

1. Close all HP 95LX applications.
2. Press (C) to start the File.
3. Use (C) to highlight the file TF.COM.
4. Press (RUN) (C).

Here's the first screen you'll see:

![maze diagram]

You are at the middle top, the tiger is at the middle bottom, and the fox is at the upper-right corner of the maze. Also, notice spiral-shaped maze changers that, if you run into them, lead you to other mazes.

(There are 45 different mazes.)

At the right of the display is the status area, and at the bottom are the descriptions of the active function keys.

- **F1** : Play
- **F2** : Keys
- **F3** : Maze
- **F4** : Speed

**G-2 TigerFox**
During the game, you control your movement by changing your direction, not your speed. (You're moving all the time, unless you're blocked by a wall ... or eaten by the tiger.) The 4 key rotates you \( \frac{1}{4} \) turn to the left (counterclockwise) each time you press it, and the 2 key rotates you \( \frac{1}{4} \) turn to the right (clockwise) each time you press it. You automatically try to move the direction you're pointing. (Note that you can redefine these movement keys to be any keys you want by using 12.)

Two other keys are worth noting:

- [pause] Temporarily suspends play. Pressing any key resumes play.
- [Q] Quits the game and returns you to the Filer.

Now ... Let's Play

If you followed the instructions under “Preparing to Play,” you should see the maze on the screen. If this is one of your first times playing, you might want to use \( \text{[G]} \) to reduce the speed to a more comfortable level until you get used to moving around the maze.

When you're ready, press \( \text{[J]} \) and then any other key to start play.

Have fun!
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