

Spectaculator

Radio Shack®



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Introduction

Spectaculator will turn your Color Computer into a sophisticated calculator and your television into a "worksheet," divided into rows and columns. After entering numbers and formulas, Spectaculator calculates and displays the computed values automatically. One powerful feature of Spectaculator is the ability to "erase" an entire worksheet while leaving the report format and formulas intact. Spectaculator recalculates the formulas with the new numbers you enter.

You can also type headings and labels on the worksheet to give your reports a professional look. With just a few simple keystrokes, you can insert and delete rows and columns of data. An eraser is no longer necessary. Now, you can make error corrections and editing changes automatically. In addition, you'll be able to save worksheets on tape for later use. All or part of a worksheet can be printed.

Use Spectaculator for budgeting and forecasting purposes, statistics, math homework—whatever you can think of. You'll soon find that you're saving not only paper but a lot of valuable time.

Features

- Overtyping for easy error correction.
- Delete or insert rows and columns of data.
- Save worksheet for later use.
- Prepare table format with formulas for easy recalculating to avoid constant retyping.
- Prints all or only part of a document.

Required Equipment

TRS-80 Color Computer with 4, 16, or 32K memory

Optional Equipment

Radio Shack Line Printer VII (or appropriate serial printer)

Tape Recorder

Overview

This manual is divided into five sections. Part I will help you get familiar with the computer. Basic terms and concepts unique to the Spectaculator program are introduced.

Part II provides a detailed explanation of each command and the various methods and options you can use. This section outlines the “fine” points and offers remedies if any problems should occur.

Part III is a “sample session,” using a step-by-step example. You’ll create a simple addition table (using a wide variety of commands) and learn how to save and print a worksheet.

In Part IV, more complicated examples involving budgets, statistics, geometry, etc. are provided. The advanced sessions include instructions on what formulas to enter and printouts of the worksheets. Part V is a command and key summary for a quick reference.

Read Parts I and III to learn the “basics” and refer to Part II when you have a particular question involving a command. After becoming familiar with Spectaculator, you’ll only need Part V—the command summary, which condenses all the information with no details.

Part I—Setting Up

If you will be using a tape recorder (to save worksheets) or serial printer, first make sure that they are properly connected to the computer. Turn on the TV. Insert the Spectaculator cartridge in the slot on the right side of the computer. Next, when you turn on the computer, the screen shows:

```

C> ■
      1      2      3      4
1  ■■■■■
2
3
4
5
6
7
8
9
10
11
12
13

```

This is just a small portion of a “worksheet” on which you can enter data. A worksheet can contain up to 99 columns and 99 rows. A column can contain from 1 up to 27 characters.

Adjust the color on your TV so that the box after C> (the Command mode prompt) is orange. This box, called a cursor, is where you enter commands and data. The black box at Cell 1,1 (Row 1, Column 1) is called the entry marker. After data is entered, it is displayed in the cell where the entry marker is positioned.

In command mode (indicated by the orange cursor), you tell the computer which command you want to use. Type `[?]` to see the first page of the command set. (To type uppercase characters, use the `[SHIFT]` key as you would on a regular typewriter. In this case, press `[SHIFT]` `[/]` to type a question mark.)

The screen shows:

```
C>
SPECTACULATOR COMMAND SET

MM - MOVE MARKER
EN - ENTER NUMBERS
CF - COLUMN FORMULA ENTRY
RF - ROW FORMULA ENTRY
CA - CALCULATE
ET - ENTER TEXT
CR - CLEAR ROW
CC - CLEAR COLUMN
CW - CHANGE COLUMN WIDTH
FR - DISPLAY FREE MEMORY
```

PRESS <ENTER> TO CONTINUE

Press **ENTER** to see the rest of the 17 commands and a list of special keys. A brief description of each command follows.

```
C>
COMMAND SET - PAGE 2

DR - DELETE ROW
DC - DELETE COLUMN
IR - INSERT ROW
IC - INSERT COLUMN
SA - SAVE ON TAPE
LO - LOAD FROM TAPE
LI - LIST TO PRINTER
SPECIAL KEYS:
BREAK - ENTER COMMAND MODE
CLEAR - BACKSPACE
? - HELP LIST
```

MOVE MARKER - Enables you to view any portion of the worksheet you want.

ENTER NUMBERS - Up to 9 digits or 8 plus a decimal point.

COLUMN FORMULA ENTRY - Specifies how that column is to be calculated from data in preceding columns.

ROW FORMULA ENTRY - Specifies how given rows in the worksheet are to be calculated from data in preceding rows.

CALCULATE - The values in formula-defined rows and columns are calculated and displayed.

ENTER TEXT - Letters, numerals and all other upper and lower case characters (up to 27 characters). Only capital letters are displayed and printed. Labels (row and column headings) make a worksheet easier to read.

CLEAR ROW - Deletes numbers in a row, without deleting any formula associated with that row. Succeeding rows are not affected.

CLEAR COLUMN - Deletes numbers in a column, without deleting any formula associated with that column. Succeeding columns are not affected.

CHANGE COLUMN WIDTH (the number of spaces a column contains) - Any value from 2 through 27. The default value (value built in the program) is 7.

DISPLAY FREE MEMORY - Shows how much room you have in memory to store data. Each worksheet can contain up to 2,173 characters for a 4K computer; 14,461 characters for a 16K computer; and 30,845 characters for a 32K computer. The amount of free memory decreases as you enter data.

DELETE ROW - Erases data (text and numbers) in a row and any formula associated with that row. Data in succeeding rows shift upward.

DELETE COLUMN - Erases data (text and numbers) in a column and any formula associated with that column. Data in succeeding columns shift to the left.

INSERT ROW - Inserts rows, allowing you to enter data or create a blank row. Data in succeeding rows shift downward.

INSERT COLUMN - Inserts columns, allowing you to enter data or create a blank column. Data in succeeding columns shift to the right.

SAVE ON TAPE - Saves the worksheet in memory on cassette tape.

LOAD FROM TAPE - Loads a file that was saved on tape, back into memory.

LIST TO PRINTER - Prints the worksheet (in memory) on a serial printer.

To enter a command, type the two-letter combination that stands for the command and press **[ENTER]**. If you enter a command incorrectly, the message, **COMMAND ERROR**, appears at the top of the screen. Reenter the correct two-letter abbreviation.

Press the **BREAK** key to return to command mode. (Some commands are performed automatically, without any further instructions from you. After these commands are executed, you enter command mode automatically.)

All commands (except the “automatic” ones) have a “help” list which gives instructions and examples on how to use the command. After you have entered the command, type **?** to see the help list. Type **?** to return to the same command.

If you make a mistake when entering a command, numbers, text, or further instructions to the computer, press the **CLEAR** key to backspace and erase the character that was previously there. Press **SHIFT**, and without releasing **SHIFT**, press the **CLEAR** key to retype the entire entry.

The data you enter on a worksheet is temporarily stored in the computer's memory. If you turn off or reset the computer (and have not saved the data on tape), the data is lost. Be sure the computer is turned off before removing the Spectaculator cartridge.

Part II—Commands

Move Marker

To move the black entry marker up and down or to the right and left, use the four arrow keys. The entry marker moves over data without erasing any characters. Press an arrow key once to move the marker one space. For example, press the **→** key 4 times to move the marker to Column 5. Note that now Columns 2-5 are visible. Next, press the **↓** key 13 times, so that Rows 2-14 are visible. The entry marker is currently at Cell 14,5 (Row 14, Column 5).

There is a much faster way to move the marker if you are entering data on a large worksheet. Type **MM** (for Move Marker) and press **ENTER**. This command is indicated by the white cursor. Type **?** to see the MOVE MARKER HELP list.

The screen shows:

```
MM:
MOVE MARKER HELP
* ENTER ROW NO., COLUMN NO.
* PRESS <ENTER>

<ENTER> ALONE HOMES THE
MARKER
```

Now, type **25**, **25** (no spaces) and press **ENTER**. (You can enter the cell while in the help screen, or type **?** to return to the worksheet.)

The screen shows:

```
C> ■
  25  26  27  28
25 ■■■
26
27
28
29
30
31
32
33
34
35
36
37
```

Note that not only has the marker moved to Row 25, Column 25, but a different portion of the worksheet is on display. The cell you entered occupies the upper left-hand corner of the worksheet. After a cell is entered, the command mode prompt automatically reappears.

Next, we want to move the marker to the "home" cell (Cell 1,1). Type **M M** and press **ENTER**. Now, simply press **ENTER**. The marker is now at Row 1, Column 1 and Rows 1-13 and Columns 1-4 are on display.

If you enter a cell incorrectly (e.g., with a space after the comma), the message, SYNTAX ERROR, appears at the top of the screen. Press the **CLEAR** key to backspace the cursor, so that you can reenter the cell.

Enter Numbers

You can enter numbers of up to 9 digits (8 digits plus a decimal point). (The column width is currently set at 7. To change the column width, see page 15.)

Move the entry marker to the cell where you want to enter a number. In command mode, type **EN** (Enter Numbers) and press **ENTER**. This command is indicated by the dark blue cursor. Type **?** to see the ENTER NUMBERS HELP list.

The screen shows:

```
EN:
ENTER NUMBERS HELP

NUMBER ENTRIES ARE RIGHT-
JUSTIFIED INSIDE THE
MARKER

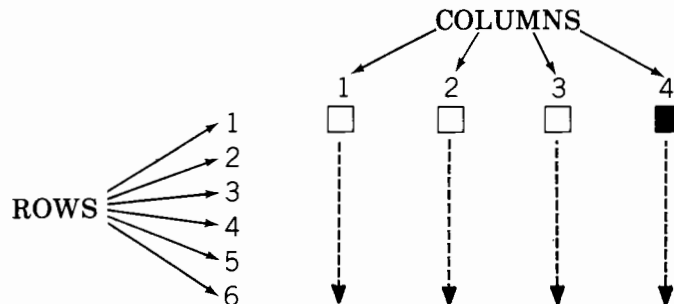
LIMITS:
* 9 DIGITS
* 6 DIGITS TO THE RIGHT OF
  THE DECIMAL POINT
```

Type **?** to return to the worksheet. After you type the number and press **ENTER**, the number is displayed in the cell. (The number is aligned to the right inside the entry marker box.)

If you entered a wrong number, simply move the marker to the cell and reenter the correct number. The new number will replace the incorrect entry. To erase a number (and leave the cell blank), move the marker to the desired cell and press **ENTER**. If you enter any character other than a number or decimal point, the message, SYNTAX ERROR, is displayed. Press **CLEAR** to move the cursor to the left one character. To reenter the entire number, press **SHIFT CLEAR**. When you are finished entering numbers, press **BREAK**. The command mode prompt reappears.

Column Formula Entry

A column formula specifies how values in that column are to be calculated from data in preceding columns. For example, suppose you want to enter a column formula for Column 4 to add the numbers in Columns 1, 2, and 3. The calculated value in Cell 1,4 will be the total of the numbers in Cells 1,1; 1,2; and 1,3. The calculated value in Cell 2,4 will be the total of the numbers in Cells 2,1; 2,2; 2,3; etc.



To enter a column formula, move the entry marker to the column where you want the calculated value to appear. (The entry marker can be on any cell in the column.) Type **[C][F]** and press **[ENTER]**. The column formula entry command is indicated by the light blue cursor.

To see the COLUMN FORMULA HELP list, type **[?]**.

The screen shows:

```
CF:
COLUMN FORMULA ENTRY HELP

EXAMPLE FORMULA:
(C1 - C2)/2 + 5*SQR(C3)

OPERATORS: + - * / ( )

FUNCTIONS: SUM SQR SMT

PRECEDE FORMULA WITH "I" OR
"D" FOR INTEGER OR DECIMAL
RESULT
```

All mathematical operations are performed from left to right. Multiplication and division operations are done first, then addition and subtraction are performed (unless enclosed in parentheses). When parentheses occur within another pair of parentheses, operations are performed beginning with the innermost parentheses and working outward.

In the example above, the computer first subtracts the value in Column 2 from the value in Column 1 and then divides the resultant value by 2. Next, the square root of the value in Column 3 is multiplied by 5. Finally, these two values are added together. (When you use the Calculate command, the computer calculates and displays the final value in the formula-defined column for each row. See page 13.)

Multiplication is indicated by an asterisk, *, while division is indicated by a slash, /. Parentheses tell the computer to perform the enclosed operation first. SQR tells the computer to take the square root of the values in the specified column following the letters, SQR.

SUM stands for “sum” and tells the computer to add the values starting from the specified column to the column where the entry marker is positioned. For example, if the entry marker is positioned on Column 5 and you enter the formula, $\boxed{S} \boxed{U} \boxed{M} \boxed{C} \boxed{1}$, Spectaculator will add the numbers in Columns 1 through 4. (This is a shortcut way of entering the formula, C1+C2+C3+C4.) After you use the Calculate command, the total will be displayed in Column 5.

SMT stands for “summation” and tells the computer to give the cumulative totals along with the final computed total value of one specified column. For example, if the entry marker is positioned on Column 5 and you enter the formula, $\boxed{S} \boxed{M} \boxed{T} \boxed{C} \boxed{1}$, followed by the Calculate command, Spectaculator will calculate and display a cumulative sum of the numbers in Column 1. The calculated value in Cell 1,5 will be the same value as in Cell 1,1. The sum of Cell 1,1 and Cell 2,1 will be displayed in Cell 2,5. Cell 3,5 will contain the sum of Cells 1,1; 2,1; 3,1; etc.

Note: The column you specify after the letters, SUM, must have a value in it. The SUM operation will not be performed if there is no number in the specified column. However, a blank cell in a subsequent column is assumed to contain a value of 0 and a sum will be calculated. In all other column formulas, calculations will not be performed for those cells that are blank. This holds true for row sums and formulas, as well.

You can also specify whether you want the calculated value to be expressed as an integer or decimal number. Simply type **I** or **D** before the formula. If you specify **I**, the calculated value will be displayed, showing only the numbers to the left of the decimal. If you choose **D**, the value will be carried out to 6 decimal places. However, the computer automatically deletes trailing zeroes.

If you don't specify "I" or "D," the computer automatically calculates the formula, using a dollar and cents form, by carrying the value out to 2 decimal places. (This is particularly useful for financial data.)

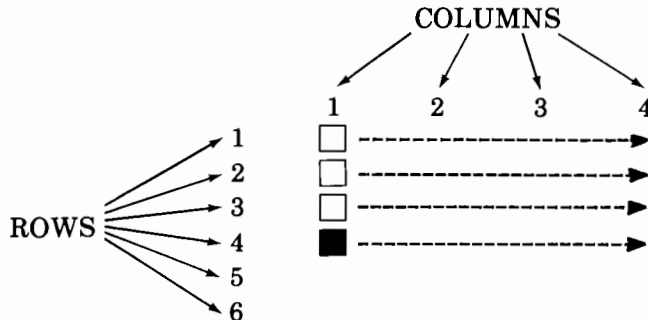
Type the formula and press **ENTER**. Do not use spaces when you enter formulas. (You can type the formula while in the Help screen or type **?** to return to the worksheet.) If you are entering a decimal in a formula, precede the number with a leading zero. For example, to enter the formula: (Column 1 × Column 2)/.6, type: **([C] 1 * [C] 2) / 0 . 6** and press **ENTER**.

The SYNTAX ERROR message appears if you enter a formula incorrectly or include spaces. Press the **CLEAR** key to backspace and type over the mistake. Press **SHIFT CLEAR** to reenter the entire formula. When you are finished entering formulas, press **BREAK** to return to command mode.

If you move the entry marker to a column where a formula has been entered, the formula is displayed at the top of the screen. Use the Calculate command to see the computed value.

Row Formula Entry

A row formula specifies how values in that row are to be calculated from data in preceding rows. For example, suppose you want to enter a row formula for Row 4 to add the numbers in Rows 1, 2, and 3. The calculated value in Cell 4,1 will be the total of the numbers in Cells 1,1; 2,1; and 3,1. The calculated value in Cell 4,2 will be the total of the numbers in Cells 1,2; 2,2; 3,2; etc.



To enter a row formula, move the entry marker to the row where you want the calculated value to appear. (The entry marker can be on any cell in the row.) Type **[R][F]** and press **[ENTER]** at the command mode prompt. The row formula entry command is indicated by the mauve-colored cursor.

Type the formula and press **[ENTER]**. Row formulas are entered in the same way column formulas are. (The ROW and COLUMN FORMULA HELP screens are identical.) If the entry marker is on a cell where both a row and column formula have been entered, the row formula takes precedence and is displayed at the top of the screen. The numbers in the specified rows under each column are used to come up with the computed values.

Calculate

To have Spectaculator calculate and display the values in all formula-defined columns and rows, type **[C][A]** and press **[ENTER]** at the command mode prompt. (If both a row and column formula are entered for the same cell, the value for the row formula will be displayed.) This command is executed automatically without any further instructions from you. The command mode prompt reappears.

Although you can only enter numbers containing up to 9 digits, calculated values can contain up to 10 digits. (Spectaculator automatically adjusts the column width to display the entire calculated value.) If a calculated value exceeds 10 digits, the message, OVERFLOW ERROR, may appear. The value is not displayed. Press **[BREAK]** to return to command mode. You can either change: 1) the formula from "D" to "I" or, 2) the values in the worksheet. Enter the Calculate command again to see the computed values.

Enter Text

A text entry can contain up to 27 characters. Letters, numerals, and all other upper and lower case characters can be used. All letters are displayed (and printed) as capitals.

Move the entry marker to the cell where you want to enter text. In command mode, type **[E][T]** and press **[ENTER]**. This command is indicated by the red cursor. After you type the text and press **[ENTER]**, the text is displayed in the cell. (The text is aligned to the left inside the entry marker box.)

If you make a mistake, simply move the marker to the cell and reenter the text. The old entry is replaced with the correct text. (While entering text, use the **CLEAR** key to backspace.) Type **[?]** to see the ENTER TEXT HELP list.

The screen shows:

ET:

ENTER TEXT HELP

TEXT ENTRIES ARE LEFT-
JUSTIFIED INSIDE THE MARKER

LIMIT:

* 27 CHARACTERS

To center text over a column, simply press the space bar a few times before typing the text and pressing **[ENTER]**. (You can also use the Change Column Width command to center text.)

When you are finished entering text, press **[BREAK]**. The command mode prompt reappears.

Note: If numbers are entered with the Enter Text command instead of the Enter Numbers command, no calculation will be performed.

Clear Row

To erase numbers in a row, move the entry marker to the desired row. Only numbers are erased—if a formula has been entered for that row, it is not affected. Data in succeeding rows remain in the original rows.

Type **[C][R]** and press **[ENTER]**. The data is erased and the command mode prompt reappears. You can now enter new data and use the Calculate command to see the computed values.

Clear Column

To erase numbers in a column (leaving the column formula intact), move the entry marker to the desired column. Type **[C][C]** at the command mode prompt and press **[ENTER]**. Data in succeeding columns remain in the original columns.

Note: The Clear commands are particularly useful when you want to reuse a worksheet and enter new values. You cannot use these commands if no data has been entered.

Change Column Width

You can change the column width (i.e., the number of spaces a column contains) from the default value of 7 to any value from 2 through 27. After the width has been changed, the worksheet is displayed (and printed) using the new width.

In command mode, type **[C][W]** and press **[ENTER]**. Type **[?]** to see the CHANGE COLUMN WIDTH HELP list.

The screen shows:

```

CW:

CHANGE COLUMN WIDTH HELP

ENTER COLUMN NUMBER,WIDTH
EXAMPLE CW: 12,9

TYPE "ALL" FOR COLUMN NUMBER
TO CHANGE THE WIDTH OF ALL
COLUMNS

LIMIT:
* 2-27

```

You can enter the Change Column Width instructions while in the HELP screen, or type `[?]` to return to the Change Column Width command. To change the width of one column, type that column number and a comma (no space after the comma). Next, type the value representing the number of spaces wide you want the column to be and press `[ENTER]`. The worksheet display changes automatically and the command mode prompt reappears.

To change the width of all columns, type `[A][L][L]` and a comma. Next, type the width and press `[ENTER]`.

Be careful when using this command. If you make the width smaller and the data (numbers or text) contain more characters than the newly specified width, some of the characters will be erased. Don't worry, however, because the original data is still in the computer's memory. If you change the width again to the original value, the data in its entirety is displayed.

Display Free Memory

To find out how much room you have in memory to store data, type **F R** and press **ENTER** in command mode. The number of “free” characters left in memory is displayed above the command mode prompt.

Each worksheet on a 4K computer can contain up to 2,173 characters. A worksheet on a 16K computer can contain up to 14,461 characters. There is room for 30,845 characters per worksheet on a 32K computer. The free memory decreases as you enter data. If there are no characters left in memory, the message, **OUT OF MEMORY**, appears at the top of the screen. (This can happen when you try to: enter numbers, text, formulas; use the Calculate command; change the column width; or insert rows or columns.) You will have to delete some data to continue using the same worksheet. Or you can save the worksheet currently in memory on tape and start a new worksheet. (See “Save on Tape” on page 19.)

Delete Row

To erase text and numbers in a row and any formula associated with that row, you must first position the entry marker on that row. Type **D R** and press **ENTER** in command mode. This is an “automatic” command, i.e., you do not have to enter any further instructions.

The data (and formula if entered) originally in that row is erased. The data (and formula) in the next row (the row below) shifts up to the row where the entry marker is positioned. The row numbers in formulas are changed so that the same values are used in calculations. Data (and formulas) in succeeding rows also shift up one row. The command mode prompt automatically reappears.

Delete Column

To erase data in a column and any formula associated with that column, move the entry marker to that column. Type **D C** and press **ENTER**. The data in the next column (the column to the right) shifts left to the column where the entry marker is positioned. Data (and formulas) in all succeeding columns shift one column to the left. You return to command mode automatically.

Note: You cannot use the Delete commands if no data has been entered on the worksheet.

Insert Row

To insert a row of data (or a blank row), move the entry marker to the desired row. Type **⌘ R** and press **ENTER**. The data and formula originally in that row (and all succeeding rows) shift downward one row. The row numbers in formulas are changed so that the same values are used in calculations. (The row numbers are not affected.) If the row contained no data, another blank row is created. The command mode prompt reappears, allowing you to enter text or numbers.

Insert Column

To insert a column of data (or a blank column), move the entry marker to the desired column. Type **⌘ C** and press **ENTER**. The data and formula originally in that column (and all succeeding columns) shift to the right one column. If the column did not contain data, another blank column is created. You return to command mode automatically.

Note: You cannot use the Insert commands if no data has been entered on the worksheet.

Save on Tape

To save a worksheet on tape, type **S A** and press **ENTER** in command mode. Type **?** to see the TAPE SAVE HELP list.

The screen shows:

SA:

TAPE SAVE HELP

- * PLACE TAPE IN PLAYER
- * REWIND TAPE
- * PRESS PLAY/RECORD
- * ENTER FILE NAME

Follow the instructions on the screen. (You can either return to the worksheet by typing **?** or continue while in the TAPE SAVE HELP screen.) If you use a tape with a leader, you'll have to manually position the tape past the leader. We recommend using TRS-80 Certified Computer Cassettes, which are leaderless.

Whether you use a file name is up to you. A file name is like a title that the computer stores the worksheet under. The computer uses a tape just like you use a filing cabinet. Later, to find a file, the computer looks in the filing cabinet (the tape) for the file name and gets (loads) the file you want.

If you want to save more than one file on a tape (and the files contain different worksheets), it is recommended that you enter a file name. (Later, when you load a file it will be much faster when you specify a file name.) Type a file name (up to 27 characters) and press **ENTER**.

If you are saving just one file or saving the same file, you can simply press **ENTER** after pressing the "Play" and "Record" buttons. The tape recorder starts recording as soon as you press **ENTER**.

The purple cursor disappears while the recording is going on. The Command mode prompt reappears after the file has been recorded. Press the "Stop" button. Be sure to label the tape using the file name you entered and make a note of the counter number.

It's a good idea to make at least one other copy of the file, either on the same tape or on another tape. An extra copy acts as a safety device to guard against accidental loss of data.

To save a file on the same tape that another file has been stored on, make sure you position the tape at least a couple of counter numbers past the last file. Follow the same instructions, but use a different file name. After the file has been recorded, make a note of the new file and counter number on the tape label.

Load from Tape

To load a file from tape back into memory, type **[L][O]** and press **[ENTER]** . Type **[?]** to see the TAPE LOAD HELP list.

The screen shows:

LO:

TAPE LOAD HELP

- * PLACE TAPE IN PLAYER
- * REWIND TAPE
- * PRESS PLAY
- * ENTER FILE NAME

Follow the instructions on the screen. (You can either return to the worksheet by typing **[?]** or continue while in the TAPE LOAD HELP screen.)

Type the name of the file you want to load and press **[ENTER]** . If you entered the name of a file that was recorded in the middle of the tape, the computer looks through the other files and loads the specified file. The worksheet saved under that file name appears on the screen. You return to command mode automatically.

If you are not sure of the file name, just press **[ENTER]** . The first file stored on the tape is loaded and displayed on the screen. Repeat the **[L][O]** command until the desired file appears.

List to Printer

A worksheet must be in memory to be printed. If you are not printing a worksheet that you have just entered, load the desired worksheet file from tape. Make sure the paper is properly aligned and the printer is ready. (If you are using a Radio Shack Line Printer VII, move the switch on the back of the printer to the 7 bit-serial position.) In command mode, type `LI` and press `ENTER`. To print an entire worksheet, press `ENTER`. After the printing is finished, press `ENTER` to return to command mode.

Note: Only 80-column serial printers are compatible with Spectaculator. Spectaculator will print up to 80 characters in a row.

If you want to print just part of a worksheet, type `LI` and press `ENTER`. Type `?` to see the PRINT HELP list.

The screen shows:

LI:

PRINT HELP

- * POSITION MARKER ON THE
FIRST CELL THAT IS TO BE
PRINTED
- * ENTER ROW NO., COLUMN NO. OF
THE LAST CELL THAT IS TO BE
PRINTED

Refer to the HELP list instructions to print a section of the worksheet. Type `?` to return to the List to Printer command. Move the entry marker to the cell where you want to start printing. (On the printed copy, this cell appears in the upper left-hand corner.) Next, type the row number, a comma, and then the column number of the cell where you want the printing to stop. Do not include spaces. (This cell appears in the lower right-hand corner on the printed copy.) When you press `ENTER`, the printing begins.

Note: You do not have to specify the last cell. If you move the entry marker to the first cell you want printed and do not specify the last cell to be printed, Spectaculator will start printing from the cell where the marker is positioned and print to the end of the worksheet.

If the message, PRINTER NOT READY, appears on the screen, check all cables and plugs. Once the printer is ready, the printing begins.

To stop printing, hold down the **BREAK** key until the printing has stopped. (A couple of additional lines of text may be printed.)

To center a worksheet on a page, use the Insert Column command at Column 1 to create some blank columns on the left of the page. (Usually three columns is sufficient).

Part III—Sample Session

To become familiar with Spectaculator, we'll take you through a sample session involving the construction of a simple addition table. You'll also learn how to reuse the same table, enter new numbers, and see how Spectaculator will recalculate all values. Finally, you'll find out how to save and print the table.

If you have a tape recorder or serial printer, make sure that they are properly connected to the computer. Turn on the TV. Insert the Spectaculator cartridge in the slot on the right side of the computer, and turn on the computer.

First, we're going to enter numbers in the worksheet. At the command mode prompt, type **EN** (Enter Numbers) and press **ENTER**. Type **1** and press **ENTER**. Next, press the **→** key once to move the entry marker to Cell 1,2 (Row 1, Column 2). Type **2** and press **ENTER**.

To move the cursor to Cell 2,1, press the **←** key once and then the **↓** key once. Type **3** and press **ENTER**. Now, press the **→** key once. Type **4** and press **ENTER**. To move the cursor to Cell 3,1, press the **←** key once and then the **↓** key once. Type **5** and press **ENTER**. Press the **→** key once to move the cursor to Cell 3,2. Type **6** and press **ENTER**. The screen looks like this:

```

EN:
      1      2      3      4
1     1     2
2     3     4
3     5     6
4
5
6
7
8
9
10
11
12
13

```

Press **BREAK** to exit the EN command. Now we want to enter a formula in Column 3, so press the **→** key once. Type **CF** (Column Formula) and press **ENTER**. To add the numbers in Column 1 and Column 2, type: **C 1 + C 2** and press **ENTER**.

Press **BREAK** to exit the CF command. Press the **↓** key to enter a formula in Row 4. Type **RF** (Row Formula) and press **ENTER**. To add the numbers in Rows 1, 2, and 3, type: **R 1 + R 2 + R 3** and press **ENTER**.

Press **[BREAK]** to return to command mode. Type **[C][A]** (Calculate) and press **[ENTER]**, to see the computed values.

The screen shows:

```

C>
      1      2      3      4
1     1     2     3.00
2     3     4     7.00
3     5     6    11.00
4     9.00 12.00 21.00
5
6
7
8
9
10
11
12
13
    
```

We want to label the table and have column and row headings, but first, we're going to have to insert some blank rows and columns.

Move the entry marker to the "home" cell (Cell 1,1) by typing **[M][M]** (Move Marker) and pressing **[ENTER]**. Press **[ENTER]** again. To insert 3 blank rows at the top of the table, type **[I][R]** and press **[ENTER]**. Repeat the Insert Row command twice.

To insert a blank row between the main table and the calculated values, move the entry marker to Row 7. Type **[I][R]** and press **[ENTER]**.

To insert a blank column at the extreme left of the table, type **[I][C]** (Insert Column) and press **[ENTER]**. Now, to insert a blank column between the main table and the calculated values, move the entry marker to column 4. Type **[I][C]** and press **[ENTER]**. When you move the entry marker to column 5 to see the row totals, the table looks like this:

```

C>
      2      3      4      5
1
2
3
4      1      2      3.00
5      3      4      7.00
6      5      6      11.00
7
8      9.00  12.00      21.00
9
10
11
12
13
    
```

To enter the title of the table, move the entry marker to Cell 1,2. Type **ET** (Enter Text) and press **ENTER**. Type: **A D D I T I O N T A B L E** and press **ENTER**. Now, move the entry marker to Cell 3,5. Type: **R . T O T A L** and press **ENTER**.

Move the entry marker to Cell 8,1. Type: **C . T O T A L** and press **ENTER**.

The table looks like the one below. (To see the Row Total column, press the **→** key.)

```

ET:
      1      2      3      4      5
1      ADDITION TABLE
2
3
4      1      2      R. TOTAL
5      3      4      3.00
6      5      6      7.00
7      11.00
8 C.TOTAL  9.00  12.00      21.00
9
10
11
12
13
    
```

In order to see the entire table on the screen, we're going to change the widths of Columns 2-4. (The text in Columns 1 and 5 contain 7 characters, so we want to leave these columns alone.) Press **BREAK** to exit the ET command.

Type **CW** (Change Column Width) and press **ENTER**. Now, type: **2,6** and press **ENTER**. To change the width of column 3, type: **3,6** and press **ENTER**. Finally, to change the width of the blank Column 4, type: **4,2** and press **ENTER**.

The table looks like this:

CW:

	1	2	3	4	5
1		ADDITIN TABL			
2					
3					R.TOTAL
4		1	2		3.00
5		3	4		7.00
6		5	6		11.00
7					
8	C.TOTAL	9.00	12.00		21.00
9					
10					
11					
12					
13					

The table looks a lot neater, but since we changed the width of some columns, the title, ADDITION TABLE, has been affected. Press **BREAK** to enter command mode. Move the entry marker to Cell 1,2. Type **ET** and press **ENTER**. Retype **ADDITION TABLE**. When you press **ENTER**, you'll see the final version of our Addition Table.

ET:

	1	2	3	4	5
1		ADDITION TABLE			
2					
3					R.TOTAL
4		1	2		3.00
5		3	4		7.00
6		5	6		11.00
7					
8	C.TOTAL	9.00	12.00		21.00
9					
10					
11					
12					
13					

Next, we're going to save and print the table. Press **BREAK** to exit the ET command. Insert a blank cassette tape in the tape recorder. Type **S A** (Save on Tape) and press **ENTER**. Rewind the tape and press the "Play" and "Record" buttons. For the file name, type: **A D D I T I O N T A B L E** and press **ENTER**. The command mode prompt reappears after the file has been recorded. Repeat this process to make another copy of the file as a precautionary measure. Press the "Stop" button.

When you want to load the file at a later time, place the tape in the recorder. Rewind the tape. Type **L Q** (Load from Tape) and press **ENTER** in command mode. Press the "Play" button. Type the file name and press **ENTER**. The Addition Table is displayed after the file has been loaded back into memory.

To print the Addition Table, first, move the entry marker to Cell 1,1, by typing **M M** and pressing **ENTER**. Press **ENTER** again. Type **L P** (List to Printer) and press **ENTER** in command mode. Make sure the paper is properly aligned and the printer is ready. Press **ENTER**. After the printing is finished, the command mode prompt reappears. The printed copy looks like the one below. Note that only the data you entered is printed—row and column numbers do not appear on the printed copy.

```

                ADDITION TABLE

                R. TOTAL
                1      2      3.00
                3      4      7.00
                5      6     11.00

C. TOTAL   9.00 12.00    21.00

```

If the message, PRINTER NOT READY, appears on the screen, check all cables and plugs. Once the printer is ready, the printing begins.

You can have Spectaculator use the same worksheet format and calculate the same formulas using different numbers. Spectaculator will "erase" the entire worksheet, leaving the text and formulas intact. Press **BREAK** to return to command mode. To erase the numbers in Column 2, move the entry marker to Column 2. Type **C C** (Clear Column) and press **ENTER**. Next, move the entry marker to Column 3 by pressing **→** once. Type **C C** and press **ENTER**. Finally, to erase the last column of numbers, move the entry marker to Column 5 and reenter the **C C** command.

Using the **[E][N]** command, enter the following numbers:

1. **[5]** in Cell 4,2.
2. **[6]** in Cell 4,3.
3. **[7]** in Cell 5,2.
4. **[8]** in Cell 5,3.
5. **[9]** in Cell 6,2.
6. **[1][0]** in Cell 6,3.

When you enter the **[C][A]** command, the new totals will be displayed.

Move the entry marker to column 6. Type **[C][F]** and press **[ENTER]**. For the column formula, type: **[S][M][T][C][5]** and press **[ENTER]**. Use the **[C][A]** command to see the cumulative totals of Column 5. Note that the value in Cell 4,6 is the same value as in Cell 4,5. The calculated value in Cell 5,6 is the sum of the values in Cell 4,5 and 5,5. The sum of Cells 4,5; 5,5; and 6,5 is displayed in Cell 6,6.

The calculated value in Cell 8,6 was calculated using the original row formula, i.e., $R1+R2+R3$. Since we inserted three rows, the row numbers in the formula have changed to: $R4+R5+R6$. (Remember that if both a row and column formula are entered for the same cell, the row formula is calculated and that resultant value is displayed.)

Next, move the entry marker to Cell 3,6. Type **[E][T]** and press **[ENTER]**. Press the space bar twice and then type: **[C][.][S][U][M]** and press **[ENTER]**. (This stands for Cumulative Sum.)

The new table looks like this:

ET:						
	1	2	3	4	5	6
1		ADDITION TABLE				
2						
3					R.TOTAL	C.SUM
4		5	6		11.00	11.00
5		7	8		15.00	26.00
6		9	10		19.00	45.00
7						
8	C.TOTAL	21.00	24.00		45.00	82.00
9						
10						
11						
12						
13						

If you want to save this new table, use the `S A` command, but enter a different file name.

When you are finished using the program, be sure the computer is turned off before removing the Spectaculator cartridge.

Part IV—Advanced Sessions

Geometry

To calculate the circumference and area of a circle, and the volume and surface area of a sphere, the following formulas are used:

$$\text{Circumference} = 2\pi r$$

$$\text{Area of Circle} = \pi r^2$$

$$\text{Volume of Sphere} = \frac{4}{3}\pi r^3$$

$$\text{Surface Area of Sphere} = 4\pi r^2$$

where:

$$\pi = \text{Pi (3.1416)}$$

$$r = \text{Radius}$$

To produce the printout on page 32, follow the instructions below, using the values of the radii given in the printout:

1. Enter the following **CW** (Change Column Width) instructions: **2,6**, **3,3**, **4,10**, **5,3**, **6,10**, **7,3**, **8,10**, **9,3**, **10,10**.
2. In Column 2, enter the values of the radii (**EN** command).
3. In Column 4, enter the formula: **2*3.1416*C2** (**CF** command).
4. In Column 6, enter the formula: **3.1416*C2*C2** (**CF** command).
5. In Column 8, enter the formula: **(4/3)*3.1416*C2** (**CF** command).
6. In column 10, enter the formula: **4*3.1416*C2** (**CF** command).
7. Use the **CA** command (Calculate) to see the computed values.
8. Move the marker to Cell 1,1 and insert a column (**IC** command).

9. Insert 3 rows (**I R** command 3 times).
10. Move the marker to Cell 1,3 and enter the Column 3 heading, **R A D I U S** (**E T** command).
11. Move the marker to Cell 1,5 and press the space bar 3 times before entering part of the Column 5 heading, **C I R C U M** . Move the marker to Cell 2,5 and press the space bar 3 times. Enter the rest of the heading, **F E R E N C E** (**E T** command).
12. Move the marker to Cell 1,7 and press the space bar 3 times before entering **A R E A** . Move the marker to 2,7 and press the space bar 4 times before entering the rest of the Column 7 heading, **C I R C L E** (**E T** command).
13. Move the marker to Cell 1,9 and press the space bar twice. Enter **V O L U M E** . Move the marker to Cell 2,9 and press the space bar 5 times. Enter **S P H E R E** as the rest of the heading (**E T** command).
14. Move the marker to Cell 1,11 and enter **S U R F .** as part of the Column 11 heading. Move the marker to Cell 2,11 and press the space bar one time, before entering the words, **O F S P H E R E** (**E T** command).
15. After you print and save the worksheet (**L I** and **S A** commands), you can erase the values for the radii in Column 3 (**C C** command), and enter new numbers (**E N** command). Spectaculator will use the formulas which are still intact to recalculate and display the new values (**C A** command).

RADIUS	CIRCUM- FERENCE	AREA OF CIRCLE	VOLUME OF SPHERE	SURF. AREA OF SPHERE
1	6.28	3.14	4.19	12.57
5	31.42	78.54	523.60	314.16
7	43.98	153.94	1436.76	615.75
83	521.51	21642.48	2395100.24	86569.93
100	628.32	31416.00	4188798.00	125664.00

Personal Budget

The following example shows how to set up a simple home budget which compares the budgeted amounts for different expense categories with actual amounts spent. By using this general budget plan, you can easily see the areas where you are overspending or underspending. Follow the steps below, using the data in the printout on page 34.

1. Enter the following **CW** (Change Column Width) instructions:
`3,10,4,3,5,10,6,10,7,10.`
2. Move the marker to Cell 3,3 and enter the word: **BUDGET**. Move the marker to Cell 4,3 and enter the word: **CATEGORIES** (**ET** command).
3. Move the marker to Cell 3,5 and press the space bar twice. Enter the word: **BUDGETED**. Move the marker to Cell 4,5, press the space bar twice, and enter the word: **AMOUNT** (**ET** command).
4. Move the marker to Cell 3,6 and press the space bar 4 times. Enter the word: **ACTUAL**. Move the marker to Cell 4,6, press the space bar 4 times and enter the word: **AMOUNT** (**ET** command).
5. Move the marker to Cell 3,7 and press the space bar 4 times. Enter the word: **NET**. Move the marker to Cell 4,7, press the space bar 4 times and enter the rest of the heading: **AMOUNT** (**ET** command).
6. Move the marker to Cell 6,3 and enter the first budget category: **AUTO**. Enter the rest of the categories (**ET** command).
7. Move the marker to Cell 14,3 and enter the row heading: **TOTAL** (**ET** command).
8. Move the marker to Cell 6,5 and enter the budgeted amount of the car payment (`175.00`) for the category **AUTO**. Enter the rest of the budgeted amounts (**EN** command).
9. Move the marker to Cell 6,6 and enter the actual amount spent for the car payment (`175.00`). Enter the rest of the actual amounts (**EN** command).
10. Move the marker to Column 7 and enter the formula: **C5-C6** (**CF** command).
11. Move the marker to Row 14 and enter the formula: **SUMR6** (**RF** command).

Statistics

To calculate the chi-square statistic, the following formula is used:

$$X^2 = \sum \frac{(OF-EF)^2}{EF}$$

where:

X^2 = Chi-square (chi is a Greek letter)

Σ = Symbol meaning "the sum of"

OF = An observed frequency

EF = An expected frequency

To produce the printout on page 36, follow these steps in the exact order given, using the data supplied in the printout on page 36:

1. In Column 1, enter the observed frequencies (**EN** command). These are the numbers in the OF column.
2. In Column 2, enter the expected frequencies (**EN** command). These are the numbers in the EF column.
3. In Column 3, enter the formula: **(C1-C2)* (C1-C2)** (**CF** command).
4. In Column 4, enter the formula: **DC3 / C2** (Decimal **CF** command).
5. Use the **CA** command to see the computed values.
6. Move the marker to Column 1 and insert a column (**IC** command).
7. Enter the following **CW** (Change Column Width) instructions: **1,9,2,12,3,12,4,12,5,18**.
8. In Row 10, enter the formula: **DSUMR1** (Decimal **RF** command).
9. Use the **CA** command to see the computed values.
10. Move the marker to Row 1 and insert 5 rows (**IR** command).
11. Move the marker to Cell 1,3 (Row 1, Column 3) to enter the title of the table. Before typing the title, press the space bar 8 times. Next, type: **CHI-SQUARE STATISTI** and press **ENTER**. Press the **→** key three times and retype the letters, **STI** and then, type **C**. Press **ENTER** (**ET** command).

12. Move the marker to Cell 4,2 and press the space bar 10 times before entering the Column 2 heading, O F (E T command).
13. Move the marker to Cell 4,3 and press the space bar 10 times before entering the Column 3 heading, E F (E T command).
14. Move the marker to Cell 4,4 and press the space bar 4 times before entering the Column 4 heading, (O F - E F) ^2 (E T command). This stands for the formula to subtract the Expected Frequency from the Observed Frequency, and then, to square the differences.
15. Move the marker to Cell 4,5 and press the space bar 7 times before entering the Column 5 heading, $\text{(O F - E F) }^2 / \text{E F}$ (E T command). This stands for the formula to divide the squared differences by the Expected Frequency.
16. Move the marker to Cell 15,2 and press ENTER while using the E T command. To erase the numbers in Cells 15,3 and 15,4, repeat this process.
17. To label the chi-square statistic, move the marker to Cell 15,4 and enter the label: $\text{CHI-SQUARE} =$ (E T command).
18. After you print and save the worksheet (L I and S A commands), you can erase the values for the observed and expected frequencies in Columns 2 and 3 (C C command), and enter new values (E N command). Spectaculator will use the formulas which are still intact to recalculate and display the new values (C A command). Before printing the new worksheet, erase the numbers in Cells 15,2; 15,3; and 15,4.

CHI-SQUARE STATISTIC

OF	EF	$(\text{OF}-\text{EF})^2$	$(\text{OF}-\text{EF})^2/\text{EF}$
68	66	4.00	0.060606
75	80	25.00	0.3125
57	60	9.00	0.15
79	73	36.00	0.493150
32	34	4.00	0.117647
45	40	25.00	0.6250
33	30	9.00	0.30
31	37	36.00	0.972972
CHI-SQUARE =			3.031875

The following formulas are used to calculate the mean, population variance, and the population standard deviation:

$$\mu = \frac{\sum x}{N} \quad \theta^2 = \frac{\sum (x - \mu)^2}{N} \quad \theta = \sqrt{\frac{\sum (x - \mu)^2}{N}}$$

where:

x = the observation

μ = the population mean

N = the total number of elements in the population

Σ = the symbol meaning the "sum of"

θ^2 = the population variance

θ = the population standard deviation

To produce the printout on page 39, follow these steps, using the data supplied in the printout on page 39:

1. In Column 1, enter the observations (**E N** command). These are the numbers in the (X) column.
2. Move the marker to Cell 17,1 and enter the formula: **S U M R 1** . This formula will total the values of all the observations in the population (**R F** command).
3. Move the marker to Cell 18,1 and enter the formula: **R 1 7 / 1 5** . This formula will divide the total by the number of elements in the population, giving the mean. Later, after the formula in step 5 is entered, the population variance will be calculated (**R F** command).
4. Use the Calculate command to see the computed values. (You will be using the calculated mean value in step 5.)
5. Move the marker to Cell 17,2 and enter the formula: **(1 C 1 - 1 6 . 6 0) * (1 C 1 - 1 6 . 6 0)** . This formula will square the differences of the observations from the mean. The population variance and standard deviation will be figured, using this computed value (**C F** command).
6. Move the marker to Cell 19,2 and enter the formula: **S Q R R 1 8** . This formula will take the square root of the average of the squared distances of the observations from the mean, giving the population standard deviation (**R F** command).
7. Use the Calculate command to see the computed values.

8. Move the marker to Cell 19,1 and press **ENTER** while using the **EN** command to erase the number.
9. Insert two columns (**IC** command).
10. Move the marker to Cell 19,4 and insert two columns (**IC** command).
11. Move the marker to Cell 1,1 and insert 5 rows (**IR** command).
12. Move the marker to Cell 1,1 and press the space bar twice. Type: **MEAN, VARIANCE, AND STANDARD** and press **ENTER**. Press the **→** key 3 times and then retype: **STANDARD**. Next, type the rest of the title, **ARD DEVIATION** and press **ENTER** (**ET** command).
13. Move the marker to Cell 4,3 and press the space bar 4 times before entering the Column 3 heading, (X) (**ET** command).
14. Move the marker to Cell 4,6 and press the space bar once, before entering the Column 6 heading, (X=U)2 (**ET** command).
15. Move the marker to Cell 22,1 and enter the Row 22 heading, **COLUMN TOTAL** (**ET** command).
16. Move the marker to Cell 23,2 and press the space bar once, before entering the parameter label: **MEAN** (**ET** command).
17. Move the marker to Cell 23,4 and press the space bar four times, before entering the parameter label: **VARIANCE** (**ET** command).
18. Move the marker to Cell 24,4 and enter the parameter label: **S.D. DEVIATION** (**ET** command).
19. Move the marker to Cell 1,1 and insert two columns (**IC** command).
20. After you print and save the worksheet (**LI** and **SA** commands), erase the (X) values in Column 5 (**CC** command), enter new numbers (**EN** command), and then, use the Calculate command. Look at Cell 23,5 to see the new mean value and revise the Column 8 formula, using that figure. Use the Calculate command again to see the new values for the population variance and standard deviation. Move the cursor to Cell 24,5 and press **ENTER** while using the **EN** command to erase the number.

MEAN, VARIANCE, AND STANDARD DEVIATION

(X)	(X-U) ²
4	158.76
6	112.36
12	21.16
14	6.76
14	6.76
15	2.56
17	0.16
17	0.16
18	1.96
19	5.76
21	19.36
21	19.36
22	29.16
24	54.76
25	70.56

COLUMN TOTAL = 249.00 509.60
MEAN = 16.60 VARIANCE = 33.97
S. DEVIATION = 5.83

Part V—Key Summary

Key	Description
[?]	To see command set or specific command's HELP list. Type again to return to same command.
[BREAK]	To return to command mode. Stops printer.
[CLEAR]	Acts as a backspace key when entering commands, numbers, text, or formulas. Moves cursor left one character and erases previous character.
[SHIFT] [CLEAR]	Moves cursor to beginning of entry line and erases all characters, allowing you to reenter command, number, text, or formula.
[ENTER]	After typing command, number, text, or formula, computer executes command or "enters" information in worksheet. Erases previous entry if pressed at entry line.
[→]	Moves entry marker to the cell on the right; does not erase data.
[←]	Moves entry marker to the cell on the left; does not erase data.
[↑]	Moves entry marker up to the cell in the previous row; does not erase data.
[↓]	Moves entry marker down to the cell in the next row; does not erase data.
[M] [M]	Move Marker—To move entry marker to specific cell, enter Row No. and Col. No. Press [ENTER] to move marker to "home" cell. After execution, returns to command mode automatically.
[E] [N]	Enter Number—Position marker and enter number. Limits: 9 digits total with maximum of 6 digits to the right of the decimal point.
[C] [F]	Column Formula Entry—Position marker and enter formula. Operation symbols include: +, -, *, /, (,), SUM, SQR and SMT. Type [I] (Integer) or [D] (for six Decimal places) before formula to specify computed value.

- C A** Calculate—After calculated values are displayed, returns to command mode. **Cannot** use until formula has been entered.
- C C** Clear Column—Position entry marker on desired column to erase all numbers in that column. Does **not** erase text or formulas. **Cannot** use until data has been entered. Returns to command mode.
- C R** Clear Row—Position entry marker on desired row to erase all numbers in that row. Does **not** erase text or formulas. **Cannot** use until data has been entered. Returns to command mode.
- E T** Enter Text—Position entry marker and enter text. Limit: 27 characters.
- F R** Display Free Memory—To find out how much room in memory is left to enter data in worksheet. Stays in command mode.
- D R** Delete Row—Position entry marker on desired row to erase numbers, text, and formulas in that row; other formulas change to reflect deletion. **Cannot** use until data has been entered. Returns to command mode automatically.
- D C** Delete Column—Position entry marker on desired column to erase numbers, text, and formulas in that column; other formulas change to reflect deletion. **Cannot** use until data has been entered. Returns to command mode automatically.
- I R** Insert Row—Position entry marker on desired row where you want to enter new data; data and formula previously in that row shift downward; other formulas change to reflect insertion. **Cannot** use until data has been entered. Returns to command mode automatically.
- I C** Insert Column—Position entry marker on desired column where you want to enter new data; data and formula previously in that column shift to the right; other formulas change to reflect insertion. **Cannot** use until data has been entered. Returns to command mode automatically.
- C W** Change Column Width—To change column width, enter Col. No. and width. To change the width of all columns, type: **A L L** and then enter the new width.

- S A** Save on Tape—Rewind tape. Press the “Play” and “Record” buttons. Enter file name or simply press **ENTER** . Returns to command mode automatically.
- L O** Load from Tape—Rewind tape. Press “Play” button, enter file name or simply press **ENTER** . Worksheet file appears on screen. Returns to command mode automatically.
- L I** List to Printer—To print entire worksheet, press **ENTER** . To print part of worksheet, position entry marker on first cell to be printed, then enter Row No., Col. No. of last cell to be printed.

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