HEWLETT PACKARD

HP 82153A
Wand Owner's Manual

April 1980

82153-90001 Rev. C

Contents

Introduction

The HP 82153A Wand enhances your HP-41C system by adding a new dimension to calculator control. The wand lets you take advantage of bar coded HP-41C programs, data and even individual HP-41C calculator functions. So that you can fully use the wand's capabilities in your HP-41C system, take time to work through the few pages in this manual. You will find the wand simple to operate, yet useful in a wide range of applications.

Plugging the Wand Into the HP-41C

1. Make sure the HP-41C is turned off.

2. Remove the port cap from any unused port. (The wand should always be plugged into a higher numbered port than any memory modules you may be using.)

3. Insert the wand interface module into the empty port. Push it into the calculator until it snaps firmly in place.
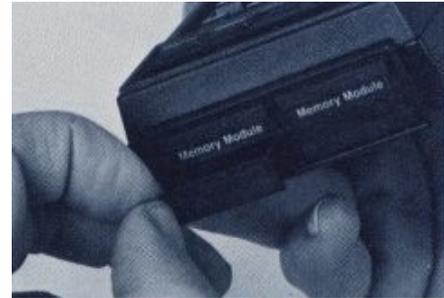
Removing the Wand From the HP-41C

1. Turn off the HP-41C!

2. Pull the wand interface module straight back until it is clear of the port. Do not pull on the cord.

3. Replace the port cap.

Getting Started

Part of the wand's uniqueness among calculator products is the degree to which you directly control factors that determine wand performance. The rate and consistency of your scan speed, the angle and constancy of tilt you maintain, and your ability to keep the wand tip within the top and bottom edges of the bar code rows all influence your results with the wand. Still another factor that impacts wand performance is the quality of the bar code itself. Well-defined bar images that contrast sharply with the print medium produce the best results. Worn, damaged, or poorly printed bar code can hinder or prevent successful wand use.

How to Operate the Wand

The bar patterns in HP-41C bar code rows are coded forms of programs, data, or functions. The information in the bar code is read into the calculator by scanning the bar code with the tip of the wand. Although you can scan in either a left to right or right to left direction, you may notice slightly better results using the left to right scan direction.

1. Hold the wand in a comfortable position. The wand performs best when tilted between 10° and 20° in any direction.

2. Press the recessed scan switch and lightly place the wand tip on the paper. The tip should be placed about 1 cm (approx. 0.4 in.) from the first bar in the row.

3. Scan the bar code at a rapid and uniform speed. (Avoid the tendency of many new users to scan too slowly, which can prevent the wand from processing the bar code.)

4. Keep the wand tip in continuous contact with the paper until you scan past the last bar in the row. If you are new to wand-type devices, you may experience scan errors frequently the first few times you use the wand. However, taking some time to practice scanning bar code will help you develop a scan technique that achieves satisfactory results.

> **Note:** To conserve battery power, keep the scan switch pressed only while you are scanning a row of bar code.
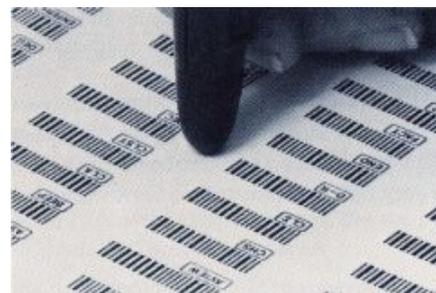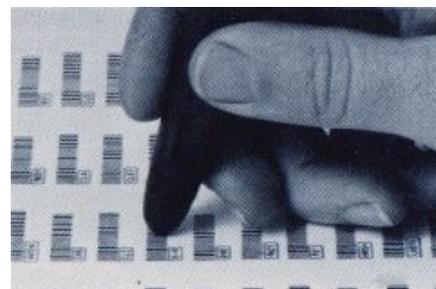
After each scan the HP-41C normally responds by sounding a short *scan tone*. But if the system detects an error during a scan, the HP-41C responds instead with a prolonged *scan error tone* and, in most cases, a displayed error message. Appendix A, Errors and Messages, describes error conditions and error recovery. If the HP-41C does not respond to a scan, check your scan angle and rescan the row more carefully.

Using the Paper Keyboard

The Wand Paper Keyboard contains bar code that allows you to execute the individual functions resident in the HP-41C and its peripherals.* Each function is scanned as a separate row, allowing you to use the wand for executing system functions you would otherwise execute from the keyboard.

Example: Scan the following bar code to execute the indicated functions. (The example assumes a FIX 4 display setting.)

HP-41C Function	Paper Keyboard Bar Code	Display
PI	PI	*3.1416*
STO	STO	*STO _ _*
0	0	*STO 0 _*

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* The HP 82104A Card Reader, the HP 82143A printer, and the HP 82153A Wand.

HP-41C Function	Paper Keyboard Bar Code	Display	
1	(bar code) 1	*3.1416*	Pi stored in R_{01}.
CLX	(bar code) CLX	*0.0000*	Clears display.
RCL	(bar code) RCL	*RCL _ _*	
0	(bar code) 0	*RCL 0 _*	
1	(bar code) 1	*3.1416*	Recalls pi to display.
CLX	(bar code) CLX	*0.0000*	Clears display.

You may want to experiment further with the paper keyboard by executing functions you use often, or by scanning the bar coded ALPHA characters needed to spell your name. If you use certain portions of the paper keyboard frequently, you may want to try using some of the pressure-sensitive bar code labels included with your wand to construct a personalized paper keyboard layout.

> **Note:** You can initiate the assignment of a function to an HP-41C keyboard location using the wand and paper keyboard. However, to complete the operation, you must press the HP-41C key to which you want the function assigned.

Protecting Bar Code

Without protection, bar code will wear with use. To protect your bar code, place one of the transparent sheets you received with the wand over the bar code, glossy side down, before you begin scanning. If you want to use other types of protective coverings for your bar code, choose those that will not present a glossy surface to the wand tip. A glossy surface may cause reflections that can reduce the wand's ability to read the bar code you are scanning.

Scanning Data Bar Code

When you scan a row of data bar code, the data is entered in the HP-41C in the same manner as when you enter data from the keyboard. Scan the following bar code to enter the approximate speed of light in kilometers per second.

Bar Code	**Display**	**Stack**	
(bar code) 299,792.5	*299,792.5000*	**T**	
		Z	
		Y	
		X	*299,792.5000*

Scanning two or more rows of numeric data in sequence affects the stack in the same way as keying in two or more numbers.

Bar Code	Display	Stack	

6.1413

6.1413

T	
Z	
Y	299,792.5000	First data entry.
X	6.1413	Second data entry.

X≷Y

299,792.5000

T	
Z	
Y	6.1413	Contents of X- and Y-
X	299,792.5000	registers exchanged.

CLX

0.0000

Clears the display.

To load bar coded numeric or ALPHA data lines in program memory, set the HP-41C to PRGM mode, then scan the data bar code. Numeric data is stored in program memory as a numeric entry. ALPHA data is stored in program memory as an ALPHA string.

Scanning Program Bar Code

HP-41C program bar code is listed in the following format:

ROW 1   (1 – 6)

ROW 2   (6 – 12)

—**Row number**

—**Program line numbers
Corresponding to This Row**
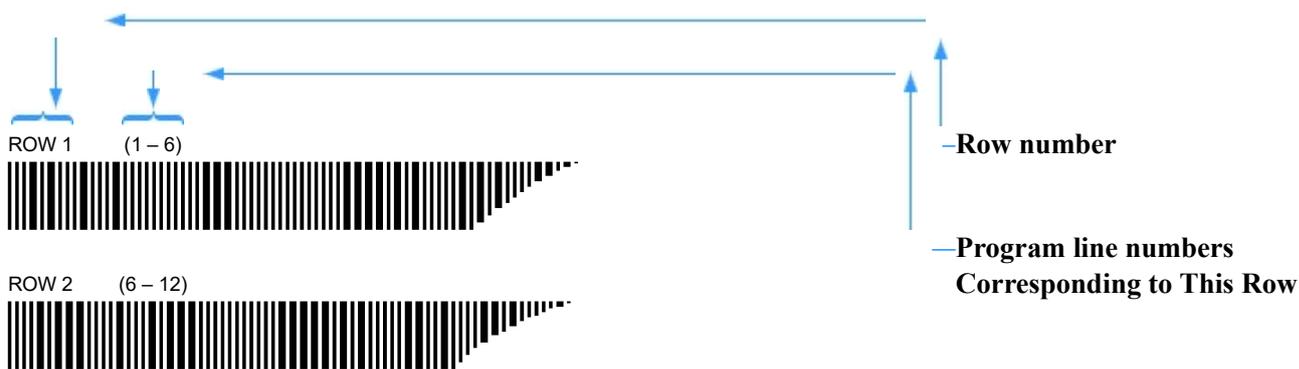
The occurrence of program line number 6 twice, i.e., at the end of row 1 and the beginning of row 2, indicates that the bar code for the function on program line 6 is divided between the two rows. To load a bar coded program into your HP-41C:

1. Ensure that there is enough space in program memory to load the program. (The number of registers required to store the program is printed above the first row of bar code.)

2. Scan the rows of barcode sequentially, beginning with row 1. After each row is scanned, the calculator should sound the scan tone and prompt you for the next line with:

W: RDY nn

Where **nn** is the number of the next bar code row to be scanned.

If the HP-41C sounds the scan error tone while you are scanning program bar code, refer to appendix A, Errors and Messages.

After you scan the last row of program code, the message *W: WORKING* temporarily appears in the display, then the normal display appears. (The HP-41C is set to line 01 of the program.) Scanning a new program clears the last program in memory. However, if you want to append the new program to those already in memory, execute **GTO** · · *before* scanning the new program.

Example: The following bar code program calculates the volume of a cylindrical tank given the tank's diameter and length. Using the procedure described above, load the program into your HP-41C.

<div align="center">PROGRAM REGISTERS NEEDED: 9</div>

ROW 1 (1 – 3)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

Display *W: RDY 02*

ROW 2 (3 – 9)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

Display *W: RDY 03*

ROW 3 (10 – 14)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

Display *W: RDY 04*

ROW 4 (15 – 18)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

Display *W: RDY 05*

ROW 5 (18 – 20)

|||||||||||||||||||||||||||||||||||||

Display *W: WORKING*, then *0.0000*.

Ensure that the HP-41C is not in PRGM mode, then use the following bar code to execute the program to calculate the volume in cubic meters of a tank 3.4 meters in diameter and 4.6 meters long.*

Bar Code   **Display**

||||||||||||||||||||||||||||||||||||

[XEQ] *VOL*   *DIAMETER?*

|||||||||||||||||||||||||

3.4   *LENGTH?*

|||||||||||||||||||||||||

4.6   *VOLUME = 41.8*

||||||||||||||||||

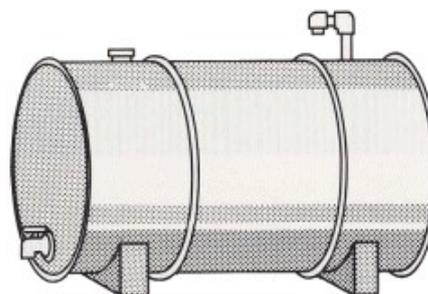[CLX]   *0.0000*   Clears the display.

A program scan session can be terminated by pressing the [←] or [R/S] keys. The partially loaded program is left in memory.

Bar Coding Programs Using Pressure-Sensitive Labels

Pressure-sensitive bar code labels are available for every function built into the HP-41C and its peripherals. Using these labels you can save time by having immediate access to the bar code you need rather than having wait for bar code produced through other sources. Pressure-sensitive labels are particularly useful when you want to rapidly

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* This program assumes flag 21 (printer enable flag) is cleared if the printer is not plugged in.

assemble bar coded program listings or create customized HP-41C configuration instructions for your own unique applications.

Using Pressure-Sensitive Labels. Where labels are to be used to load program bar code, first write and check your program to reduce the changes of having to make later changes. Then, one by one, remove the needed labels from the label sheet and apply them to a worksheet. Avoid creases in the labels as the wand may detect them in the bar code and respond with an error condition.

Layout and Scanning. Because each label is processed individually by the wand, a row of bar code labels cannot be scanned as rapidly as a row of standard program code. For this reason, ensure that the scan tone indicating a good read, sounds sounds after each label is scanned. If you find it difficult to maintain a comfortable speed while scanning labels in a row format, try a columnar format. Scanning labels in a column normally allows the wand sufficient time between scans to prevent any error due to insufficient processing time.

One of the protective transparent sheets you received with the wand should be placed over any set of labels you are going to scan. The transparent sheet will protect the labels and reduce the possibility of the wand reading label edges as bars and causing an error condition.
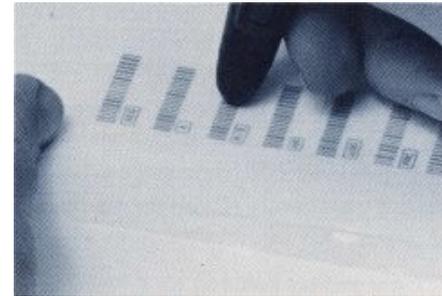
Wand Functions

The wand functions are contained in the wand circuitry and become active in the HP-41C system whenever the wand is plugged into the HP-41C. Wand functions may be executed manually or under program control in the same manner as other HP-41C functions. All can be terminated early by pressing ⬅ or R/S keys.

WNDDTA

The WNDDTA *(wand data)* function halts a running program to let you input a single row of numeric or ALPHA data. When WNDDTA is executed, the HP-41C prompts you by displaying

W: SCAN DATA

After you scan a row of data bar code, program execution resumes.

WNDDTX

The WNDDTX *(wand data by x)* function, like WNDDTA, halts a running program to let you scan data bar code. However, under WNDDTX control, you can load an entire set of data directly into one or more of the HP-41C's storage registers. WNDDTX uses the data control number you place in the X-register to specify the storage registers to be used.

How **WNDDTX** works:

1. Using the following format place a data control number into the X-register.

    bbb.eee

    bbb is the beginning (lowest numbered) data storage register address used and **eee** is the ending (highest numbered) data storage register address used. The **bbb** portion can be less than three digits. The **eee** portion *must* be three digits. The absolute value of **bbb.eee** is used to select the series of consecutively numbered data storage registers in which to store the data. For example, when using **WNDDTX** with 10,020 in the X-register, the calculator stores data in 11 registers, R_{10} through R_{20}.

2. Execute **WNDDTX**. The HP-41C then prompts you to scan the data bar code rows, one at a time, by displaying

    W: SC TO nn

    nn is the storage register to receive the data from the next row of data bar code scan. Each time you scan a data bar code row, **nn** automatically increments by one. When data has been stored in all registers specified by **bbb.eee**, program execution resumes.

When using **WNDDTX** to load data into only one register, simply enter that register address as **bbb** and omit the **eee** portion of the data control number.
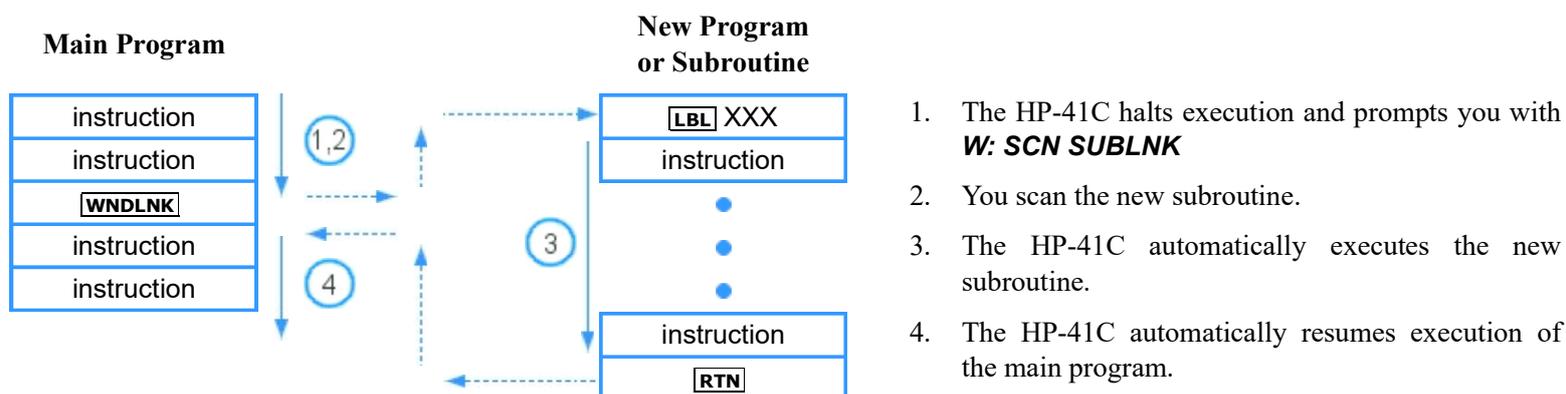
WNDLNK

The **WNDLNK** *(wand link)* function causes the calculator to halt program execution so that you can using the wand to load and automatically execute a new subroutine. If the new subroutine terminates with a **RTN** instruction, the HP-41C will then automatically resume execution of the original program. The new subroutine you scan replaces the last program in memory * unless one of the following conditions applies:

1. The executing **WNDLNK** instruction is the last program in memory, or
2. **WNDLNK** is executed manually while the calculator is positioned to the last program in memory.

When **WNDLNK** is executed, the HP-41C prompts you with

W: SCN SUBLNK

After you scan the first row of the new subroutine, the HP-41C begins to prompt you in the same manner as other program bar code scans, i.e., with *W: RDY* nn

Main Program

| instruction |
| instruction |
| **WNDLNK** |
| instruction |
| instruction |

New Program or Subroutine

| **LBL** XXX |
| instruction |
| • |
| • |
| • |
| instruction |
| **RTN** |

1. The HP-41C halts execution and prompts you with *W: SCN SUBLNK*
2. You scan the new subroutine.
3. The HP-41C automatically executes the new subroutine.
4. The HP-41C automatically resumes execution of the main program.

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* Executing **GTO** **·** **·** before executing **WNDLNK** protects all programs currently in memory from being cleared by the new subroutine.
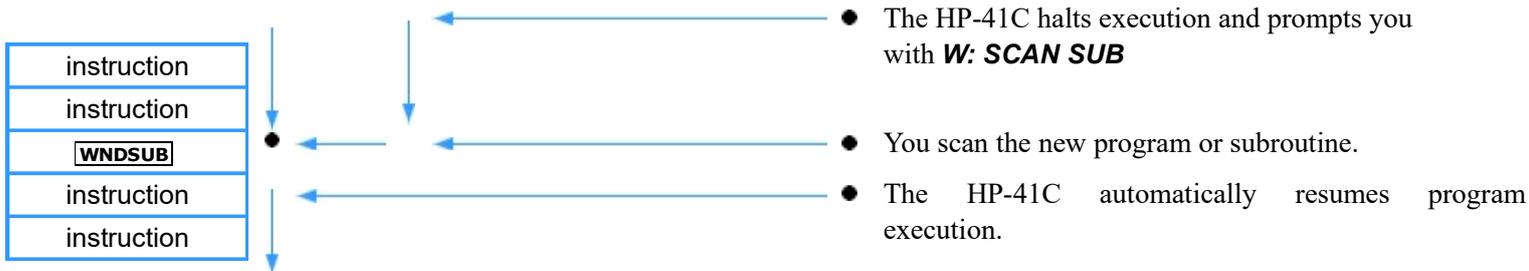
WNDSUB

The WNDSUB *wand subroutine* function halts program execution so you can use the wand to scan a new subroutine. WNDSUB operates in the same manner as WNDLNK , exept:

1. When WNDSUB is executed, the HP-41C prompts with

> **W: SCAN SUB**

2. After the new subroutine is scanned, program execution resumes with the first instruction in program memory after the WNDSUB instruction.

Main Program

instruction
instruction
WNDSUB
instruction
instruction

● The HP-41C halts execution and prompts you with **W: SCAN SUB**

● You scan the new program or subroutine.

● The HP-41C automatically resumes program execution.

WNDSCN

The WNDSCN *wand scan* function is designed for use in specialized applications involving control of the HP-41C system through unique patterns of user-created bar code. If you are new to the HP-41C system or to the more technical aspects of bar code design and generation, you may want to bypass this topic until a later time.

Use of WNDSCN involves:

1. Producing your own specialized HP-41C bar code or using the specialized labels included in the pressure-sensitive label set shipped with your wand.* Instead of translating your bar code into HP-41C functions or data, the wand converts the binary (base two) value of each byte (set of eight bars) of your specialized bar code into the decimal (base 10) equivalent and stores this equivalent in one of the HP-41C's data storage registers.

2. Creating an HP-41C program that will use the decimal equivalent from WNDSCN for selecting predetermined functions, operations, or whole routines.

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* The label set shipped with your wand includes a series of one-byte labels identified with a number between 1 and 64. Each number is the decimal equivalent of the binary value of the bar code printed on the label.

Example: A game of checkers using the wand could employ the following short program to convert wand inputs into displayed coordinates of positions on the board.

[LBL] SQR
[FIX] 0
[CF] 29

} Converts the single byte of binary bar code data for the square that was scanned into decimal data
[WNDSCN] and stores the converted data in R_{01}

[RCL] 01
10
[÷]
[INT]   } Identifies the square's row number and places it in the ALPHA register with a *ROW* label.
[ALPHA] ROW
[SPACE] [ALPHA]
[ARCL] X

[RCL] 01
10
[MOD]
[ALPHA] [APPEND]   } Identifies the square's column number and appends it with a *COL* label, to the row data in the
[,] [SPACE]   ALPHA register.
COL [SPACE]
[ALPHA]
[ALPHA] X

[AVIEW]
[FIX] 4   } Displays the decimal coordinates of the selected square.
[SF] 29
[RTN]

Load and execute the program using the following bar code. Then scan the bar code in a square of the checkerboard illustration on the next page and view the corresponding square identification in the HP-41C's display. (The bar code row in each square consists of the binary equivalent of a two-digit decimal number that identifies the square by row and column.) The above program could be modified to make the data from the squares available for other operations as well.

PROGRAM REGISTERS NEEDED: 7

ROW 1 (1 – 4)

Display *W: RDY 02*

ROW 2 (5 – 11)

Display *W: RDY 03*

ROW 3 (12 – 15)

Display *W: RDY 04*

ROW 4 (16 – 20)

Display *W: WORKING*, then *0.0000*. (Assumes a [FIX] 4 display that was cleared before the program was scanned.)

Ensure that the HP-41C is not in PRGM mode. Then execute SQR by scanning the following bar code:

Bar Code   **Display**

XEQ SQR

Scan the square in the upper left corner
of the following illustration.

```
W: READY


ROW 1, COL 1
```

Identifies the row and column of the square you scanned.

To scan another square and view its
position, reexecute SQR.

How to use WNDSCN :

1. Ensure that there are enough data storage registers available in the HP-41C for the number of bytes (set of eight bars) in the row you will scan under WNDSCN control. Beginning with R_{01}, WNDSCN uses one data storage register for each byte in a row. A row can be as short as one byte (8 bars), or as long as 16 bytes (128 bars).

Bytes
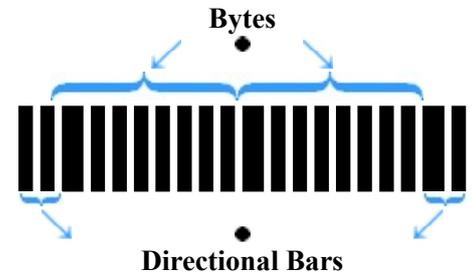
Directional Bars

Note: Because the first and the last pairs of bars in a row indicate the scan direction, every row of bar code must also include the illustrated directional bars.

2. Execute WNDSCN . The HP-41C will prompt you to scan a row of bar code by displaying

W: READY

3. Scan the desired row.

After you scan a row of your bar code, the HP-41C's registers are loaded as follows:

1. The total number of bytes read *(n)* is placed in the HP-41C's X-register as a normal digit entry.

T	
Z	
Y	
X	*n*

Total number of byte in the row.
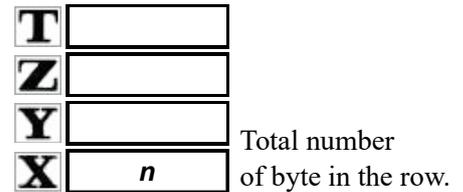
2. The decimal equivalent (yyy) of the binary value of each byte is placed sequentially in the HP-41C's data storage registers. The value of the first byte is placed in R_{01}. The value of the last byte is placed in R_n (where *n* is the value placed in the X-register in step 1, above).

R_{01}	yyy_1
R_{02}	yyy_2
R_n	yyy_n
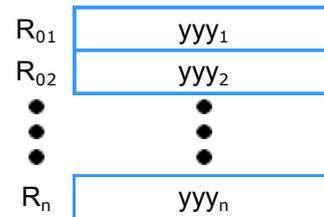
With the decimal form of the byte values in the HP-41C's data storage registers, the WNDSCN operation is complete. The value can now be accessed and interpreted according to your instructions.

If you execute WNDSCN in a running program, program execution resumes with the first instruction in program memory following the WNDSCN instruction. Note that under WNDSCN control the wand cannot perform the error checking it performs during other wand operations (refer to appendix A, Errors and Messages). However, you can design your own error tests in the programs you write for use with WNDSCN .

WNDTST

The WNDTST *wand test* function lets you test the wand of any HP-41C bar code by displaying what has been read in a row you scanned. To use this test, execute WNDTST and scan a row of bar code. Then note and compare each set of digits returned in the HP-41C's display with the corresponding bar pattern in each consecutive byts of eight bars in a row. The narrow and wide bars corresponding to 0's and 1's in the display, i.e.,

1 1 0 1 0 1 0 0 0 0 0 0 1 0 0 1
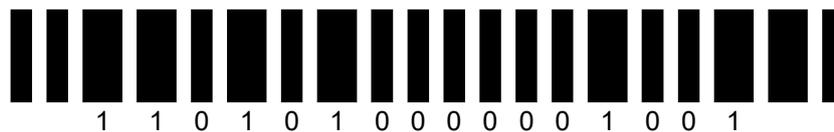
Note: Because the first and last pairs in a row indicate scan direction, they are not displayed by WNDTST .

Example: Use $\boxed{\text{WNDTST}}$ to test a copy of the above bar code. Because $\boxed{\text{WNDTST}}$ uses R_{00} as a counter, plus one storage register for each byte in a row, be sure that the data registers R_{00} through R_{02} are available for this example. To run the test, scan the following bar code.

Bar Code   **Display**

$\boxed{\text{WNDTST}}$

W: READY   Executes $\boxed{\text{WNDTST}}$.

Test Bar Code

B1.=1.1.0.1.0.1.0.0.   Corresponds to the pattern of the wide and narrow bars in the first byte:

11010100

B2.=0.0.0.0.1.0.0.1.   Corresponds to the pattern of the wide and narrow bars in the first byte:

00001001

$\boxed{\text{CLX}}$

0.   Clears the display. ($\boxed{\text{WNDTST}}$ sets the display to $\boxed{\text{FIX}}$ 0 and clears the stack of any previous data.)

Note: If flag 29 is cleared you will not see the radix marks (refer to page 230, Display Control Flags, in the *HP-41C Owner's Handbook and Programming Guide*).

If the wand correctly reads the bar code you scan, the displayed zeros will correspond to the narrow bars and the displayed ones will correspond to the wide bars. A series of consistently misreads of a bar code row normally indicates defective bar code. However, if the wand consistently misreads bar code that is in good condition, the wand may need service. If you suspect that your wand is operating improperly, refer to Appendix B, Maintenance and Service.

How it Works. When you execute $\boxed{\text{WNDTST}}$ and scan a row of bar code, the value of each consecutive byte in the row is stored in a separate data storage register. Because the wand is designed to handle rows up to 16 bytes long, you will never need more than R_{00} through R_{16} for any $\boxed{\text{WNDTST}}$ operation. The byte values will always be displayed in the left-to-right sequence that the corresponding bytes occur in the row, regardless of your direction of scan.

Programming $\boxed{\text{WNDTST}}$. As you would expect $\boxed{\text{WNDTST}}$ is loaded into program memory in the same way as other HP-41C functions. However, unlike the other wand functions, $\boxed{\text{WNDTST}}$ is actually an HP-41C applications program that calls a wand function ($\boxed{\text{WNDTST}}$). For this reason, when you scan $\boxed{\text{WNDTST}}$ or key in $\boxed{\text{XEQ}}$ $\boxed{\text{WNDTST}}$ with the HP-41C in PRGM mode, the instruction appears in program memory as

$$XROM^{\text{T}}WNDTST \qquad *$$

$\boxed{\text{WNDTST}}$ **Options.** If you use an HP 82143A Printer with your HP-41C, executing $\boxed{\text{WNDTST}}$ will result in an automatic printout of the displayed byte values. If you doe not use a printer, but want the HP-41C to halt for each byte value display instead of pausing, set flag 21 before executing $\boxed{\text{WNDTST}}$. After the first byte value appears, execute $\boxed{\text{R/S}}$ each time you are ready to step from one byte value display to the next.

Customized ALPHA Prompts

Using the following programming procedure you can replace initial $\boxed{\text{WNDDTA}}$, $\boxed{\text{WNDDTX}}$, $\boxed{\text{WNDSUB}}$, $\boxed{\text{WNDLNK}}$, $\boxed{\text{WNDSCN}}$, or $\boxed{\text{WNDTST}}$ function prompts with your own customized ALPHA prompts.

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* If $\boxed{\text{WNDTST}}$ has been copied into program memory first, placing the HP-41C in PRGM mode, then scanning or keying in $\boxed{\text{XEQ}}$ WNDTST result in *XEQ* $^{\text{T}}$ *WNDTST* appearing as an instruction in program memory.

Program Memory

instruction
instruction
your prompt
AVIEW
named instruction
instruction
instruction

● Execution halts with your prompt displayed.
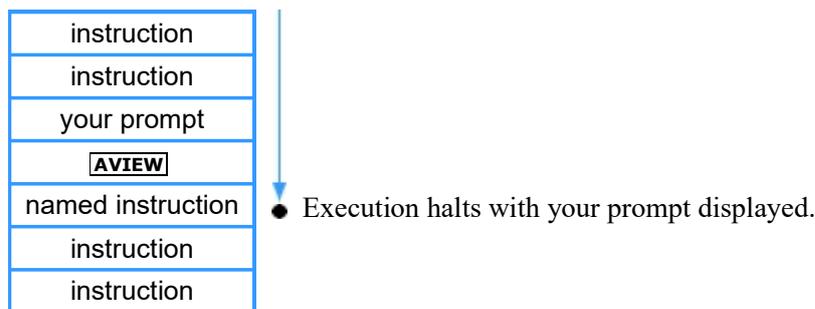
Program lines 03 through 05 and 11 through 13 of the program on page 10 shows an example of this usage.

Executing Programs Containing Wand Functions With No Wand Present

Remember from the beginning of this section that the wand functions only become available while the wand is plugged in. So if you have programs stored in program memory that contain specific wand functions, and the wand is not attached, those wand functions are nonexistent and that program will not execute properly (when a wand function is encountered, the display will show *NONEXISTENT*). However, when you plug the wand back in and execute that program, it will execute properly. Here is how the HP-41C keeps track of these wand functions:

1. While the wand is in place, the function name appears normally in program memory, like this: *18 WNDDTA*, or *27 WNDSUB*.

2. While the wand is removed, these functions are displayed in PRGM mode as a function called XROM. An XROM function tells the HP-41C that the function belongs to some plug-in accessory. Next to the XROM function name are two numbers. These indicate which accessory the function belongs to as well as an indicator of the function. So, the program line *18 WNDDTA* (with the wand plugged in) would change to *18 XROM 27,01* while the wand was removed. The *XROM* tells the system that the function belongs to a plug-in accessory, and the *27,01* tells the system that that accessory is number *27* (the wand) and the function number is *01* (WNDDTA).

Programs containing these function have the following XROM numbers while the wand is removed:

Function	XROM Number
WNDDTA	XROM 27,01
WNDDTX	XROM 27,02
WNDLNK	XROM 27,03
WNDSUB	XROM 27,04
WNDSCN	XROM 27,05
WNDDTST	XROM 27,06

Appendix A

Errors and Messages

Scan Error Conditions

Most scan errors are caused by slow or uneven scanning, inaccurate scans, i.e., missing some of the bars in a row, excessively tilting the wand, or by defective bar code. When the wand detects a scan error condition, the HP-41C sounds the prolonged scan error tone, and, in most cases, displays an error message. Bar coded information from the row causing the scan error is rejected, and no information transfer or function execution takes place.* To hear the difference between the normal scan tone and the scan error tone, scan the following rows of paper keyboard bar code. Scanning the row of good bar code gives you the normal scan tone and causes the indicated function to be executed. Scanning the meaningless bar code consistently produces the scan error tone. Scanning the defective paper keyboard (or label) bar code can result in no response, a scan error indication, or, in some cases, the wrong function.

Good Bar Code	Meaningless Bar Code	Defective Bar Code
`ON` (Disables automatic turn-off.)		`ON` (Disables automatic turn-off.)

You can reduce errors to a minimum by developing a good scanning technique and by protecting your bar code. When you experience scan errors that are not due to defective bar code, you can normally recover by simply rescanning the rejected row. But if the error condition persists, ou may want to execute the `WNDTST` function (refer to page 16, `WNDTST`). If `WNDTST` indicates wand read failures and the bar code is not worn of poorly printed, refer to appendix B, Maintenance and Service.

Direct sunlight overloads the wand's light sensor sufficiently to hinder or prevent the wand from reading bar code. For this reason, if you operate the wand in direct sunlight, shield the bar code you are scanning.

Error Messages

W: ADDR ERR   **Address error.** An attempt was made to store data in a nonexistent data storage register.

Recovery: You may want to use `SIZE` to create more storage register space or store the data in another, existing storage register. If you interrupt a `WNDDTX` operation to create more storage registers of change **bbb.eee,** reexecute the entire operation.

W: CHKSUM ERR   **Checksum error.** The system has detected a scan error or program barcode sequence error.

Recovery: Paper keyboard or date barcode. Re-scan the row where the error condition occurred. If repeated scan errors occur, the barcode may be defective. Enter the function or data from the keyboard. If data entry was under `WNDDTA` of `WNDDTX` control, do the following:

1. Press the `←` key to terminate the `WNDDTA` or `WNDDTX` function.
2. Enter from the keyboard all remaining data in that series to avoid any storage errors.
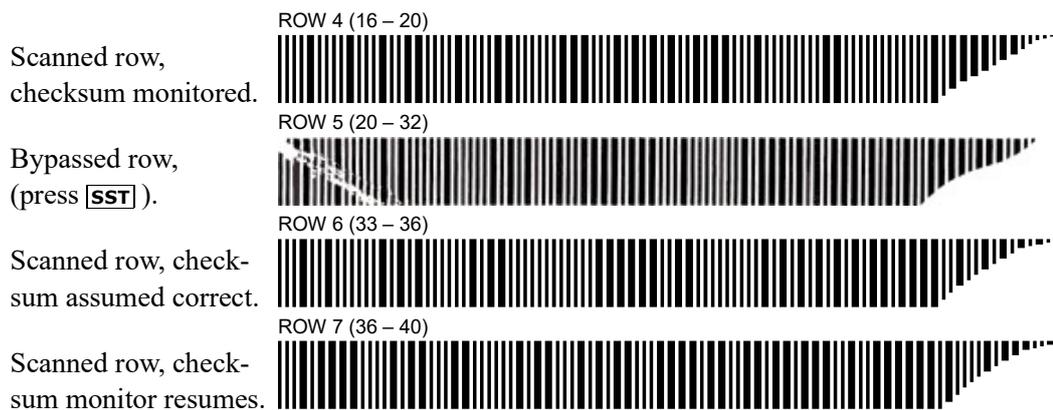3. If the error occurs in a running program, execute `R/S` to resume program execution.

Recovery: Program barcode.

1. Check the display prompts to be sure you scanned the proper row. Scan the row indicated by the prompt.

---

* Most bar code types use a checksum to detect errors, e.g., the checksum in program bar code causes an error message if the bar pattern is misread. However, with the short rows and similar patterns in *paper keyboard* and *label* bar code, it is possible that a row code as one function can be misread and accepted as another function. In most cases this condition is due to defective bar code or use of improper scan techniques.

2. If the checksum error condition persists, bypass the row by pressing the [SST] key. The display will then prompt for the row following the bypassed row and you can continue scanning the program. (If the error condition occurs in the last row of bar code in a program, press [←] instead of [SST] .) After you scan the last row of the program. identify the bypassed program instructions by comparing the program in the HP-41C with a written listing of the same program. (Where the printed program line numbers indicate that a numbered program instruction begins on a row you scanned and ends on a row you bypassed, that entire program instruction is bypassed.) Then go to the place in program memory where the missing instructions belong and load them using the paper keyboard or the HP-41C's keyboard.

> **Note:** The system uses a running checksum to monitor program bar code rows for scan errors. When you bypass a row of program bar code and resume scanning with the following row, the checksum monitoring system assumes that the row scanned after the bypassed row was correctly read. When you scan the second row after the bypassed row, normal running checksum monitoring is reinitialized to the correct running value. For this reason you should compare the instructions in program memory with a listing of the program to be sure the series of instructions in the row following the bypassed row were read correctly.

Scanned row, checksum monitored.

ROW 4 (16 – 20)

Bypassed row, (press [SST]).

ROW 5 (20 – 32)

Scanned row, checksum assumed correct.

ROW 6 (33 – 36)

Scanned row, checksum monitor resumes.

ROW 7 (36 – 40)

W: DATA ERR	**Data error.** The data just scanned is out of the calculator's range, or there is an illegal character recorded in the data barcode line.
	Recovery: Enter the data from the keyboard. If *W DATA ERR* occurs during a [WNDDTX] operation, enter from the keyboard all data beginning with the data in the line that will not read. (Refer to *W CKSUM ERR* information for the correct procedure.)
W: NO ROOM PACKING TRY AGAIN	**Memory Filled.** There is insufficient space in memory to load the current line of program instructions or key reassignments.
	Recovery: Create more space in memory, then rescan the program from the beginning, or resume your key assignment operations.
W: SEQ ERR	**Checksum error.** Occurs only if you bypass a row of program bar code using [SST] , then scan a row other than the row indicated in the display by *W RDY nn.*
	Recovery: Scan the row indicated by *W RDY nn.*
W: TYPE ERR	**Type error.** An unexpected type of barcode has been scanned.
	Recovery: Complete or terminate the previous operation before proceeding to the new type.

Procedural Messages

W: RDY **nn**	The wand is ready to scan program barcode row **nn**.
W: READY	The wand is waiting to scan.
W: SC TO **nn**	Follows execution of the `WNDDTX` function. Scan the row of data barcode you want stored in data storage register **nn**.
W: SCAN DATA	Follows execution of the `WNDDTA` function. Indicates the wand is ready to scan a single row of data barcode. Numeric data will be placed in the X-register; ALPHA data in the ALPHA register.
W: SCN SUBLNK	The prompt following execution of the `WNDLNK` function. Scan the desired subroutine.
W: SCAN SUB	The prompt following execution of the `WNDSUB` function. Scan the desired program or subroutine.

Appendix B

Maintenance and Services

> **CAUTION**
> Always turn off the HP-41C before inserting or removing the wand interface module. Failure to turn off the HP-41C could damage both the calculator and the wand.

Specifications

Power

Draws less than 50 mA at 5V from the HP-41C's batteries when the scan switch is pressed (HP-41C turned on or off).

The wand's cumulative effect on the HP-41C's batteries varies with the frequency and duration of use, but can be significant with heavy use. (If the scan switch is continuously pressed, a new set of batteries in the HP-41C will last approximately 10 hours.)

Scan Angle and Distance

Up to 25° from the vertical with tip in contact with bar code medium (the optimum angle is 10° to 20°).

Temperature and Altitude

Operating	0° to 45° C	32° to 113° F
Storage	−20° to 65° C	−4° to 149° F

25,000 feet maximum (non-pressurized cabin)

Wand Care

While there are no user-serviceable parts inside the wand, observing the following precautions will help ensure long term satisfactory performance.

> **CAUTION**
> Do not use spray cleaner on the sensor or the wand. If you spray any liquid on the wand parts, damage may result.

1. Keep the electrical contacts of the wand interface module and calculator module ports free of obstructions. Should the contacts become dirty, carefully brush or blow the dirt out of the contact area. do not use any liquid to clean the contacts.

2. Check the aperture in the wand tip periodically for dirt or obstructions. If it is necessary to clean the tip, first turn off the HP-41C and remove the wand from the calculator. Then unscrew the tip from the wand body. The aperture can be cleared with a cotton swab or similar device and a liquid detergent. The glass window on the sensor should be inspected and cleaned if dust, dirt, or fingerprints are visible. To clean the sensor window, dampen a lint free cloth with liquid glass cleaner and clean the window with the cloth.

Take care not to disturb the positioning of the sensor or damage the sensor assembly while the wand tip is off for cleaning. After cleaning the aperture and sensor window, the tip should be gently and securely screwed back into the wand.

3. Store the wand in a clean, dry place. Static electricity could damage the wand's circuitry.

4. Always turn off the HP-41C before inserting or removing the wand interface module. Failure to do so could damage both the calculator and the wand.

CAUTION

Do not insert your fingers or any objects other than an HP module or plug-in accessory into any port. To do so could alter the Continuous Memory or damage the port of the calculator. Always keep the port caps in place over any module ports you are not currently using.

A Word About Bar Code

Bar code is a combination of bars and spaces formatted to represent various types of information. Three parameters that help determine readability are contrast ratio between the bars and spaces, space width, and wear or print quality of the bars. Because the use of color in bar code can reduce the contrast ratio between bars and spaces, it is recommended that you use only black bar code printed on white surfaces. Error in space width can result from the distortion introduced to some degree by most copying machines. Depending upon the degree of distortion present, this may noticeably affect the bar code you copy. Your copies should have a narrow bar width and spacing of no less than 15 mils. Wear of poor print quality may introduce frequent errors and can render the bar code unreadable. Here are some examples of worn bar code and bar code of poor print quality.

Copying Bar Code

Most typical office copiers do not reproduce bar code well. Poor bar resolution, reduced bar width, and stray marks are the most frequently encountered problems. These problems can be minimized by using a copier that produces a very dark image with sharp resolution. When copying bar code label materials, it is best to use a machine with a "pasteup" mode to avoid reproducing the edges of the labels on the copy. The wand may detect such images and produce an error condition. In most cases, reliable copies cannot be made from other copies.

As you may have noticed, the photo mechanisms in copy machines move in either side-to-side or top-to-bottom motion. The sharpness of resolution in your copies of bar code may vary with the direction of this motion across the originals you copy from. If the bars in your copies are not sharply defined, try copying the material with the originals turned 90° on the copy surface. If the copier you have access to does not reproduce bar code well, you may want to try the alternative of having your bar code reproduced through an offset printing process.

Protecting Bar Code

When scanning bar code, remember that the wand should be used with a light touch. Applying pressure only increases wear. Because most bar code will wear rapidly if unprotected, you should always cover bar code you are scanning with one of the transparent sheets provided with the wand. Another method of protecting bar code is to cover it permanently with a non-glossy, transparent adhesive tape. If bar code you are using becomes smeared, creased, or smudged, it should be replaced.

Improper Wand Operation

If the HP-41C operates, but fails to respond properly when you scan bar code, do the following:

1. Ensure that any failures are not due to faulty bar code. Examine the bar code for signs of wear or obvious defects that would affect readability. Test the wand using $\boxed{\textbf{WNDTST}}$ or by scanning several bar code rows that are in good condition.

2. Check for the *BAT* annunciator in the display. If *BAT* is displayed the batteries may not be providing adequate power and may cause the wand to operate improperly. Refer to appendix B, Maintenance and Service in your *HP-41C Owner's Handbook and Programming Guide*.

3. Be sure you are operating the wand according to the instructions in Getting Started, page 6.

4. Be sure the wand tip is securely screwed into the wand.

5. Check the red light in the wand tip. Be sure that the scan switch turns the light on *and* off. Turn off the HP-41C, unplug the wand interface module, plug the module back in and turn on the HP-41C. Then operate the wand. Also try operating the wand with the interface module plugged into a different port, and/or try operating another peripheral using the original wand module port.

6. Execute the $\boxed{\textbf{WNDTST}}$ function (refer to page 15).

7. Examine the HP-41C's module ports and wand module contacts for obstructions or damage.

8. If you are unsure as to the source of the problem, you may want to take your HP-41C and the HP 82153A Wand to your nearest authorized HP retail dealer prior to sending the unit in for service. By temporarily exchanging the wand or calculator and operating the system, you and your dealer may be able to determine which device is not functioning properly. Only the device that has been determined to be malfunction should be sent to HP for service. If you and the dealer are unable to determine the source of the malfunction, send both the HP-41C and the HP 82153A Wand to the HP for service. Refer to Service, page 26.

Note: The wand reads bar code using a photosensor to detect light reflected from the bar code. Because of the low intensity of the reflected light signal, highly sensitive circuitry has been built into the wand. Due to this sensitivity, the wand can be affected by nearby strong electrical or magnetic fields (such as those caused by power cords, electric machinery, or electric power lines). Any magnetic or electrical interference occurring in the wand will result in "no read" or "read error" conditions. Using a recharger in the HP-41C system while operating the wand can cause interference conditions. If there is recharger interference, it can sometimes be reduced by reversing the recharger plug in its socket. Read problems due to interference can also be reduced by ensuring that you do not grasp the wand near the tip, where the wand's sensitive circuitry is located, and by scanning the bar code at a different angle.

Limited One-Year Warranty

Wat Will We Do

The HP 82153A Wand is warranted by Hewlett-Packard against defects in materials and workmanship for one year from the date of original purchase. The wand is designed and warranted to read only bar code that is within Hewlett-Packard's specifications for HP 82153A Wand bar code. (Refer to *Creating your own HP-41C Bar Code*.) If you sell your wand 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 repair center.

Wat Is Not Covered

The warranty does not apply if the wand has been damaged by accident or misuse, or as a result of service or modification by other than an authorized Hewlett-Packard repair center.

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. **ANY 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.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state, province to province, or country to country.

Warranty for 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.

Obligation to Make Changes

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.

Warranty Information Number (In the U.S. only)

If you have any questions concerning this warranty please call toll-free (except in Alaska, Hawaii, and Oregon) 800/547-3400. In Oregon call 757-2000.

Service

How to Obtain Repair Service

Hewlett-Packard maintains repair centers in most major countries throughout the world. You may have your wand repaired at a Hewlett-Packard repair center anytime it needs service, whether the unit is under warranty or not. There is a charge for repairs after the one-year warranty period. Please refer to Shipping Instructions.

In the United States

The Hewlett-Packard United States Repair Center for handheld and portable printing calculators is located in Corvallis, Oregon. The mailing address is:

<div align="center">

HEWLETT-PACKARD COMPANY
CORVALLIS DIVISION SERVICE DEPARTMENT.
P.O. BOX 999/1000 N.E. CIRCLE BLVD.
CORVALLIS, OREGON 97330
U.S.A.

</div>

In Europe

In Europe, returns should be made to the nearest Hewlett-Packard designated collection point or service center. Contact your HP authorized dealer directly for assistance.

A Hewlett-Packard designated service center is maintained in most European countries.

International Service Information

Not all Hewlett-Packard repair centers offer service for all models of HP calculator products. However if you bought your wand from an authorized Hewlett-Packard dealer you can be sure that service is available in the country where you bought your wand.

If you happen to be outside of the country where you bought your wand, you can contact the local Hewlett-Packard repair center to see if HP 82153A Wand service is available. If service is unavailable, please ship your wand to the address listed under ''In the United States,'' above. A list of repair centers for other countries may be obtained by writing to the above address.

All shipping, reimportation arrangements, and customs costs are your responsibility.

Hewlett-Packard calculator products are normally repaired and reshipped within five (5) working days of receipt an any repair center. This is an average time and could possibly vary depending upon the time of year an work load at the repair center.

The total time you are without your wand will depend largely on the shipping time.

Service Repair Cost

There is a fixed repair charge for out-of-warranty repairs. The repair charges include labor, material, and all return shipping charges. In the United States, the full charge is subject to the customer's local sales tax.

Calculator products damaged by accident of misuse are not covered by the fixed repair charges. In these situations repair charges will be individually determined based on time and material.

Service Warranty

Any out-of-warranty repairs performed are warranted against defects in materials and workmanship for a period of 90 days from date of service.

Shipping Instructions

Should your HP 82153A Wand require service, return it with the following items:

1.   A completed Service Card, including a description of the problem.

2.   A sales receipt or other proof of purchase if the one-year warranty period has not expired.

The wand, Service Card, and (if required) the proof of purchase should be packaged in the original shipping case or other adequate protective packaging to prevent in-transit damage. Such damage is not covered by the one-year limited warranty; Hewlett-Packard suggests that you insure the shipment to the repair center. The packaged wand should be shipped to the nearest Hewlett-Packard designated collection point or service center. Contact your dealer directly for assistance. (If you are not in the country where the wand was originally purchased, refer to International Service Information on .)

Whether the unit is under warranty or not, it is your responsibility to pay shipping charges for delivery to the Hewlett-Packard repair center.

After warranty repairs are completed, the repair center returns the unit with postage prepaid. On out-or-warranty repairs in the United States and some other countries, the unit is returned C.O.D. (covering shipping costs and the service charge).

Further Information

Service contracts are not available. Calculator circuitry and design are proprietary to Hewlett-Packard, and service manuals are not available to customers.

Should other problems or questions arise regarding repairs, please call your nearest Hewlett-Packard sales office or repair center.

Users' Library

For information concerning currently available HP bar code materials, please contact one of the following Hewlett-Packard Users' Libraries:

Hewlett-Packard S.A.	Hewlett-Packard Company
USERS' CLUB EUROPE	USERS' LIBRARY
7, Rue du Bois-du Lan	1000 N.E. Circle Blvd.
P. O. Box, CH-1217 Meyrin 2	Corvallis, Oregon 97330
Geneva, Switzerland	U.S.A.

Appendix C

Wand Accessories

Standard Wand Accessories

The following standard accessories are shipped with your HP 82153A Wand:

Accessory	HP Part Number
• *HP 82153A Wand Owner's Manual*	82153-90001
• *HP 82153A Wand Paper Keyboard*	82153-90008
• Standard Pressure-Sensitive Label Set (10 pages—more than 800 labels)	
• Three transparent protective sheets	

Optional Wand Accessories

In addition to the standard accessories shipped with your HP 82153A Wand, Hewlett-Packard also makes available the following optional publication for users who desire to generate their own bar code.

Creating Your Own HP-41C Bar Code (available Spring, 1981), HP part number 82153-90019.

> Provides the detailed information needed to implement bar code production on computer-plotter of computer-printer systems. Include coverage of HP bar code types and specifications, annotated computer BASIC language programs, flowcharts, general guidelines for implementation on various systems, and a discussion of HP bar code algorithms.

To order *Creating Your Own HP-41C Bar Code*, contact your nearest authorized Hewlett-Packard dealer or consult the accessory brochure included with your wand.

Appendix D

Bar Code for the HP-41C
Standard Application Pac

The bar code in this appendix corresponds to the program listings in the *HP-41C Standard Applications Pac Handbook* (revised B, November 1979)

This appendix includes the bar code needed to perform the following operations for each HP-41C standard Application program:

- Set the HP-41C to any special status conditions (SIZE, display settings, and flag settings) required by the program.

- Load the program.(If you place the HP-41C in USER mode before scanning the RPN Primer or Vector Operations program bar code, the key assignments indicated in the *HP-41C Standard Applications Pac Handbook* for those programs will also be made.)

- Execute the program (XEQ instructions are provided for all programs except the RPN Primer program).

- Following execution of the program, clear any flags set, but not cleared, by the program.

The Calendar Functions, Hexadecimal-Decimal Converter, and Financial Calculations programs begin with local labels (refer to, , Subroutines, in your *HP-41C Owner's Handbook and Programming Guide*). Local labels will not appear in the HP-41C's program catalog (▮ CATALOG 1 on the keyboard). If you want easier access to any or these programs, and you have sufficient space in program memory, insert a non-local (global) label of your choosing at the beginning or the desired program.

The bar coded flag commands that follow most of the program bar code listings are provided to normalize flags that may be left in a non-normal status following execution or partial execution of the programs.

NOTICE

RPN Primer

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SIZE 1

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FIX 0

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

SF 27 (Sets USER mode.)

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CF 29

PROGRAM REGISTERS NEEDED: 44

ROW 1 (1 – 4)

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

ROW 2 (4 – 9)

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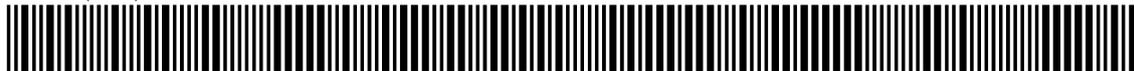
ROW 3 (9 – 14)

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ROW 4 (15 – 20)

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ROW 5 (21 – 27)

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ROW 6 (28 – 33)

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ROW 7 (34 – 39)

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ROW 8 (39 – 44)

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ROW 9 (44 – 50)

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ROW 10 (50 – 57)

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ROW 11 (57 – 60)

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ROW 12 (60 – 64)

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ROW 13 (64 – 68)

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ROW 14 (69 – 72)

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ROW 15 (73 – 77)

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ROW 16 (77 – 81)

ROW 17 (81 – 84)

ROW 18 (85 – 90)

ROW 19 (90 – 93)

ROW 20 (93 – 97)

ROW 21 (97 – 102)

ROW 22 (102 – 107)

ROW 23 (108 – 112)

ROW 24 (109 – 113)
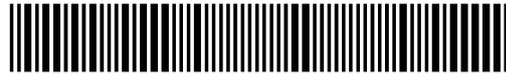
CF 05

SF 29

Calendar Functions

SIZE 10

FIX 4

SF 27 (Sets USER mode.)

PROGRAM REGISTERS NEEDED: 54

ROW 1 (1 – 9)
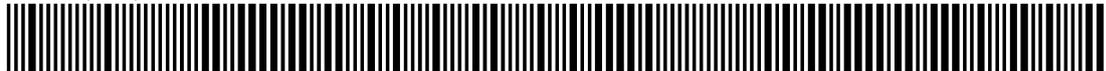
ROW 2 (10 – 16)

ROW 3 (17 – 22)

ROW 4 (22 – 28)


ROW 5 (29 – 40)

ROW 6 (41 – 53)

ROW 7 (54 – 61)

ROW 8 (62 – 69)

ROW 9 (70 – 78)

ROW 10 (79 – 88)

ROW 11 (89 – 100)

ROW 12 (100 – 108)

ROW 13 (108 – 116)

ROW 14 (117 – 124)

ROW 15 (125 – 134)

Calendar Functions

ROW 16 (135 – 142)

ROW 17 (143 – 148)

ROW 18 (149 – 153)

ROW 19 (153 – 157)

ROW 20 (157 – 160)

ROW 21 (160 – 163)

ROW 22 (163 – 166)
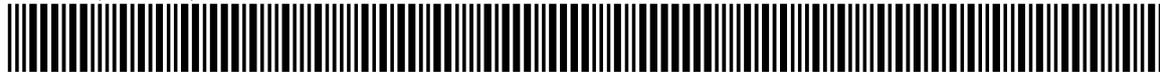
ROW 23 (166 – 172)

ROW 24 (172 – 178)

ROW 25 (178 – 183)

ROW 26 (184 – 188)
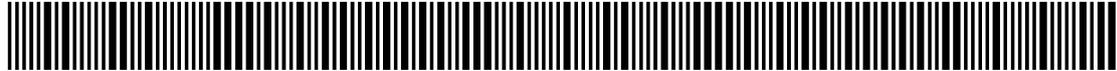
ROW 27 (189 – 193)

ROW 28 (194 – 199)

ROW 29 (199 – 203)

XEQ A

XEQ B
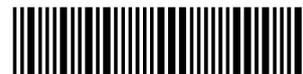
XEQ C

XEQ E

CF 06

CF 22

SF 28

SF 29

Word Guessing Game

SIZE 19	FIX 0	CF 29

PROGRAM REGISTERS NEEDED: 37

ROW 1 (1 – 2)

ROW 2 (2 – 6)

ROW 3 (7 – 10)

ROW 4 (10 – 12)

ROW 5 (13 – 14)

ROW 6 (14 – 17)

ROW 7 (17 – 23)

ROW 8 (23 – 31)

ROW 9 (31 – 39)

ROW 10 (40 – 47)

ROW 11 (48 – 55)

ROW 12 (56 – 62)

ROW 13 (63 – 70)

ROW 14 (70 – 74)

ROW 15 (74 – 77)

Word Guessing Game

ROW 16 (78 – 82)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||

ROW 17 (82 – 84)

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ROW 18 (84 – 87)

||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
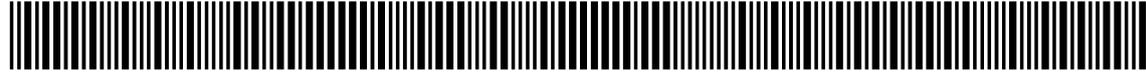
ROW 19 (88 – 96)

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ROW 20 (96 – 99)

|||||||||||||||||||||||||||||||||||||||||

|||||||||||||||||||||||||||||||||||||||||||||||||| ||||||||||||||||||

XEQ **WORDS**   R/S

||||||||||||||||||||||||

SF 29

Arithmetic Teacher
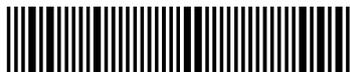
SIZE 10

FIX 0
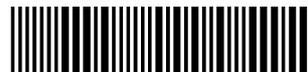
CF 29

PROGRAM REGISTERS NEEDED: 52

ROW 1 (1 – 3)

ROW 2 (4 – 6)

ROW 3 (6 – 11)
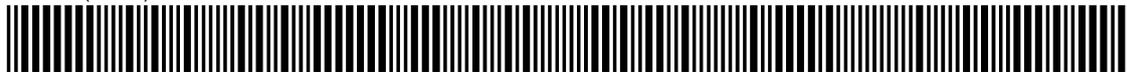
ROW 4 (12 – 17)
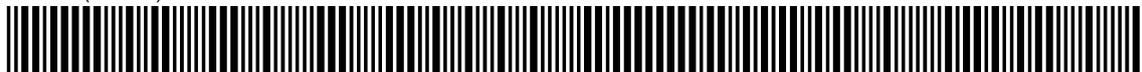
ROW 5 (17 – 23)

ROW 6 (23 – 27)

ROW 7 (28 – 31)

ROW 8 (32 – 37)

ROW 9 (37 – 43)

ROW 10 (43 – 49)

ROW 11 (49 – 55)
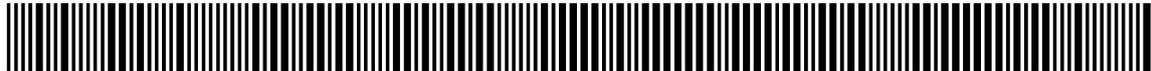
ROW 12 (56 – 58)

ROW 13 (59 – 67)

ROW 14 (67 – 73)

ROW 15 (73 – 77)

Arithmetic Teacher

ROW 16 (78 – 86)

ROW 17 (86 – 93)
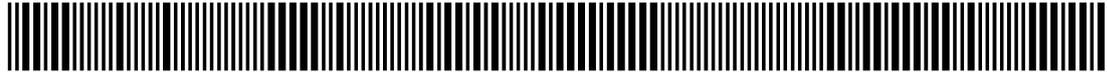
ROW 18 (94 – 103)

ROW 19 (103 – 111)
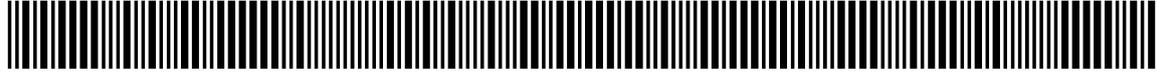
ROW 20 (111 – 118)

ROW 21 (118 – 122)

ROW 22 (122 – 131)

ROW 23 (131 – 135)

ROW 24 (135 – 141)

ROW 25 (142 – 147)

ROW 26 (147 – 152)

ROW 27 (153 – 159)

ROW 28 (160 – 164)

.021946

XEQ TEACH

R/S

SF 29

CF 00

Hexadecimal-Decimal Converter

SIZE 21   FIX 0   SF 27 (Sets USER mode.)

PROGRAM REGISTERS NEEDED: 37

ROW 1 (1 – 7)

ROW 2 (7 – 15)

ROW 3 (16 – 24)
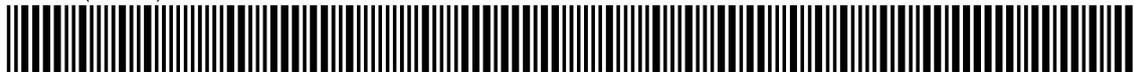
ROW 4 (25 – 32)

ROW 5 (33 – 38)

ROW 6 (39 – 45)

ROW 7 (46 – 54)

ROW 8 (55 – 62)

ROW 9 (63 – 71)

ROW 10 (71 – 78)

ROW 11 (78 – 85)

ROW 12 (86 – 94)

ROW 13 (94 – 101)

ROW 14 (102 – 109)

ROW 15 (110 – 116)

Hexadecimal-Decimal Converter
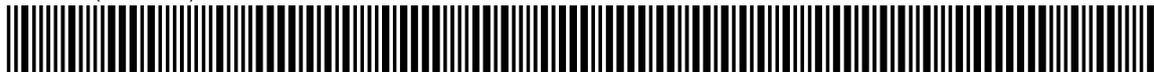
ROW 16 (116 – 122)
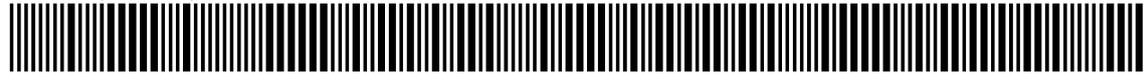
ROW 17 (123 – 129)

ROW 18 (129 – 135)

ROW 19 (136 – 141)

ROW 20 (141 – 143)

XEQ A
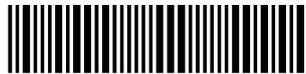
XEQ E

ALPHA

CF 22

CF 23

Financial Calculations

SIZE 10	FIX 2	SF 27 (Sets USER mode.)

PROGRAM REGISTERS NEEDED: 40

ROW 1 (1 – 11)

ROW 2 (12 – 21)

ROW 3 (22 – 31)

ROW 4 (32 – 42)

ROW 5 (43 – 54)

ROW 6 (55 – 67)
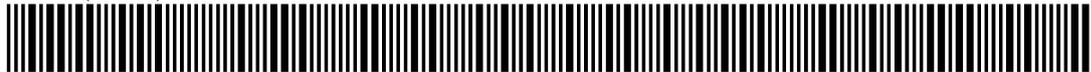
ROW 7 (68 – 76)

ROW 8 (76 – 88)
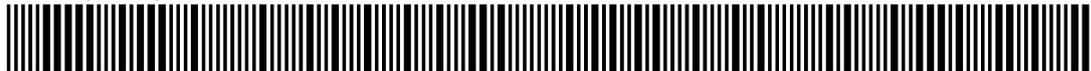
ROW 9 (89 – 101)

ROW 10 (102 – 110)
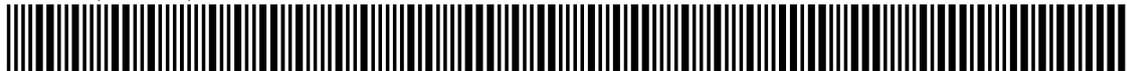
ROW 11 (110 – 117)

ROW 12 (118 – 126)

ROW 13 (126 – 134)

ROW 14 (134 – 142)

ROW 15 (142 – 152)

Financial Calculations

ROW 16 (152 – 159)
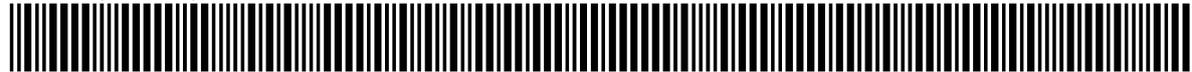
ROW 17 (160 – 169)

ROW 18 (169 – 176)

ROW 19 (177 – 189)

ROW 20 (190 – 198)

ROW 21 (198 – 199)

ROW 22 (199 – 202)
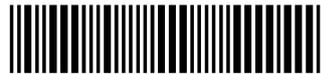
XEQ a

XEQ A

XEQ B

XEQ C

XEQ D
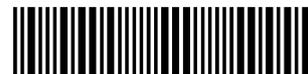
XEQ E

CF 22

Root Finder

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

SIZE 8

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DEG

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖

FIX 4

PROGRAM REGISTERS NEEDED: 21

ROW 1 (1 – 2)

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ROW 2 (2 – 5)

‖‖

ROW 3 (6 – 8)

‖‖

ROW 4 (9 – 13)

‖‖

ROW 5 (14 – 24)

‖‖

ROW 6 (25 – 36)

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ROW 7 (37 – 44)

‖‖

ROW 8 (45 – 55)

‖‖

ROW 9 (56 – 65)

‖‖

ROW 10 (66 – 71)

‖‖

ROW 11 (71 – 75)

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XEQ **ROOT**

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R/S

Curve Fitting

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SIZE 16	**ΣREG** 10	**FIX** 2

PROGRAM REGISTERS NEEDED: 37

ROW 1 (1 – 4)

ROW 2 (4 – 7)
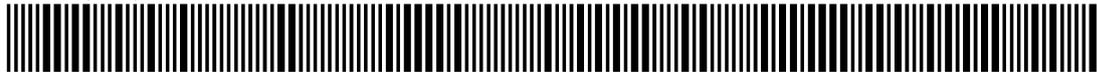
ROW 3 (8 – 11)

ROW 4 (11 – 15)

ROW 5 (15 – 20)

ROW 6 (20 – 30)

ROW 7 (30 – 41)

ROW 8 (42 – 51)

ROW 9 (52 – 61)
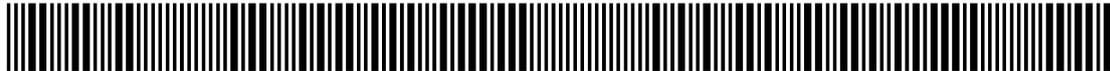
ROW 10 (62 – 72)
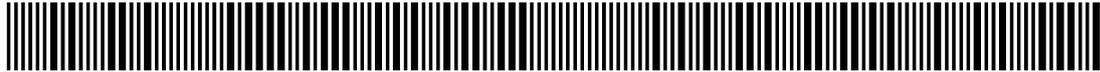
ROW 11 (73 – 85)

ROW 12 (86 – 92)

ROW 13 (92 – 102)

ROW 14 (103 – 113)

ROW 15 (113 – 121)

ROW 16 (122 – 132)

ROW 17 (133 – 141)

ROW 18 (142 – 147)
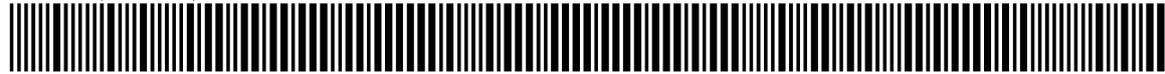
ROW 19 (147 – 153)

ROW 20 (153 – 156)

XEQ LIN

XEQ EXP

XEQ LOG

XEQ POW

CENTER+

XEQ A

XEQ C

XEQ E

XEQ a

R/S

CF 00

CF 01

CF 02

CF 21

CF 27

SF 29

Vector Operations
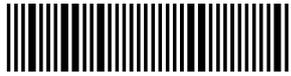
SIZE 00

SF 27 (Sets USER mode.)
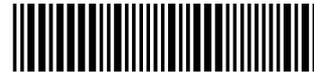
FIX 2

PROGRAM REGISTERS NEEDED: 13

ROW 1 (1 – 6)

ROW 2 (6 – 12)

ROW 3 (13 – 15)

ROW 4 (16 – 20)
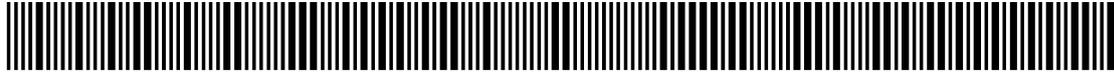
ROW 5 (20 – 32)
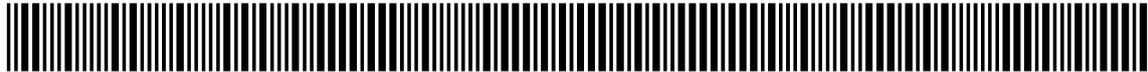
ROW 6 (33 – 36)
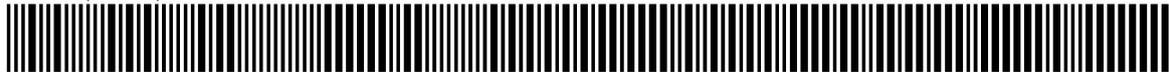
ROW 7 (36 – 40)

CENTER✶

XEQ **CADD**

XEQ **CSUB**

XEQ **CMULT**

XEQ **CDIV**

Blackjack

SIZE 27   FIX 0   CF 29
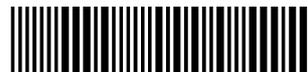
PROGRAM REGISTERS NEEDED: 89

ROW 1 (1 – 6)

ROW 2 (7 – 10)

ROW 3 (11 – 21)

ROW 4 (22 – 29)

ROW 5 (29 – 36)

ROW 6 (36 – 45)

ROW 7 (45 – 52)

ROW 8 (53 – 60)

ROW 9 (61 – 67)

ROW 10 (67 – 72)

ROW 11 (72 – 76)
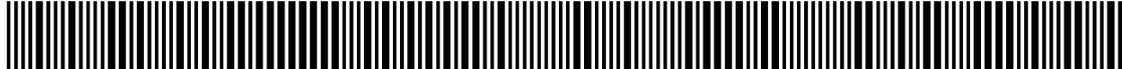
ROW 12 (76 – 81)
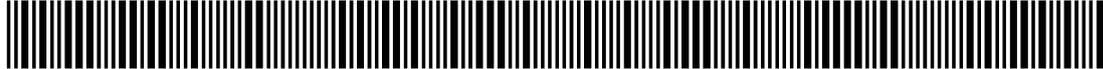
ROW 13 (82 – 84)

ROW 14 (84 – 91)

ROW 15 (91 – 98)

Blackjack

ROW 16 (98 – 103)

ROW 17 (104 – 111)

ROW 18 (111 – 116)

ROW 19 (116 – 122)

ROW 20 (122 – 125)

ROW 21 (126 – 131)

ROW 22 (132 – 134)

ROW 23 (135 – 142)

ROW 24 (143 – 148)

ROW 25 (148 – 151)

ROW 26 (151 – 156)

ROW 27 (156 – 163)

ROW 28 (164 – 169)
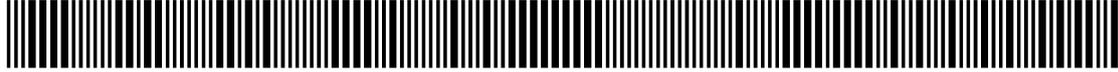
ROW 29 (169 – 175)

ROW 30 (175 – 177)

ROW 31 (177 – 181)

ROW 32 (182 – 186)

ROW 33 (186 – 193)

ROW 34 (193 – 201)

ROW 35 (201 – 207)
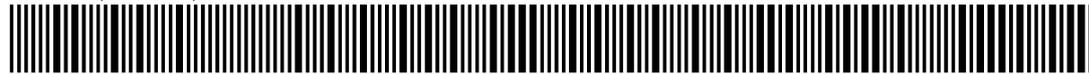
ROW 36 (208 – 214)

ROW 37 (214 – 220)
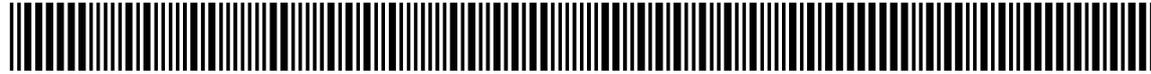
ROW 38 (220 – 221)

ROW 39 (222 – 225)

ROW 40 (226 – 231)

ROW 41 (231 – 234)

ROW 42 (235 – 239)

ROW 43 (239 – 245)

ROW 44 (245 – 249)

ROW 45 (249 – 254)
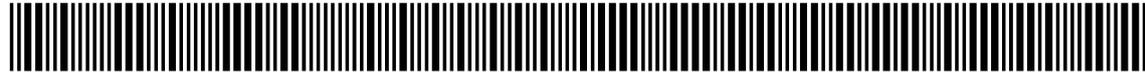
ROW 46 (255 – 259)

ROW 47 (259 – 262)

ROW 48 (262 – 263)
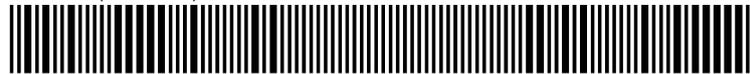
ASN DL 11

ASN HT 12

ASN S 13

SF 27 (Sets USER mode.)

XEQ SH

STO 21

STO 00

XEQ DL

XEQ HT

XEQ S

CF 00

CF 01

CF 02

CF 03

CF 04

CF 06
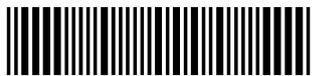
CF 07

CF 08
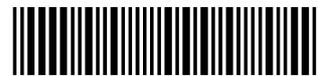
CF 09

SF 29

CF 22

Appendix E

Demonstration Programs

The HP 82153A Wand allows convenient entry of bar coded HP-41C programs, functions, and data. The utility of reading programs into your calculator from bar code listings is obvious; the following demonstrations programs are intended to help you glimpse the potential of being able to read data and execute individual HP-41C functions form bar code.

"Search and Destroy" is a destroyer vs. submarine game typical of grid search games. The advantage of using the wand is that grid positions are simply scanned in as opposed to keyed in, eliminating the need to specify row and column numbers. Furthermore, commands to drop depth charges, etc. are scanned in from the "game board," freeing the player from referring to user instructions or remembering key assignments.

"Character Builder" demonstrates the wand's usefulness in another problem of a grid nature, only this time in a very practical application. Building special characters by specifying which of the forty-nine dots in the 7×7 printhead matrix will print and which will not is a somewhat cumbersome task without the wand. With it, just scan the desired "dots" on the grid and the program builds the character, instructing the corresponding dots in the printhead to print. You can quickly and easily make monograms, logos, or other special symbols.

"Triangle Solutions" illustrates how some problems can be structured to take advantage of very natural data entry and solution schemes using the wand. In this example, an infinity of triangles of any shape and size can be solved in the same straightforward way using the wand and a simple graphic aid.

And if you are having trouble reading bar code using the wand, or cannot read it at all, there is a very short program called "Pace" that will help you with your technique.

Search and Destroy

Imagine that you are the commander of a destroyer with orders to search out and destroy an enemy submarine. The submarine is somewhere in an area 10 leagues by 10 leagues. To find the submarine, input the position of your ship by scanning the bar code grid. From that position, you search for the submarine with your sonar, as indicated by the display and the initial tone. If the sub is within sonar range, there will be an echo, indicated by the display and a second tone. The pitch of the echo is determined by the distance to the submarine—the higher the pitch, the closer the submarine.

Attempt to move your destroyer directly over the sub for an attack by scanning the grid. Then scan the bar code to "DROP DEPTH CHARGES." If you are directly over the submarine, you will sink it. If you are within 1.5 leagues, there is a change you will sink it.

A successful attack is indicated by ***BOOM*** appearing in the display. Otherwise ***MISSED*** will be displayed and the submarine will have moved. Its new location will be within a radius of one league from its last position.

To play, the steps are as follow:

1. Execute the program memory `SIZE` command and load the program by scanning the bar code on .
2. Scan the `XEQ` **SG** barcode.
   The display will prompt you with *SEED*.
3. Key in any integer number, and the scan "BEGIN".
4. The display will prompt you with *ORDERS? nm* where *n* is the row and *m* is the column of the last position scanned (initially 0). Search for the submarine, moving the destroyer to any location on the grid by scanning the bar code for that position. You'll hear the sonar pulse go out. If you're within range of the sub (within 2.5 leagues) you'll hear an echo, the higher the pitch the closer the sub.
5. Alternatively, you can "DROP DEPTH CHARGES" of check the "STATUS" to determine how many soundings you have made and how many depth charges you have dropped.

Example:

Operation	Display	
Scan `XEQ` **SG**	*SEED?*	
Key in the integer seed 73, then scan BEGIN	*ORDERS 0*	
First move: Scan 55	*SCANNING* *ORDERS 55*	(no echo)

Since there was no echo, eliminate the shaded region below.

Second move: Scan 22	*SCANNING* *CONTACT* *ORDERS 22*	(low pitch echo)

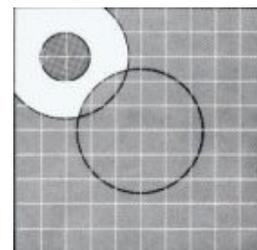Since a low pitch echo sounded, eliminate the area very close to the ship's location.
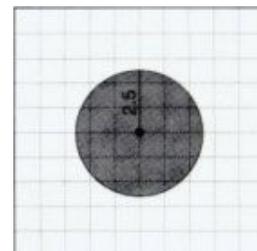
Third move: Scan 20	*SCANNING* *CONTACT* *ORDERS 20*	(high pitch echo)

Since a high pitch echo sounded, the sub is close. Scan DROP DEPTH CHARGES.

BOOM
1 SCAN
3 SCANS
GOOD JOB
NEW GAME
ORDERS 0

XEQ SG

BEGIN

DROP DEPTH CHARGES

STATUS

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Character Builder

Here's a slick application for your wand. If you've ever tried building special characters on the 82143A Printer using `BLSDPEC`, you know how long it takes to specify which dots in the 7×7 matrix to turn on and which to leave off. Using this program and the 6×6 dot matrix of specialized bar code on the facing page, a corresponding 6×6 dot matrix character can be built by simply scanning the "dots" that are ro be turned on. The specialized bar code "dots" are simply two digit numbers, 11 through 66, that comprise the row and column information

Notes:

1. Because of printer buffer limitations, a 6×6 matrix is used rather than a 7×7 matrix.

2. To run this program a printer and one memory module are required.

Instructions:

1. `SIZE` memory and load the program by scanning the bar code on page 63.

2. Using the graphic aid on the facing page, scan `XEQ` **CRBLD**.

3. When the prompt *W: READY* is displayed, scan any element of the matrix that is to be incorporated into the special character.

4. Repeat step 3 until all "dots" are specified. Then scan STOP; the finished character will be printed together with a super graphic of the character.

Example:

Use the wand to build a "flying goose."

SOLUTION:

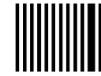|					
11	12	13	14	15	16
21	22	23	24	25	26
31	32	33	34	35	36
41	42	43	44	45	46
51	52	53	54	55	56
61	62	63	64	65	66
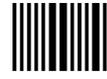
XEQ CRBLD

STOP

Triangle Solution

Given three sides of a triangle or a combination of sides and angles, this program solves for the remaining sides and angles and computes the area of the triangle. There are no keystrokes required—everything can be accomplished with the wand and the graphic aid on the facing page. Simply scan the values for the sides or angels together with the bar code for the corresponding sides or angles in the diagram, in any order, untill all of the known values are input. Then scan the code for any of the sides or angles in the diagram to display their lengths or measures. Scanning the bar code labeled AREA displays the computed area of the triangle.

Notes:

1. If a triangle cannot exist with the side lengths and angle measures given, i.e., the data is inconsistent, *DATA ERROR* will be displayed.

2. In some cases, two solutions exist because one of the angles can be either obtuse or acute. Both solutions will be displayed.

3. The equations used are derived from the Law of Sines and the Law of Cosines.

Instructions:

1. $\boxed{\text{SIZE}}$ memory and load the program by scanning the bar code on .

2. Using the graphic aid on the facing page, scan $\boxed{\text{XEQ}}$ TRI.

3. Scan the numeric value for any known part of the triangle followed by the bar code for the part. Angles are measured in degrees.

4. Repeat step 3 until all date are entered. A minimum of three known parts is required, but if additional information is known, more than three parts may be entered and execution time will be shortened.

5. Scan the bar code for the area or any side or angle to display its calculated value.
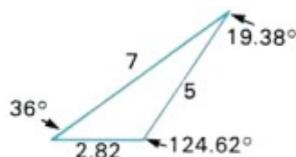
6. For another triangle, go to step 3.

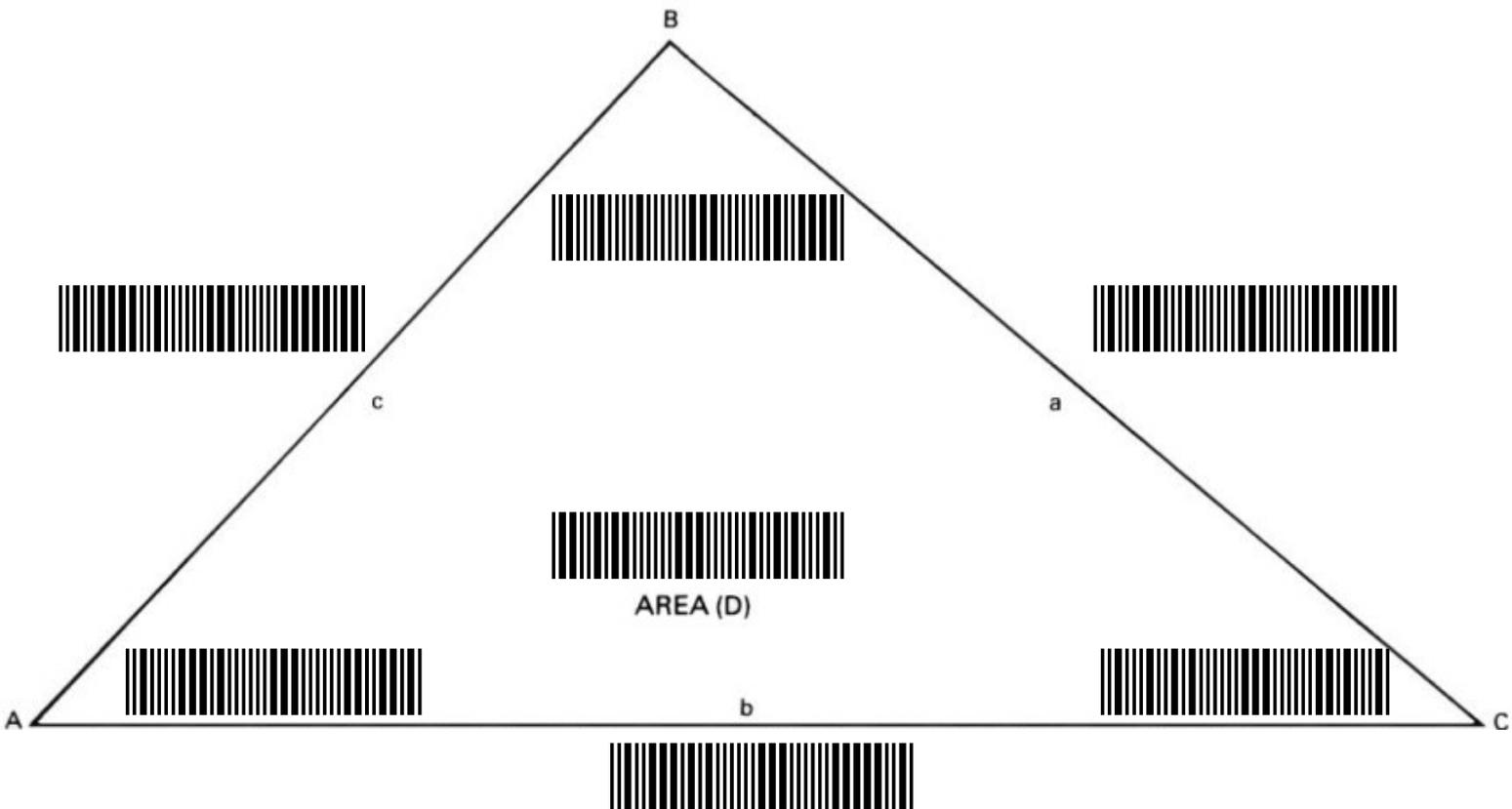**Example:** Solve the triangle below.
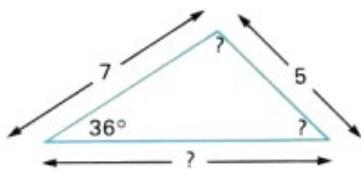
Solution:
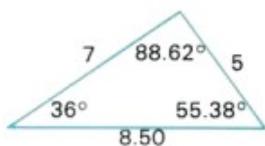
1st solution   2nd solution


```
              XEQ "TRI"
      7.0000  XEQ c
c=7.0000
      5.0000  XEQ a
a=5.0000
     36.0000  XEQ A
∡A=36.0000
              XEQ b

SOLUTION 1
b=8.5041

SOLUTION 2
b=2.8222
              XEQ D
SOLUTION 1
AREA=17.4950
SOLUTION 2
AREA=5.8059
              XEQ C
SOLUTION 1
∡C=55.3761
SOLUTION 2
∡C=124.6239
```
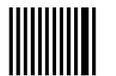
B

c

a

AREA (D)

A

b

C

7   8   9

4   5   6

1   2   3

XEQ TRI
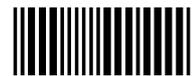
0   ·   CLX   ←

Pace

This short program is intended to help new wand users surmount an obstacle many encounter when learning to read bar code—scanning too slowly.

First remove the wand from the HP-41C, set program mode, and key in the following:

██ ⌷LBL⌷ ⌷ALPHA⌷ PACE ⌷ALPHA⌷
██ ⌷LBL⌷ 01
⌷XEQ⌷ ⌷ALPHA⌷ PSE ⌷ALPHA⌷
⌷XEQ⌷ ⌷ALPHA⌷ TONE ⌷ALPHA⌷ 7
██ ⌷GTO⌷ 01

Then take the HP-41C out of program mode and press ⌷R/S⌷. Turn to a page of program bar code, and although you won't actually be reading anything into the calculator, sweep the wand across the rows using the programmed tone to pace yourself. The rate at which you must move the wand to scan one row per tone is an indication of the rate required to successfully read bar code—much slower and the wand won't process the bar code.

Turn off the calculator and plug the wand into an empty port. Now that you have a feeling for how fast to scan bar code, try it!

Search and Destroy

PROGRAM REGISTERS NEEDED: 55

SIZE 008

ROW 1 (1 – 4)

ROW 2 (4 – 12)

ROW 3 (13 – 19)
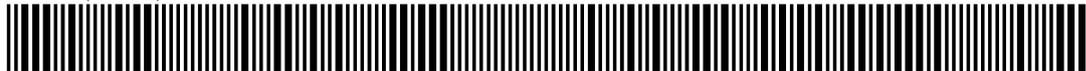
ROW 4 (19 – 22)

ROW 5 (23 – 31)

ROW 6 (31 – 32)

ROW 7 (33 – 39)

ROW 8 (40 – 48)

ROW 9 (49 – 50)

ROW 10 (51 – 58)

ROW 11 (59 – 64)

ROW 12 (65 – 71)

ROW 13 (72 – 76)

ROW 14 (76 – 84)

ROW 15 (84 – 88)

ROW 16 (89 – 93)

ROW 17 (94 – 100)

ROW 18 (100 – 108)

ROW 19 (108 – 112)

ROW 20 (112 – 118)

ROW 21 (119 – 126)

ROW 22 (127 – 132)

ROW 23 (132 – 140)

ROW 24 (140 – 148)

ROW 25 (149 – 159)

ROW 26 (160 – 165)

ROW 27 (165 – 166)

ROW 28 (166 – 171)

ROW 29 (171 – 176)

ROW 30 (177 – 178)

Character Builder
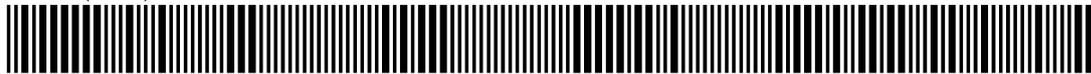
PROGRAM REGISTERS NEEDED: 35
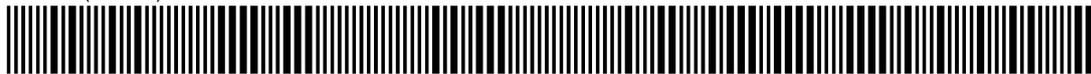
SIZE 041

ROW 1 (1 – 4)

ROW 2 (5 – 11)

ROW 3 (12 – 19)

ROW 4 (20 – 30)

ROW 5 (31 – 41)

ROW 6 (41 – 44)

ROW 7 (44 – 47)

ROW 8 (47 – 53)

ROW 9 (53 – 60)

ROW 10 (61 – 70)

ROW 11 (71 – 78)

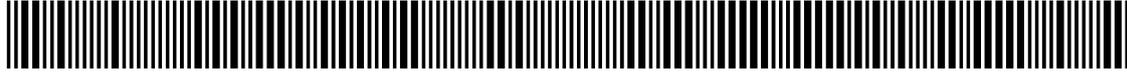ROW 12 (79 – 85)

ROW 13 (86 – 93)

ROW 14 (93 – 98)

ROW 15 (99 – 105)

ROW 16 (105 – 111)

ROW 17 (112 – 118)

ROW 18 (118 – 120)

ROW 19 (120 – 121)

Triangle Solutions

PROGRAM REGISTERS NEEDED: 94

SIZE 030

ROW 1 (1 – 5)

ROW 2 (5 – 9)

ROW 3 (9 – 14)

ROW 4 (15 – 18)

ROW 5 (18 – 23)

ROW 6 (24 – 27)

ROW 7 (27 – 33)

ROW 8 (33 – 36)

ROW 9 (36 – 42)

ROW 10 (42 – 45)
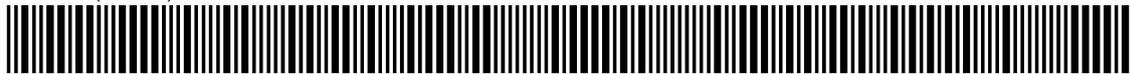
ROW 11 (46 – 49)

ROW 12 (50 – 53)

ROW 13 (53 – 55)

ROW 14 (55 – 57)

ROW 15 (57 – 61)

Triangle Solutions

ROW 16 (61 – 64)

ROW 17 (64 – 69)

ROW 18 (69 – 70)

ROW 19 (70 – 74)

ROW 20 (75 – 79)

ROW 21 (80 – 82)

ROW 22 (82 – 87)

ROW 23 (87 – 89)

ROW 24 (90 – 97)

ROW 25 (98 – 104)

ROW 26 (105 – 109)

ROW 27 (109 – 114)

ROW 28 (114 – 118)

ROW 29 (118 – 124)

ROW 30 (124 – 128)

ROW 31 (129 – 135)

ROW 32 (135 – 138)

ROW 33 (138 – 140)

ROW 34 (141 – 147)
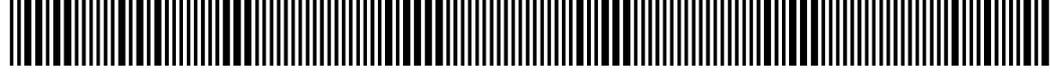
ROW 35 (147 – 152)

ROW 36 (153 – 159)

ROW 37 (160 – 166)

ROW 38 (167 – 171)

ROW 39 (172 – 184)

ROW 40 (185 – 194)

ROW 41 (195 – 205)

ROW 42 (205 – 215)

ROW 43 (216 – 226)

ROW 44 (227 – 236)

ROW 45 (237 – 248)

ROW 46 (249 – 259)

ROW 47 (259 – 270)

ROW 48 (270 – 279)

ROW 49 (280 – 292)

ROW 50 (293 – 305)

ROW 51 (306 – 310)

Pace

PROGRAM REGISTERS NEEDED: 3

ROW 1 (1 – 5)

ROW 2 (5 – 6)

Pace

HP 82153A Wand Function Index

When the HP 82153A Wand is plugged into the HP-41C, the following functions become active in the system. These functions and programs containing these functions are only executable while the wand is plugged in. You can list all of these functions by executing `CATALOG` 2.

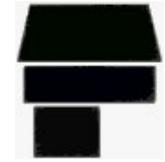|	
`WNDDTA`	Scan one row of data bar code.
`WNDDTX`	Scan one store one or more rows of data bar code as directed by X.
`WNDSUB`	Scan a bar coded subroutine.
`WNDSCN`	Scan a row of specialized bar code for control of user-defined functions.
`WNDTST`	Scan a row of bar code to test for correct reads of the bar code.

HEWLETT-PACKARD
82153A
WAND

OWNER'S MANUAL

WAND PAPER KEYBOARD

OFF USER **ALPHA** PRGM ALPHA

AON
AOFF
ASHF

RDTA
RDTAX

RSUB
MRG

VER

WDTA
WDTAX

WPRV

WSTS

WALL

a | b | c | d | e
A | B | C | D | E

Σ | % | ≠ | < | >
F | G | H | I | J

IND | APPEND | ASTO | ARCL | BST
| K | L | M | SST

^ | ∠ | $ | CLA
N | O | P | <—

WNDLNK
WNDSUB

WNDDTA
WNDDTX

WNDSCN

WNDTST

− | 7 | 8 | 9
Q | R | S | T

+ | 4 | 5 | 6
U | V | W | X

× | 1 | 2 | 3
Y | Z | = | ?

÷ | 0 | . | AVIEW
: | SPACE | , | R/S

PRAXIS

REGPLOT

PRPLOT

ACX

ACCHR

ACCOL

ACSPEC

STKPLOT

PRPLOTP

ACA

SKPCHR

SKPCOL

BLDSPEC

PRBUF

PRFLAGS

PRSTK

PRX

PRREG

PRP

PRKEYS

PRΣ

PRA

PRREGX

LIST

WAND PAPER KEYBOARD

FACT

OFF

USER

PRGM

ALPHA

SDEV

Σ −

Y ^ X

X ^ 2

10 ^ X

E ^ X

E ^ X − 1

MEAN

Σ +

1 / X

SQRT

LOG

LN

LN 1 + X

%CH

CL Σ

%

ASIN

ACOS

ATAN

RAD

ΣREG

X < > Y

RDN

SIN

COS

TAN

GRAD

X< >

DEG

R ^

IND

ASN

LBL

GTO

BST

XEQ

STO

RCL

SST

CLRG

DSE

CAT

ISG

RTN

CL X

CLST

ENTER ^

CHS

EEX

<—

CLD

FS ? C

X ≠ Y ?

X = Y ?

SF

CF

FS ?

FC ? C

X < Y ?

−

7

8

9

FC ?

HMS−

TONE

X <= Y ?

BEEP

P − R

R − P

HMS+

+

4

5

6

X > Y ?

FIX

SCI

ENG

RND

X > 0 ?

×

1

2

3

X < 0 ?

PSE

X ≠ 0 ?

X = 0 ?

PI

LASTX

VIEW

STOP

X < = 0 ?

÷

0

.

R/S

PROMPT

MOD

ADV

INT	D – R	HMS	OCT	ABS
FRC	R – D	HMR	DEC	SIGN

SIZE	ON	COPY	END	PACK	CLP	DEL

82153A WAND