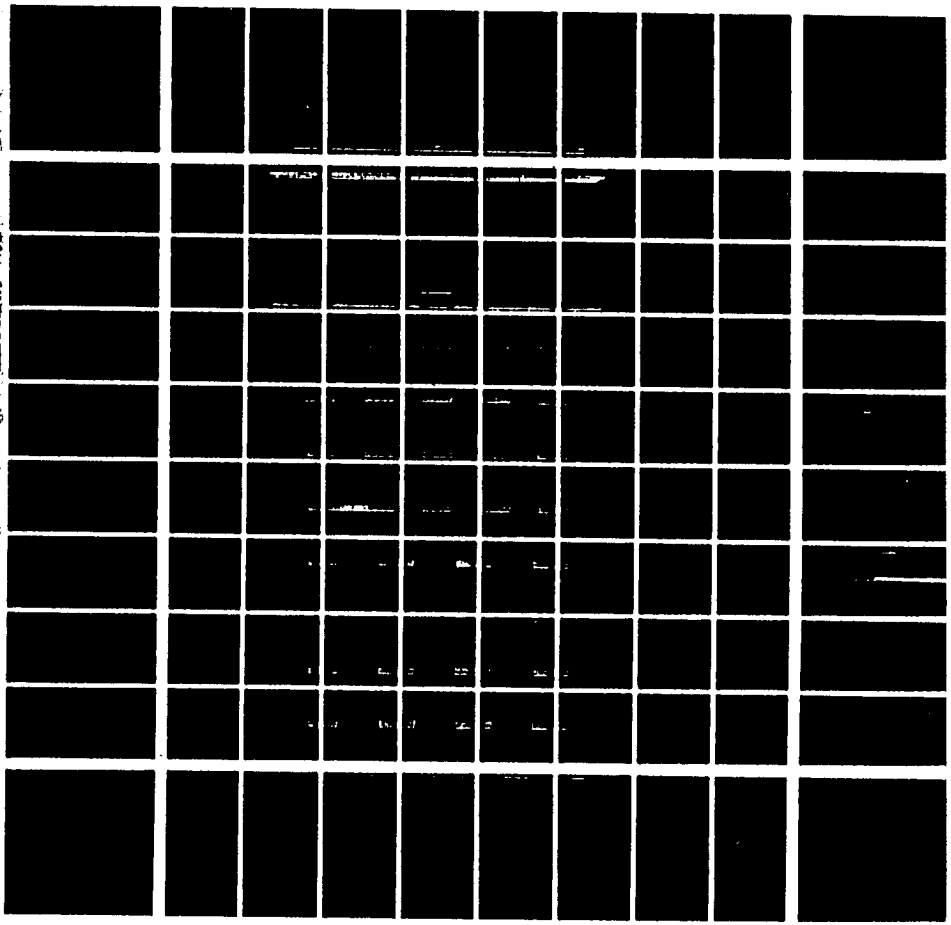
HEWLETT-PACKARD

HP 82242A

Infrared Printer Module

Owner's Manual



HP 82242A
Infrared Printer Module

Owner's Manual

Edition 1 September 1987
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For regulatory information, see page 60.

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1

Getting Started

The HP 82242A Infrared Printer Module, when installed in your HP-41C, CV, or CX, enables your calculator to communicate via an infrared beam with an HP 82240A Thermal Printer. With this easy-to-use system, you can print text, generate plots and graphics, and run programs that access your printer, without the bother of cable interconnections between devices.

The Printing System

We will make reference throughout this manual to the "printing system". The "printing system" consists of your calculator, an Infrared Printer Module installed in a calculator port, and the HP 82240A Thermal Printer.

Installing Your Module

CAUTION

Be sure the calculator is turned off before connecting or disconnecting the module. Failure to do so may damage the calculator or module, or may disrupt system operation.

Your Infrared Printer Module plugs into any of your calculator's ports. With the arrow on the module facing up, push the module into a port until it snaps into place.

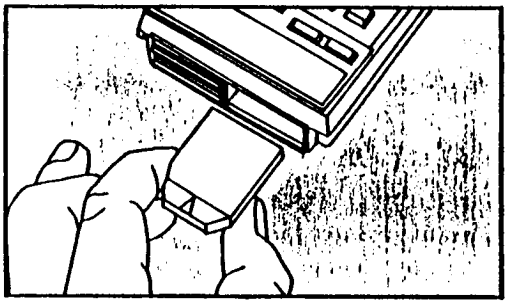


Figure 1-1. Installing the Module

Note:

- If HP 82106A Memory Modules and the Infrared Printer Module are installed in calculator ports, the memory modules will operate correctly only if installed in the lowest-numbered ports.
- If an HP 82160A HP-IL Module is installed in a port, the Infrared Printer Module will operate correctly only if the HP-IL Module's PRINT FUNCTION switch is set to DISABLE.
- The Infrared Printer Module will not operate correctly if an HP 82143A Thermal Printer is plugged into the calculator.

When you install the Infrared Printer Module and turn your calculator on, there is an approximately 1.5 second delay before the calculator display lights up.

Your calculator and printer must be positioned within the limits described by figures 1-2 and 1-3 to ensure proper communication:

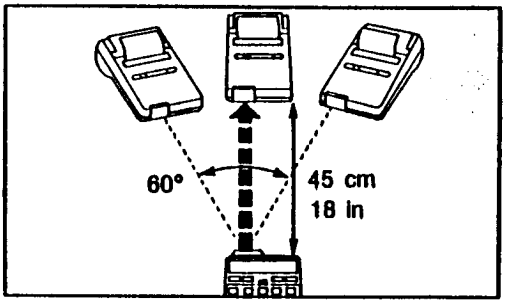


Figure 1-2. Maximum Horizontal Transmitting Distance and Transmitting Angle

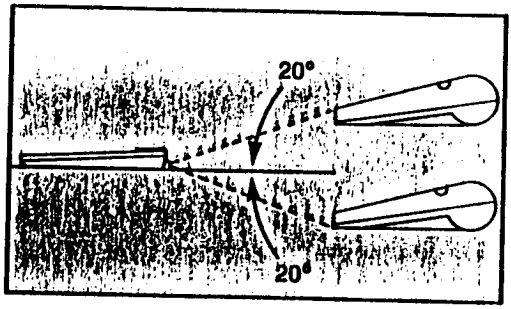


Figure 1-3. Maximum Vertical Transmitting Angle

Note: The maximum transmitting angles are reduced if any of the following are also installed in a calculator port:

- The HP 82160A HP-IL Module.
- The HP 82153A Wand.
- The HP 82104A Card Reader.

Disconnecting Your Module

To remove the module, first turn off the calculator. Then pull the module out of the port and insert a port cover over the empty port.

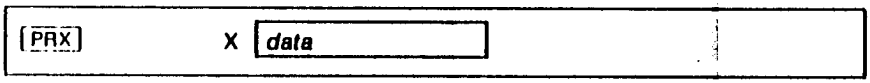
Using This Manual

Chapters 2 through 7 of this manual describe the printing, graphics, plotting, and programming operations available to you with the Infrared Printer Module and HP 82240A Thermal Printer. The manual uses single, colored keys to represent functions not on the calculator keyboard, such as [ACCOL]. When you want to execute such a function, you can do it in two ways:

- by using [XEQ] [ALPHA] *function name* [ALPHA].
- by assigning the function to a key using [ASN] and pressing that key in USER mode.

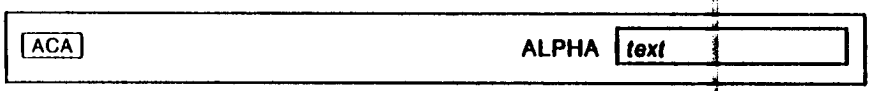
For more information on function execution, refer to the owner's manual for your calculator.

In this manual the description of each function is preceded by a visual guide that summarizes how to execute the function. For example:



The above guide indicates that you must enter data (a number) in the X-register of your calculator to execute the PRX function from the calculator keyboard or in a program.

Here's another example:



This guide indicates that you must enter text in the ALPHA register of your calculator to execute the ACA function from the keyboard or in a program.

If at any time an error message is displayed by the calculator, refer to the error message appendix for an explanation of its cause. In certain conditions, there may be a short delay before the calculator displays the message.

You may have experience using your calculator with an HP 82143A Thermal Printer, or with an HP 82160A HP-IL Module and HP 82162A Thermal Printer. Many of the print functions built into these two printing systems are similar to or identical to those available to you in your new infrared printing system. Some new functions have been added to your infrared system, and a few functions from the earlier systems have not been incorporated. You may choose to review briefly or skip entirely chapters 2 through 7 of this manual and refer directly to appendix E, "If You've Used an HP Thermal Printer...." Appendix E summarizes the module function set, highlights differences from the earlier printing systems, and in some cases refers you back to the main body of the manual for detailed explanations.

2

Controlling Printer Operations

In following chapters, you'll learn how to print text, generate graphics and plots, and print information from calculator programs. First, though, you'll find it helpful to understand how the set of calculator flags and module functions described in this chapter affect printer operations. These flags and functions enable you to control *how* and *when* printer operations are executed.

Calculator Flags That Control Printer Operations

The calculator flags that influence printer operations are user flags; you can set, clear, and test them.

The Printer Enable Flag

The Printer Enable Flag (flag 21) is used to control printing in *programs* that contain specific print functions. Flag 21 has no effect on print functions executed from the keyboard. When flag 21 is set, printing functions contained in a program are executed normally. When flag 21 is clear, execution of printing functions in a program is suppressed.

The Double-Wide Flag

The Double-Wide Flag (flag 12) is a special-purpose user flag that controls how characters are printed on the printer paper. When flag 12 is set, all characters and graphics columns are printed double-wide.

The Lowercase Flag

The Lowercase Flag (flag 13) is a special-purpose user flag that controls the way letters A through Z are printed. When flag 13 is set, letters A through Z, including those in program listings, are printed in lowercase form. (Other characters are not affected by flag 13.)

Table 2-1. The Printer Enable, Double-Wide, and Lowercase Flags.

Flag	Set	Clear
Flag 21 (Printer Enable)	Printer operations are performed normally.	In programs, printer operations are ignored.
Flag 12 (Double-Wide)	Characters are accumulated and printed double-wide.	Characters are accumulated and printed single-wide.
Flag 13 (Lowercase)	Letters A—Z are accumulated and printed in lowercase.	Letters are accumulated and printed without change of case.

The Print Mode Flags

The Print Mode Flags (flags 15 and 16) determine the print mode of the system:

Table 2-2. The Print Mode Flags.

Flag 15	Flag 16	Print Mode
clear	clear	MAN (manual)
clear	set	NORM (normal)
set	clear (or set)	TRACE

- In MAN (*manual*) mode, the printer is idle and does not print unless a print function is executed by you or a program. In MAN mode, program listings are printed left-justified.
- In NORM (*normal*) mode, the printer prints numbers and ALPHA strings that are keyed in, function names as they are executed from the keyboard, and output from print functions. In programs, only output from print functions and the [PROMPT] function are printed. In NORM mode, program listings are printed left-justified.
- In TRACE mode, the printer prints numbers and ALPHA strings that are keyed in, function names, intermediate and final answers, and output from print functions. In TRACE mode, program listings are printed in a special "packed" or condensed form.

Note that your calculator clears all special-purpose user flags (flags 11–20) each time you turn it on. However, once you set any of the printer flags, the printer will operate accordingly until you clear the flag or turn the calculator off. Notice that the conditions of the flags do not affect the calculator's display.

Functions That Control Printer Operations

You can control additional printer operations by executing the following functions.

Turning Print Functions On and Off

PRTON

When you execute the PRTON (*print on*) function, the output mode of your printing system is set to PRTON. In this mode, printing operations are executed normally.*

When you install the Infrared Printer Module and turn your calculator on, the printing system is *automatically* set to PRTON mode. The printing system will remain in PRTON mode until you execute the PRTOFF function (described next).

(When you execute PRTON, flag 21 is automatically set. If you clear flag 21 in PRTON mode, execution of print functions in programs is suppressed and print functions executed from the keyboard are performed normally.)

PRTOFF

When you execute the PRTOFF (*print off*) function, the output mode of the printing system is set to PRTOFF. In this mode, all printing operations (those executed in programs and those executed from the keyboard) are suppressed.

* PRTON sets flag 55 (the Printer Existence Flag). PRTOFF clears flag 55. Flag 55 is not a user flag; it cannot be directly set or cleared. It *can* be tested.

If you have executed [PRTOFF], the printing system remains in PRTOFF mode until you do one of the following:

- Execute the [PRTON] function.
- Execute the [RESETP] function (described at the end of this chapter).
- Turn the calculator off, remove the Infrared Printer Module, reinsert the module, and turn the calculator on again.

Setting the Print Mode

In addition to directly setting the states of flags 15 and 16, you can specify the print mode of your printer by executing the following three functions.

[MAN]	

When you execute the [MAN] (*manual*) function, the print mode of your printer is set to MAN.

[NORM]	

When you execute the [NORM] (*normal*) function, the print mode of your printer is set to NORM.

[TRACE]	

When you execute the [TRACE] function, the print mode of your printer is set to TRACE.

Setting the Delay

[DELAY]	X [*time*]

The [DELAY] function enables you to specify how long your calculator waits between sending lines of information to the HP 82240A Thermal Printer. The number in the X-register is the delay time, in seconds. When you install the Infrared Printer Module and turn your calculator on, the delay is set to 1.8 seconds. The maximum delay is 1.9 seconds. (The actual delay will be the number in the X-register, plus or minus one tenth of a second.)

[DELAY] can be useful when your calculator is sending multiple lines of information to the printer (for example, in execution of the [CAT] function described in chapter 3). To optimize the efficiency of the printing operation, set the delay just longer than the time the printhead in your printer requires to print one line of information. (The printhead speed varies from printer to printer). Be aware that if you set the delay *shorter* than the time to print one line, you may lose information. Also, as the battery in your printer loses charge, the printhead slows down, and, if you have previously decreased the delay, you may have to increase it to avoid losing information. (Battery discharge will *not* cause the printhead to slow to more than the 1.8 second default delay setting.)

Resetting the System Control Flags and Functions

[RESETP]

When you execute the [RESETP] function, the flags and functions discussed in this chapter are returned to their default state:

- Flag 12 clear (characters accumulated and printed single-wide).
- Flag 13 clear (characters accumulated and printed without change of case).
- Output mode set to PRTON.
- Print mode set to MAN (flags 15 and 16 clear).
- Delay set to 1.8 seconds.

([RESETP] returns another set of functions, described in chapter 4, to their default state. Refer to "Printing the Contents of the Print Buffer" in chapter 4.)

3

Standard Printing Operations

Information stored in your calculator may be printed directly using the functions described below. These functions are grouped into four categories in this chapter:

- Calculator functions; when executed, the outcome returned to the display is printed.
- Print-register functions; when executed, the contents of calculator registers are printed.
- Print-program functions; when executed, programs or parts of programs stored in your calculator are printed.
- Print-key assignments and print-status functions; when executed, calculator key assignments and flag status are printed.

Calculator Functions That Print

There are five standard calculator functions that will, in addition to performing their normal functions (described in the owner's manual for your calculator), automatically generate printed output. These functions are [VIEW], [AVIEW], [PROMPT], [ADV], and [CATALOG].

[VIEW]	R_{nn} *data*

When you execute the [VIEW] (*view register contents*) function, the contents of the specified register are printed, as well as displayed by the calculator. The printing system can be set to MAN, NORM, or TRACE mode.

[AVIEW]	ALPHA [text]

When you execute the [AVIEW] (*ALPHA view*) function, the contents of the ALPHA register are printed, as well as displayed by the calculator. The printing system can be set to MAN, NORM, or TRACE mode.

[PROMPT]	ALPHA [prompt]

If the printing system is set to NORM or TRACE mode and you execute the [PROMPT] function, the contents of the ALPHA register (the prompt) are printed, as well as displayed by the calculator.

[ADV]

When you execute the [ADV] (*advance*) function, either in a program or from the keyboard, any information held in the print buffer is printed on the current line, and the printer paper is advanced a single line. (For an explanation of the print buffer, refer to "The Print Buffer" in chapter 4.) If the printing system is not operating, your calculator ignores the [ADV] command.

Your HP 82240A Thermal Printer has an ADVANCE switch. When you activate the switch, the paper will advance one line, but information held in the print buffer will not be printed.

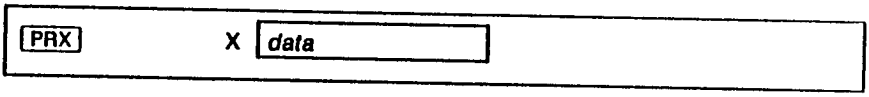
[CAT] *n*

When you execute the [CAT] (*catalog*) function, your calculator displays the contents of any of the calculator catalogs.* When the printing system is set to TRACE mode, the contents of the specified catalog are also printed. When you execute [CAT] 1, the number of bytes that each program occupies in program memory is printed next to the end of each program. (Refer to the owner's manual for your calculator for a discussion of bytes.)

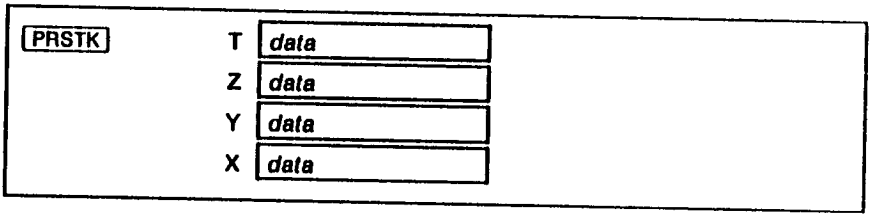
* You may wish to use the [DELAY] function (discussed in chapter 2) to improve the print speed performance during execution of [CAT]. [DELAY] will also improve the print speed performance during execution of the following functions (discussed later in this chapter): [PRBUF], [PRUSR], [PRP], [LIST], and [PRTAGS].

Printing Registers

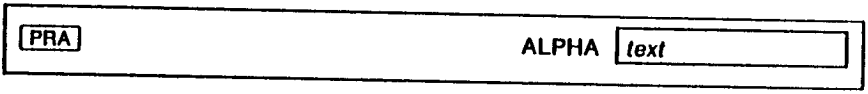
Six functions enable you to print the contents of certain registers in the calculator. Any listing can be stopped by pressing [R/S].



When you execute the [PRX] (*print X*) function, the contents of the X-register are printed and marked with ***.

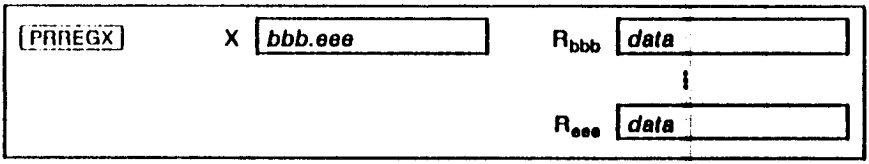


When you execute the [PRSTK] (*print stack*) function, the contents of the automatic memory stack are printed and labeled in T, Z, Y, X order.



When you execute the [PRA] (*print ALPHA*) function, the contents of the ALPHA register are printed. The printed output is left-justified; it lines up with the left margin.

When you execute the [PRREG] (*print registers*) function, the contents of all currently allocated storage registers, beginning with R_{00}, are printed and labeled. When a register contains ALPHA characters, your printer encloses these characters in quotes: `R01 = "ABC"`.

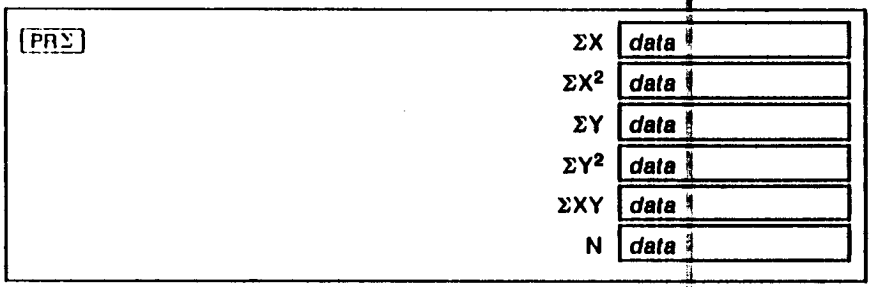


The PRREGX (*print registers as directed by X*) function provides you with control over which registers you print. PRREGX uses a number in the X-register to control printing. Before executing PRREGX, place a control number in the X-register using the following format:

bbb.eee

where *bbb* is the beginning data storage register address, and *eee* is the ending data storage register address. The *bbb* portion can be one to three digits. The first three digits of the *eee* portion define the ending data storage register. For example, specify registers R_{03} through R_{07} by placing 3.007 in the X-register.

Note that if you enter 3.7 in the X-register and execute the PRREGX function, the contents of registers R_{03} through R_{319} (the highest numbered data storage register) are printed! Similarly, if you enter 3.07 in the X-register, the contents of registers R_{03} through R_{70} are printed.



The PRΣ (*print statistics registers*) function enables you to print the contents of the currently defined statistics registers. (Refer to the owner's manual for your calculator for information about ΣREG and how statistics registers are defined.) When you execute the PRΣ function, the contents of all six statistics registers are printed.

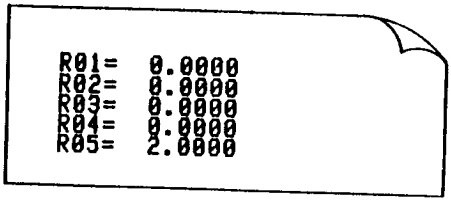
Example: Printing Registers. In this example, we'll print the contents of five data storage registers, and then print the contents of the ALPHA register in double-wide and lowercase modes.

Allocate 17 storage registers, then clear them and store 2.0000 in R_{05}.

[SIZE] 017
[CLRG]
2 [STO] 05

Specify R_{01} through R_{05} and print their contents. (HP 82240A Thermal Printer: MAN mode.)

1.005
[PRREGX]

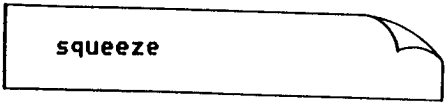


Now print an ALPHA string double-wide. Clear the Double-Wide Flag afterwards. (HP 82240A Thermal Printer: MAN mode.)

[SF] 12
[ALPHA] STRETCH [ALPHA]
[PRA]
[CF] 12

Print an ALPHA string in lowercase. Clear the Lowercase Flag afterwards. (HP 82240A Thermal Printer: MAN mode.)

[SF] 13
[ALPHA] SQUEEZE [ALPHA]
[PRA]
[CF] 13



Printing Programs

When you execute the [PRP] or [LIST] functions, programs or parts of programs that you have stored in program memory are printed. The print mode determines the format in which program lines are printed. You can stop the printing operation at any time by pressing [R/S]. These two functions are not programmable.

PRP

When you execute the PRP (*print program*) function, a specific program stored in program memory is printed. The calculator prompts you for the name of the program you wish to print. Simply key in the name of the program (by pressing ALPHA *name* ALPHA); printing will begin at the first line of the specified program. If you do not specify a program name in response to the prompt (if you press ALPHA ALPHA), the printer will print the program to which the calculator is currently positioned, beginning at the first line. (If you are using an HP 41CX calculator, or an HP 41C or CV calculator with an HP 82182A Time Module installed in a calculator port, the time and date will also be printed at the head of the program listing.)

LIST *nnn*

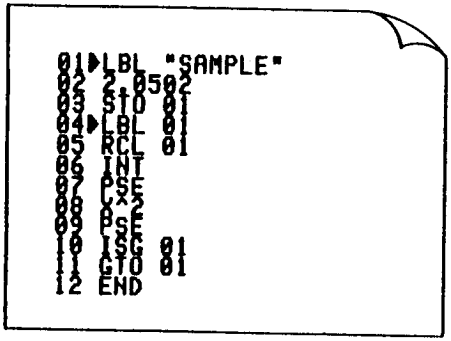
When you execute the LIST function, a specified number of program lines are printed. First, position the calculator to the desired program and then to the line within the program where you wish printing to begin. Then execute LIST. When prompted, key in a three-digit number specifying the number of lines you wish to print.

Example: Printing a Program. The following program listings show the two format options specified by the print mode. (For program listings, the format in NORM mode is identical to that in MAN mode, except that, in NORM mode, the PRP instruction is printed.) The program name is SAMPLE. To execute the example, first key in the program, using the listing shown in the example.

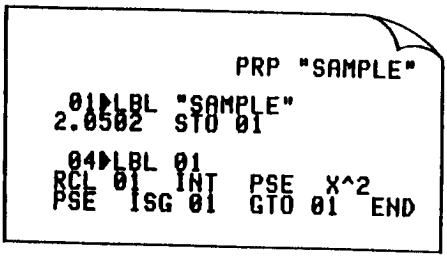
Print the program named SAMPLE.

[PRP]
[ALPHA] SAMPLE [ALPHA]

HP 82240A Thermal Printer: MAN mode.

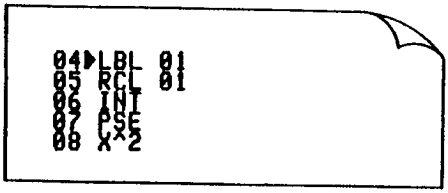


HP 82240A Thermal Printer: TRACE mode.



Locate the SAMPLE program and print five lines, beginning at line 004. (HP 82240A Thermal Printer: MAN mode.)

[■][GTO]
[ALPHA] SAMPLE [ALPHA]
[■][GTO] [·] 004
[LIST] 005



Printing Status and Key Assignments

If you wish to review the calculator's internal conditions, you can use the [PRKEYS] and [PRFLAGS] functions to print this information at any time.

[PRKEYS]	

When you execute the [PRKEYS] (*print key assignments*) function, in a program or from the keyboard, the keycode of each reassigned key, followed by the name of the function or program assigned to each key, is printed. A keycode is row-column code of a key's location on the keyboard. Your printer prefixes the keycodes for shifted key locations with a − (minus sign).

[PRFLAGS]	

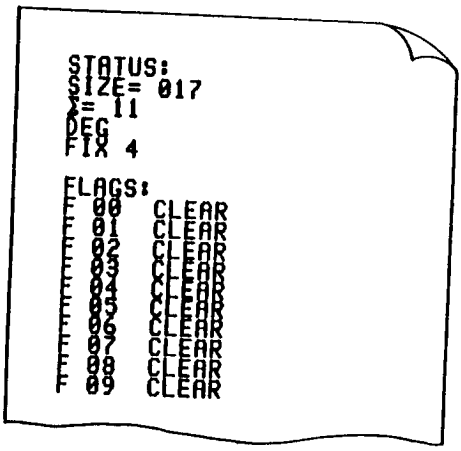
When you execute the [PRFLAGS] (*print flags*) function, from the keyboard or in a program, the following information is printed:

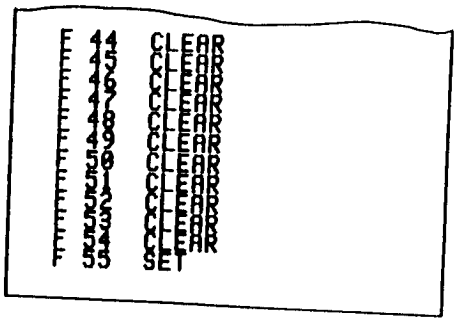
- Number of data storage registers (SIZE = *nnn*).
- Location of first statistics register (Σ = *nnn*).
- Trigonometric mode (DEG, RAD, or GRAD).
- Display format (FIX *n*, SCI *n*, or ENG *n*).
- Status of all flags (F *nn* SET, or F *nn* CLEAR).

Example: Printing Calculator Information.

Print the status of the calculator flags and other information. (HP 82240A Thermal Printer: MAN mode.)

PRFLAGS





4

Accumulating Printer Output

The functions described in this chapter (and the following chapter on graphics) enable you to build up, or *accumulate*, a string of information in your printer, and then print the string. You can combine numeric, ALPHA, and graphics information in the same string. In this chapter, you'll learn how to:

- Accumulate alpha-numeric data from the registers of your calculator, and numeric codes for a host of characters not available on your calculator keyboard.
- Accumulate spacing and underlining commands.
- Print your accumulated strings of information.

Your printing system must be set to MAN mode to properly execute these operations. In NORM or TRACE mode, accumulated information will be printed prematurely.

The Print Buffer

In the previous chapter, "Standard Printing Operations," you learned a number of functions that you can execute to directly print information contained in your calculator. When you execute these functions, the information to be printed actually makes a short stop in the HP 82240A Thermal Printer in a special set of registers called the *print buffer*. The information automatically enters, then leaves the buffer en route to its final destination on the printer paper.

In the following sections, you'll learn how to use the print buffer as a temporary *storage* location for information to be printed. The print buffer is made up of 200 storage locations called bytes. Most types of information, such as alpha-numeric characters, occupy one byte in the buffer. Other types of information, such as mode change commands (for exam-

ple, the "start underlining function" discussed later in this chapter), and graphics instructions and custom characters (discussed in the next chapter), occupy more than one byte in the buffer. Appendix C presents a complete listing of character types and commands and the space they occupy in the buffer.

Accumulating Characters

When the following three functions are executed, alpha-numeric characters are accumulated in the print buffer.

ACA	ALPHA *text*

When you execute the ACA (*accumulate ALPHA*) function, all of the characters from the ALPHA register are copied and placed in the print buffer at the end of any string of characters already in the buffer. ACA can be executed from the keyboard or in a running program.

Example: Accumulating Characters. In this example, we'll first build an ALPHA string in the print buffer using the ACA command, and then print the string.

Advance the paper (and print whatever is already in the print buffer). Place the letters AB in the ALPHA register and accumulate them in the print buffer without printing.

ADV
ALPHA AB ALPHA
ACA

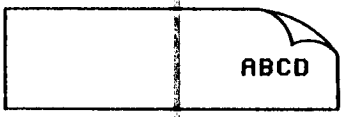
Now accumulate the letters CD in the buffer, print the entire string and advance the paper. (HP 82240A Thermal Printer: MAN mode.)

ALPHA CD ALPHA
ACA
ADV

Here is what happened when you accumulated the ALPHA characters using [ACA] and then executed [ADV].

Keys:	ALPHA Register:	Print Buffer:
[ALPHA] AB [ALPHA]	AB	□□□□
[ACA]	AB	A B □□
[ALPHA] CD [ALPHA]	CD	A B □□
[ACA]	CD	A B C D
[ADV]	CD	□□□□

Printer:



Remember that the status of flags 12 and 13 also affects how characters are accumulated in the print buffer. If you set flag 12, characters are accumulated double-wide. If you set flag 13, letters A through Z are accumulated in lowercase.

[ACX] X *data*

The [ACX] (*accumulate X-register*) function operates in the same way as [ACA], except that when you execute [ACX], information from the X-register is accumulated in the print buffer.

[ACX] accumulates the entire formatted number into the print buffer—the number (according to the current display format) and the space for the sign of the number (blank for a positive number, filled with a minus sign for a negative number). If you wish to omit the initial space for positive numbers, use [ARCL] and [ACA] to accumulate numbers. You can do this by pressing ■ [ARCL] [·] X in ALPHA mode, which recalls the contents of the X-register into the ALPHA register, and then using [ACA] to accumulate those ALPHA characters. When you execute [ARCL], a minus sign will be copied, but not a leading blank for a positive number.

ACCHR	X	character code

When you execute the ACCHR (*accumulate character*) function, one standard printer character is accumulated in the print buffer. The number in the X-register specifies the particular character to be accumulated. ACCHR enables you to accumulate and print many more characters than are available on the keyboard. Appendix D lists the standard characters and their numeric codes for the HP 82240A Thermal Printer. Note that the table includes two characters sets; one when the printing system is in MAPON mode, the other when the printing system is in MAPOFF mode.

MAPON

When you execute the MAPON (*character remapping on*) function, the character set mode of the printing system is set to MAPON. Characters 0-31 and 123-127 are *remapped* so that (with the exceptions noted in appendix D) the character set matches that of the HP 82162A Thermal Printer and HP 82143A Thermal Printer. You'll find the MAPON function very useful (and in some cases, necessary) if you wish to run programs that have been written for these two printers and utilize their extended character set. (Appendix D contains detailed information on this topic.)

When you install the Infrared Printer Module and turn your calculator on, the printing system is automatically set to MAPON mode. The printing system remains in MAPON mode until you execute the MAPOFF function (described next).

MAPOFF

When you execute the MAPOFF (*character remapping off*) function, the character set mode of the printing system is set to MAPOFF; character remapping is turned off. You'll note that the character set in MAPOFF mode matches that listed on pages 18-19 of the owner's manual for your HP 82240A Thermal Printer. Also note that in MAPOFF mode, characters 4, 10, and 27 are *control* characters. Refer to appendix D for an explanation of control characters.

If you have executed [MAPOFF], the printing system remains in MAPOFF mode until you do one of the following:

- Execute the [MAPON] function.
- Execute the [RESETP] function.
- Turn your calculator off, remove the Infrared Printer Module, reinsert the module, and turn your calculator on.

Example: Accumulating Characters, Single- and Double-Wide. In this example, we accumulate a character that is specified by a character code, and print that character double-wide.

First, print whatever is in buffer. Then set the printing system to MAPON mode and set the Double-Wide Flag. Enter the character code for "α" in the X-register and accumulate it. Next, clear the Double-Wide Flag.

[ADV]
[MAPON]
[SF] 12
4
[ACCHR]
[CF] 12

Enter the number −2.6 in the X-register. Enter an ALPHA string and append the X-register to it. After accumulating this ALPHA string, print the contents of the buffer and advance the paper. (HP 82240A Thermal Printer: MAN mode.)

2.6 [CHS]
[ALPHA]
[SPACE] = [SPACE]
[ARCL] [·] X
[ALPHA]
[ACA]
[ADV]

Accumulating Spaces

[SKPCHR] X *number*

When you execute the [SKPCHR] (*skip character*) function, character spaces are accumulated in the print buffer (character positions are skipped). The number placed in the X-register specifies the number of spaces to skip. This function allows you to format information you accumulate and print, without entering individual spaces. You can skip up to 24 spaces. (Your HP 82240A Thermal Printer has a 24 character line; skipping 24 spaces is the same as executing a paper advance.)

Accumulating Underline

STARTU

When you execute the STARTU (*start underlining*) function, the underlining mode of the printing system is set to STARTU. An instruction to underline all subsequently printed characters is accumulated in the print buffer. The printing system remains in STARTU mode until you do one of the following:

- Execute the STOPU function (described next).
- Execute the RESETP function.
- Turn the *printer* off, then on.

STOPU

When you execute the STOPU (*stop underlining*) function, the printing system is set to STOPU mode. An instruction to resume printing of all characters without underlining is accumulated in the print buffer. The printing system remains in STOPU mode until you execute the STARTU function. When you turn your printer on, the printing system is automatically set to STOPU mode.

Example: Accumulating Characters With and Without Underlining. This example shows how to accumulate characters with and without underlining in the same ALPHA string.

Print whatever is in the buffer, advance the paper, and accumulate the STARTU command.

ADV
STARTU

Enter an ALPHA string and accumulate it.

ALPHA E SPACE ALPHA
ACA

Now accumulate the STOPU command. Enter a new ALPHA string and accumulate it. Print the contents of the buffer and advance paper. (HP 82240A Thermal Printer: MAN mode.)

STOPU
ALPHA F ALPHA
ACA
ADV

Here is what happened when you accumulated [STARTU] and [STOPU] escape sequences in your print buffer while accumulating a string of text. (We'll represent the STARTU command by !!, the STOPU command by $$.)

Keys:	ALPHA Register:	Print Buffer:	Printer:
[STARTU]		!!	
[ALPHA] E			
[SPACE]	E_	!!	
[ALPHA]			
[ACA]	E_	!!E	
[STOPU]	E_	!!E$$	
[ALPHA] F	F	!!E$$	
[ALPHA]			
[ACA]	F	!!E$$F	E_F
[ADV]	F		

Printing the Contents of the Print Buffer

After you have accumulated the desired characters in the print buffer, you can instruct the printer to print the contents of the buffer. The contents of the buffer are printed left to right—the first character placed in the buffer is printed at the left, and the last character is printed at the right. The buffer clears as its contents are printed.

[ADV]

When you execute the [ADV] (*advance*) function, the contents of the print buffer are normally printed right-justified; lined up with the right margin of the paper. If the information in the buffer exceeds 27 bytes, the information is printed *left*-justified.

[PRBUF]

When you execute the [PRBUF] (*print buffer*) function, the contents of the print buffer are printed left-justified.

In addition, the information in the print buffer is printed when:

- in MAN, NORM, or TRACE mode, you execute any of the functions described in the previous chapter, "Standard Printing Operations."
- in NORM or TRACE mode, you execute any function whose name is printed when you execute the function in these two modes.

[FMT]

When you execute the [FMT] (*format*) function, the formatting done by [ADV] and [PRBUF] is superceded. If [FMT] is executed before or after accumulating a string of information in the buffer, the string is centered on the printer paper. Centered lines are centered to the nearest dot position in the printed output. If [FMT] is executed between accumulated strings of information, the strings are separated (and left- and right-justified). [FMT] will *not* format any string that [ADV] left-justifies.

Example: Printing the Contents of the Print Buffer Using the [ADV], [PRBUF], and [FMT] Functions. In this example, we'll print the same ALPHA string in four different formats.

Accumulate the ALPHA string HI THERE and then accumulate character 33, "!". Print the complete string right-justified. (HP 82240A Thermal Printer: MAN mode.)

[ALPHA] HI [SPACE] THERE
[SPACE] [ALPHA]
[ACA]
33 [ACCHR]
[ADV]

Print the same string left-justified. If you have not changed the contents of the ALPHA or X-registers, you can simply execute the accumulate functions again. (HP 82240A Thermal Printer: MAN mode.)

[ACA]
[ACCHR]
[PRBUF]

Now print the string centered using the [FMT] function. (HP 82240A Thermal Printer: MAN mode.)

```
[FMT]
[ACA]
[ACCHR]
[ADV]
```

Print the ALPHA string separated from character 33 by executing the [FMT] function between accumulation of the ALPHA string and character 33. (HP 82240A Thermal Printer: MAN mode.)

```
[ACA]
[FMT]
[ACCHR]
[ADV]
```

When the print buffer is filled, the printer automatically prints one line of information to provide additional space. However, *some information may be lost* when this operation is performed. If information is lost by overflowing the buffer, the "▯" character is printed. In such a case, your printer may require a linefeed command ([ADV] or [PRBUF]) to resume printing.

```
[RESETP]
```

When you execute the [RESETP] function, the printer modes described in this chapter are returned to their default state:

- Character set mode set to MAPON.
- Underline mode set to STOPU.

Note that when you execute [RESETP], any information in the print buffer is printed and the buffer is cleared. (Accumulated information is first grouped into 26- to 28-byte packages in the Infrared Printer Module before being sent to the printer. When you execute [RESETP], any accumulated information in the *module* is *lost*.)

(Remember that [RESETP] also returns the system control flags and functions to their default state, as described in "Resetting the System Control Flags and Functions" in chapter 2.)

5

Graphics

Special graphics functions described in this chapter afford you precise control over the smallest component of printed information, the individual dot. Using these functions, you can build and print your own special characters and non-character graphics. In this chapter, we'll show you how to:

- Specify a column of dots using graphics functions.
- Accumulate columns.
- Skip columns.
- Build, accumulate, store, and print your own custom characters.
- Build a graphics pattern using a "specified length graphics sequence".

Your printing system must be set to MAN mode to properly execute these operations. In NORM or TRACE mode, the contents of the print buffer will be printed prematurely.

The Character Matrix

All standard characters are defined by dots in a five-by-seven character matrix. To provide spaces between standard characters, two empty columns and an empty row are added to form a seven-by-eight full matrix.

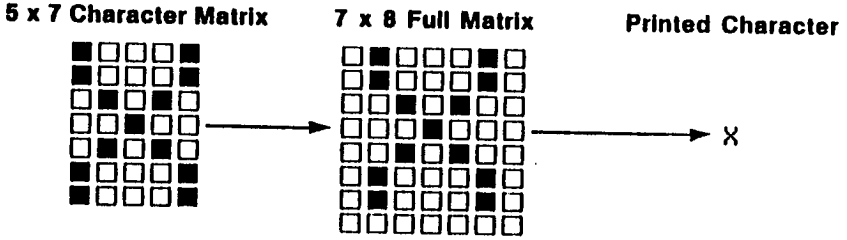


Figure 5-1. The Character Matrix.

Using graphics functions, you can actually tell your HP 82240A Thermal Printer which dots to print in each of the 166 columns of a printed line (including the one row and two columns left blank with standard characters).

Specifying a Column of Dots

You'll use a *column print number* to specify which dots to print in a particular column. Each dot in the column is assigned a numeric value, as shown in the following illustration. To calculate the column print number, simply add the numbers for the dots you want to print in the column; the sum is the column print number. The column print number can be 0 through 255.

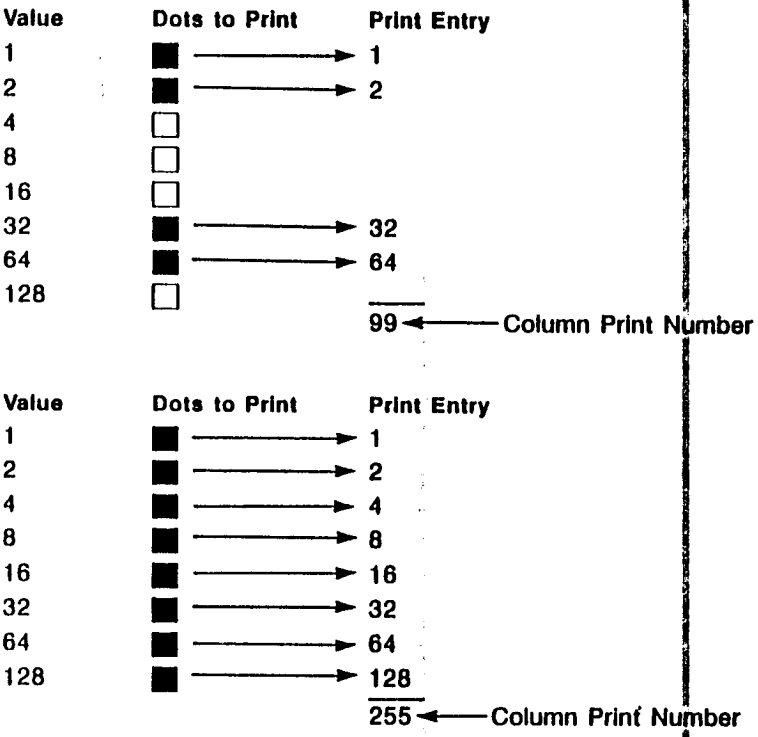


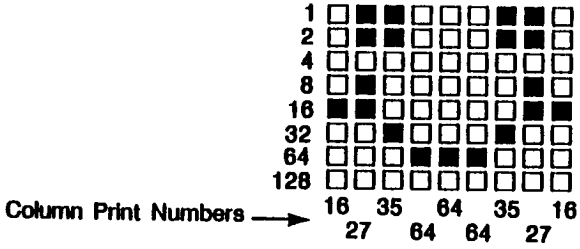
Figure 5-2. Calculating the Column Print Number.

Accumulating Columns

[ACCOL]	X	c-p number

When you execute the [ACCOL] (*accumulate column*) function, a single dot-column is accumulated in the print buffer. The specific dot pattern is determined by the column print number in the X-register.

Example: Building and Printing a Graphics Pattern. The following example shows how to accumulate and print the nine-column pattern shown below.



First clear the print buffer and advance the paper. Then enter and accumulate the ALPHA string A FINE DAY.

[ADV]
[ALPHA] A [SPACE] FINE [SPACE]
DAY [SPACE] [ALPHA]
[ACA]

Now accumulate the first four column print numbers for the dot pattern.

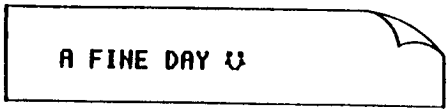
16 [ACCOL]
27 [ACCOL]
35 [ACCOL]
64 [ACCOL]

Accumulate column print number 64 two more times.

[ACCOL]
[ACCOL]

Accumulate the last three column print numbers and print the contents of the buffer. (HP 82240A Thermal Printer: MAN mode.)

35 [ACCOL]
27 [ACCOL]
16 [ACCOL]
[PRBUF]



Skipping Columns

SKPCOL	X	*number*

When you execute the SKPCOL (*skip column*) function, a specified number of blank columns is accumulated in the print buffer. The number in the X-register indicates the number of columns to skip. You can skip from 0 up to 166 columns using SKPCOL. (Your HP 82240A Thermal Printer has a 166 column line; skipping 166 columns is the same as executing a paper advance.)

Building Special Characters

If you want to repetitively print a custom character that is not in the standard character set, you can use the following special-character functions to build, and print a custom character that can be stored and recalled.

BLDSPEC	X	*c-p number*
	Y	*reserved*

The BLDSPEC (*build special character*) function uses up to seven column print numbers, one at a time, to define the dot pattern for your special character. Be sure to clear the X- and Y-registers of the calculator (press 0 ENTER↑) before beginning to build your special character.* Execute BLDSPEC for each of the column print numbers, left to right. As you execute BLDSPEC, a character *representation* is built in the X- and Y-registers and displayed by your calculator. (The display is otherwise meaningless.) The representation can be stored in any register for use at any time. If you specify more than seven print columns, earlier numbers are lost—only the last seven numbers will be used to form the character. If you specify fewer than seven numbers, blank columns will remain in the undefined left part of the character.

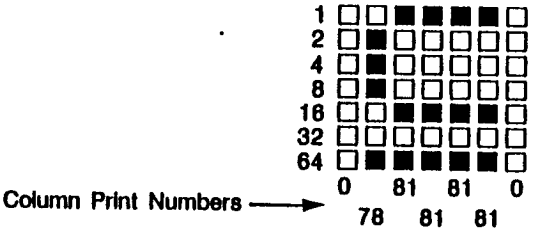
* The BLDSPEC function will execute correctly if *numeric* data is present in the X- and Y-registers. It will not execute correctly if *alpha* data is present in these registers. You can skip the register-clearing step if numeric data is present in the X- and Y-registers.

Note that your special characters can use columns 1 and 7, which are left blank when standard characters are printed. Unlike [ACCOL]-accumulated graphics, special characters *cannot* use the eighth (underline) dot in each column.

[ACSPEC] X *representation*

When you execute the [ACSPEC] (*accumulate special character*) function, a special character is accumulated in the print buffer. The X-register must contain the character representation generated by the [BLDSPEC] process. (The representation may be recalled into the X-register from a register where it has been previously stored).

Example: Building, Storing, and Printing a Special Character. Following is an example showing how to build, store and print the special character shown below.



Clear the X- and Y-registers. Then build the special character and store its representation in R_{01}.

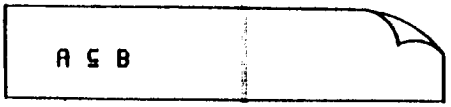
0 [ENTER↑]
0 [BLDSPEC]
78 [BLDSPEC]
81 [BLDSPEC]
81 [BLDSPEC]
81 [BLDSPEC]
81 [BLDSPEC]
0 [BLDSPEC]
[STO] 01

Clear the X-register, then enter and accumulate the ALPHA string A_.

[◆]
[ALPHA] A [SPACE] [ALPHA]
[ACA]

Now recall and accumulate the special character representation. Then enter and accumulate the ALPHA string _B and print the contents of the buffer.

[RCL] 01
[ACSPEC]
[ALPHA] [SPACE] B [ALPHA]
[ACA]
[PRBUF]



Justification and Formatting of Graphics

When you use the [ADV] function to print graphics strings, your HP 82240A Thermal Printer will *left*-justify:

- Any graphics string greater than 27 total bytes in length. (2 bytes are always accumulated to begin a graphics string.)
- Strings that contain information accumulated with the [ACCOL] or [ACSPEC] functions, unless the [ACCOL]- or [ACSPEC]-accumulated information *begins* the string.
- Any [ACCOL]- or [ACSPEC]-accumulated string that contains a mode-change instruction ([STARTU], [STOPU], [SF] 12, or [CF] 12).

The [FMT] function will *not* format any graphics string that [ADV] left-justifies.

Graphics in MAPOFF Mode

All the graphics functions described in this chapter operate identically in MAPOFF mode. Additionally, in MAPOFF mode, you can use control character 27 to begin a *specified length graphics sequence*. To initiate such a sequence, use [ACCHR] to accumulate control character 27. Then use [ACCIR] to accumulate *nnn* (a number from 1 to 166 that specifies the length, in bytes, of the graphics sequence.) (You must calculate the number of bytes in the string before initiating the graphics sequence.)

In a specified length graphics sequence, all data bytes generated by accumulate functions or mode changes are treated as graphics bytes (as column print numbers).*

In a specified length graphics sequence, [ADV] left-justifies any graphics sequence greater than 27 total bytes (as in standard graphics operations). However, [ADV] *right*-justifies sequences that are less than 27 total bytes and contain imbedded [ACCOL] or [ACSPEC] instructions or mode change instructions. [FMT] does not format any string that [ADV] left-justifies.

* A useful application of a specified length graphics sequence utilizes the [XTOA] function (built into the HP-41CX calculator, the HP 82180A Extended Functions/Memory Module, and the HP 82183A Extended I/O Module). [XTOA] transfers into the ALPHA register the equivalent ASCII character for any number (character code) entered into the X-register; you can enter up to a 24 character string into the ALPHA register. In a specified length graphics sequence, when you subsequently execute [ACA], each successive character code in the string is treated as a column print number. The string can of course be stored and recalled, since it is in the ALPHA register and thus can be used in the same way as a special character built with [BLDSPEC] and accumulated with [ACSPEC]. Remember that a special character built with [BLDSPEC] may be only seven columns wide and cannot utilize the eighth row of dots in the character matrix, while a graphics pattern built with [XTOA] can be 24 columns wide and can utilize the eighth row of dots.

6

Plotting

Using the five plotting operations described in this chapter, you can plot any valid single-valued mathematical function.

In this chapter, you'll learn how to:

- Use the elements of the standard plotting format.
- Plot with special characters.
- Use an interactive plotting operation called [PRPLOT].
- Use plotting operations in a program.
- Use plotting functions that generate individual parts of a plot.

Your printing system must be in MAN mode to properly execute these plotting operations. In NORM or TRACE mode, the contents of the print buffer will be printed prematurely.

Let's begin this chapter by showing you the capabilities of the plotting operation called [PRPLOT].

Example: Plotting a Function. In this example, we'll plot the function

$$y = \sin x$$

This example assumes that your calculator is in degrees mode and the allocation of data storage registers is [SIZE] 017.

First, enter a program that computes the function. (The program name is WIGGLE.)

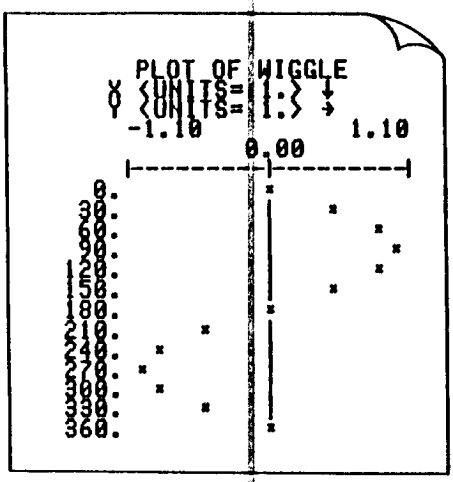
Keys:	Display:	Description:
PRGM		
■ GTO · ·		
■ LBL		
ALPHA WIGGLE ALPHA	01 LBL"WIGGLE	Names the progam.
SIN	02 SIN	Computes sin x and leaves the result in X.
■ GTO · ·		Ends program.
PRGM	0.0000	

Next, clear register R_{03} (PRPLOT uses R_{03}.) Then, execute PRPLOT; your calculator will prompt you for plotting information. (Plot the function for x from 0° to 360° in steps of 30°. To allow room for y values close to -1 and $+1$, draw the y axis from -1.1 to $+1.1$. Draw the x-axis at $y = 0$.)

Keys:	Display:	Description:
0 STO 03	0.0000	Clears register R03.
PRPLOT	NAME?	Begins plotting routine. Displays NAME prompt.
WIGGLE R/S	Y MIN?	Enters program name. Displays Y MIN? prompt.
1.1 CHS R/S	Y MAX?	Enters minimum y value. Displays Y MAX? prompt.
1.1 R/S	AXIS?	Enters maximum y value. Displays AXIS? prompt.
0 R/S	X MIN?	Enters x-axis location. Displays X MIN? prompt.

Keys:	Display:	Description:
0 [R/S]	X MAX?	Enters minimum x value. Displays X MAX? prompt.
360 [R/S]	X INC?	Enters maximum x value. Displays X INC? prompt.
30 [R/S]		Enters x increment value. Begins printing.

HP 82240A Thermal Printer: MAN mode.



[PRPLOT] automatically supplies each x value, runs your function program (WIGGLE), and plots the calculated point using the y value returned in the X-register.

In the following sections, we'll show you in more detail how [PRPLOT] and four other plotting functions work, beginning with a description of each of the parameters in the basic plot format.

The Printer Plot Format

Two basic plotting operations, [PRPLOT] and [PRPLOTP], generate plots using the format shown in the previous example. This format is described in detail in figure 6-1. Three other plotting operations generate individual parts of a plot, enabling you to customize your plots according to your needs.

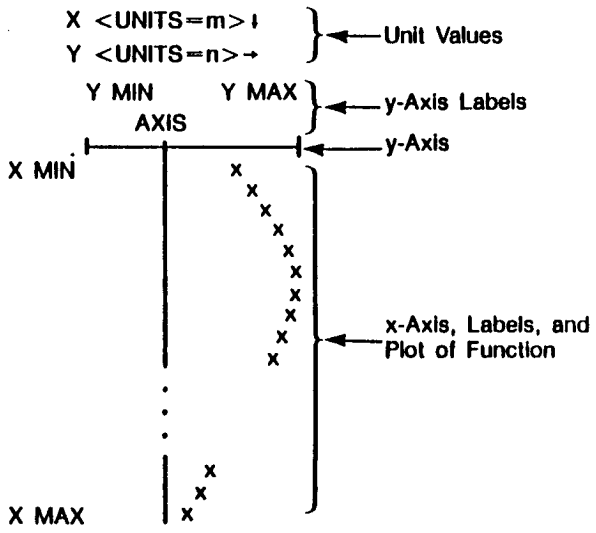


Figure 6-1. The Printer Plot Format.

The unit values are automatically determined by [PRPLOT], [PRPLOTP], and [PRAXIS]. ([PRAXIS] is described later in this chapter). Unit values enable the axis labels to be printed in a shorter form. The X unit value applies to the numbers down the left side of the plot. The Y unit value applies to the numbers across the top of the plot. For example, a unit value of E−2 means the numbers along the axis are expressed in units of 10^{-2}.

The *y*-axis labels must be specified either from the keyboard or in a program, according to the plotting operation being performed. Y MIN and Y MAX represent the minimum and maximum values of *y* to be plotted. AXIS represents the position on the *y*-axis where the *x*-axis is to be drawn. (If NONE or any other ALPHA characters are specified for AXIS, no *x*-axis is drawn.)

The x-axis labels must be specified using three numbers; X MIN, X MAX, and X INC. X MIN and X MAX represent the minimum and maximum values of x for which the plot will be drawn. X INC determines the size of the step between values of x: if X INC is positive, x increases in steps of X INC; if X INC is negative, x has that many equal increments from X MIN to X MAX. For example:

Parameters	Function plotted at these values	
X MIN 0		
X MAX 360		
X INC 10	0,10,20,30,40,...,360	(10-unit increments)
X MIN 0		
X MAX 360		
X INC −10	0,36,72,108,144,...,360	(10 equal increments)

The y function values that are plotted are computed by the function program that you provide. It can be *any* program that uses a number in the X-register and returns a corresponding y function value to the X-register.* (If the program returns a y function value greater than Y MAX, that value is plotted at Y MAX. If the program returns a y function value less than Y MIN, that value is plotted at Y MIN.) The function program should not alter registers R_{00} through R_{11}—these registers are used by the plotting routine. (Register R_{06} contains a copy of the x value placed into the X-register.)

Plotting with Special Characters

All but one of the plotting operations use register R_{03} to specify the plotting symbol. If the contents of this register are numeric, the plotting symbol is a small "x". If R_{03} contains a character representation generated by [BLDSPEC], that special character is used to plot the function. If you do not specify a plotting symbol, clear R_{03} (by pressing 0 [STO] 03) to ensure that an unwanted symbol is not used.

* When executed from a program, the [PRPLOT] operation uses either (a) three subroutine levels or (b) two subroutine levels more than the number of subroutine levels in your function program, whichever is greater. (Refer to the owner's manual for your calculator for more information about the allowed number of pending subroutines.)

Interactive Plotting

[PRPLOT]	R_{03} [plot symbol]

When you execute the [PRPLOT] (*print plot*) operation, a plot of your programmed function is printed. [PRPLOT] prompts you for the information it needs to construct the axes of the plot. Then it uses the program that you have already stored in program memory (your function program) to plot the actual values.

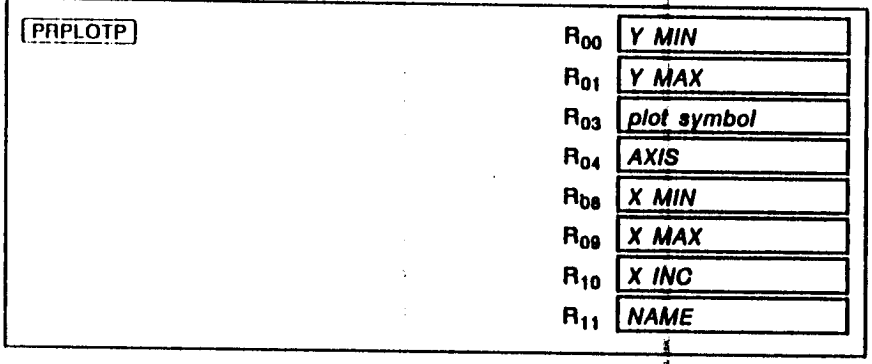
Registers used by [PRPLOT] include registers R_{00} through R_{11}. These registers store plotting information. Before you execute [PRPLOT], you must be sure that storage registers are allocated to at least [SIZE] 012. In particular, the contents of register R_{03} specify the character (the plot symbol) used to plot the function.

If you allow [PRPLOT] to execute to completion, the display format will be set to [FIX] 4, regardless of the format that was in effect when [PRPLOT] began execution. In addition, flag 12 (Double-Wide) will be cleared.

The [PRPLOT] operation is actually a program that uses normal calculator and module functions. If you wish to look at the program, you can load it into program memory using [COPY]. The [PRPLOT] program requires 77 registers of program memory. Once the [PRPLOT] program is in program memory, you can add new lines and delete existing lines. However, the changes you make cannot be recorded back into your Infrared Printer Module. Instead, you must use the altered program as it is in memory, or record it on a mass storage device. You can print the complete program on your printer. Appendix B contains an annotated listing of [PRPLOT].

Programmable Plotting

The interactive plotting operation, [PRPLOT], can be executed in a running program. It operates just as it does when executed from the keyboard—by prompting you for the required information. However, another plotting operation, [PRPLOTP], may be more suitable for use in a program. [PRPLOTP] generates plots in the same format as [PRPLOT], but does not obtain the plotting information by prompting for it. This feature can be useful for programmed plotting since it does not require you to key in information during program execution.



[PRPLOTP] obtains the needed plotting parameters from registers R_{00} through R_{11}. Before executing [PRPLOTP], either from the keyboard or in a running program, store the plotting parameters in the corresponding registers as shown above. [PRPLOTP] uses these values to construct the plot, just as [PRPLOT] uses them. Be sure your function program does not alter the contents of registers R_{00} through R_{11}.

[PRPLOTP] is actually a part of the [PRPLOT] program. It consists of normal calculator functions and can be copied into program memory using [COPY]. It requires 77 registers of program memory.

Plotting a y-Axis

[PRAXIS]		
	R_{00}	*Y MIN*
	R_{01}	*Y MAX*
	R_{02}	*column width*
	R_{04}	*AXIS*

The [PRAXIS] (*print axis*) operation is a part of the [PRPLOT] program. It can be executed separately to print the *y*-axis. When you execute [PRAXIS], the *y*-axis is scaled, printed, and labeled. This operation can be used for special applications where you want to construct your own plotting routines.

As shown above, the [PRAXIS] operation uses the contents of four registers to construct and label the *y*-axis, as well as to determine the *y*-axis unit value. The column width stored in R_{02} specifies the number of dot columns to be spanned by the *y*-axis—it specifies how many columns wide the plot should be. (Your printer has a 166 column line, therefore this parameter can not be greater than 166.) The [PRAXIS] operation modifies the column width parameter in R_{02} to include information for plotting the *x*-axis, stores it in R_{02}, and displays it in the X-register. This revised parameter is suitable for use by two subsequent plotting operations, discussed next. The other plotting parameters are the same as described earlier.

The [PRAXIS] operation uses two subroutine levels in its execution. After the axis has been printed, the two additional levels become available again. [PRAXIS] clears flag 12 (Double-Wide) and leaves the display in [FIX] 4 format.

Plotting a Function Value

Two functions, [REGPLOT] and [STKPLOT], enable you to plot a single numeric value on one line of printer output. By using either of these functions, you have complete control over how data points are plotted. [REGPLOT] uses data storage registers that are compatible with the [PRAXIS] operation. [STKPLOT] uses the stack registers for specifying

plotting information, making all of the storage registers available for your use. The following information is needed to plot the point:

- Function value.
- Y MIN.
- Y MAX
- Modified Column Width (*nnn.aaa*).
- Plot symbol (if using [REGPLOT]).

The function value is the *y* value to be plotted. Y MIN and Y MAX define the limits of the *y*-axis, as discussed earlier. The modified column width—mentioned in connection with [PRAXIS]—defines both the dot column width of the *y*-axis and the column number for the *x*-axis. The format for the modified column width is *nnn.aaa*. The *nnn* portion specifies how many columns wide the *y*-axis is—the same as with [PRAXIS]. The *aaa* portion (after the decimal point) specifies in which column of the *y*-axis, from 001 to *nnn*, the *x*-axis bar should be printed. (If *aaa* is zero, the *x*-axis bar is automatically printed in the column closest to $y = 0$.) If the modified column width is negative, the *x*-axis bar is not printed. Remember that the modified column width parameter is *automatically* calculated and stored in R_{02} when [PRAXIS] is executed; if you've executed [PRAXIS] to begin your plot, you do not need to calculate the modified column width when you subsequently execute [REGPLOT] or [STKPLOT].

[REGPLOT]	X	*y value*	R_{00}	*Y MIN*
			R_{01}	*Y MAX*
			R_{02}	*modif. col. width*
			R_{03}	*plot symbol*

When you execute the [REGPLOT] (*register plot*) function, registers R_{00} through R_{03} are used to plot the *y* value in the X-register.

[STKPLOT]	T	*y value*
	Z	*Y MIN*
	Y	*Y MAX*
	X	*modif. col. width*

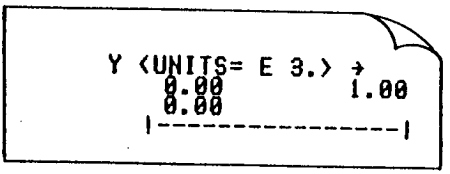
When you execute the [STKPLOT] (*stack plot*) function, plotting information is obtained from the stack registers only—no data storage registers are used. The plotting symbol is automatically a small "x".

You can also print labels for single line plotting using [REGPLOT] and [STKPLOT]. You can create a label by accumulating the label in the print buffer using any of the functions described earlier in this manual. When [REGPLOT] or [STKPLOT] is executed, the buffer is printed immediately to the left of the plot column.

Example: Plotting a y-Axis and a Function Value. In this 2-part example, we'll plot a *y*-axis and one labeled function value for the function $y = 10x$.

Part 1: Plot a *y*-axis after defining the plotting parameters as follows: Y MIN = 0, Y MAX = 1000, Column Width = 120, AXIS = 0. (HP 82240A Thermal Printer: MAN mode)

0 [STO] 00
1000 [STO] 01
120 [STO] 02
0 [STO] 04
[PRAXIS]



Note that [PRAXIS] modified the column width parameter from 120 to 120.0010 and displayed it in the X-register. [PRAXIS] also stored the modified column width parameter in R_{02}.

Part 2: Now plot a single, labeled function value. First, fix the display format to [FIX] 0. Then enter and accumulate a label (an *x* value) and one character space.

[FIX] 0
30
[ACX]
[ALPHA] [SPACE] [ALPHA]
[ACA]

Next, return the function value (*y*-value) by executing 10 [×]. Then enter Y MIN, and Y MAX, and recall the Modified Column Width (automatically calculated by [PRAXIS] in Part 1.).

10 [×]
0 [ENTER↑]
1000 [ENTER↑]
[RCL] 02

Finally, execute the plotting routine, printing the function value.

[STKPLOT]

7

Programming and Printer Operations

In this chapter we'll cover:

- Printing during program entry.
- Printing during program execution.
- Information on how your calculator displays print functions in a program.

Printing During Program Entry

While you are keying a program into the calculator in PRGM mode, you can use your HP 82240A Thermal Printer to print a record of each line you enter. Simply set the print mode to NORM or TRACE.

Printing During Program Execution

Flag 21 (the Printer Enable Flag)—described in chapter 2—affects printer operation during program execution. Flag 21 does not affect printing functions executed from the keyboard. The following table lists the effects of flag 21 on operations performed in a running program.

FLAG 21		
	SET	CLEAR
Printer Operations	Operation is normal in PRTON mode. PRTOFF MODE displayed in PRTOFF mode. (NONEXISTENT displayed if no module present.)	Ignored. (NONEXISTENT displayed if no module present.)
[VIEW] and [AVIEW]	Display is printed and program execution is not halted in PRTON mode. Display is not printed and program execution is halted in PRTOFF mode.	Display is not printed and program execution is not halted.
[ADV]	Paper is advanced in PRTON mode. Ignored in PRTOFF mode.	Ignored.

Note that by setting flag 21 in PRTOFF mode, execution of [VIEW] and [AVIEW] cause program execution to be halted and program results to be displayed by the calculator. This feature can be useful to you if you wish to run a program that contains [VIEW] or [AVIEW] functions when no printer is present. (Program execution is resumed when you execute [R/S]).

If the print mode is set to TRACE during program execution, the printer will print the operation on each line along with any intermediate and final results calculated. In this mode, you'll notice that program execution slows significantly to allow the printer to keep up with the execution. TRACE mode execution is a good way to debug your program. However, programs will be executed faster in MAN or NORM mode; in these modes, only output from print functions is printed. Also, in these modes, information is accumulated normally in a program. (In TRACE mode, the contents of the buffer are automatically printed—and are cleared from the buffer—any time that a function name is also printed.)

Almost all print functions discussed in the previous chapters can be executed in a running program—only [PRP], [LIST], and [CAT] cannot be programmed. (Be sure that you place in the proper registers any parameters needed by the print function before the function is executed.)

Print Functions in Programs

The print functions discussed in chapters two through six may be entered as part of a program whenever your Infrared Printer Module is installed in a calculator port. When the module is installed, print *functions* in program lines are displayed and printed as normal functions. Print *programs* ([PRAXIS], [PRPLOT], and [PRPLOTP]) in program lines are displayed and printed as **XROM** followed by the program name; for example, **XROM PRAXIS**.

If your module is disconnected at a later time, print functions in program lines are displayed as XROM functions with two identification numbers. The first number identifies the accessory, (the HP 82242A Module), and the second number identifies the function:

Function	XROM Number	Function	XROM Number
[ACA]	XROM 29,01	[PRX]	XROM 29,20
[ACCHR]	XROM 29,02	[REGPLOT]	XROM 29,21
[ACCOL]	XROM 29,03	[SKPCHR]	XROM 29,22
[ACSPEC]	XROM 29,04	[SKPCOL]	XROM 29,23
[ACX]	XROM 29,05	[STKPLOT]	XROM 29,24
[BLDSPEC]	XROM 29,06	[FMT]	XROM 29,25
[LIST]	Not Programmable	[DELAY]	XROM 29,27
[PRA]	XROM 29,08	[MAN]	XROM 29,28
[PRAXIS]	XROM 29,09	[MAPOFF]	XROM 29,29
[PRBUF]	XROM 29,10	[MAPON]	XROM 29,30
[PRFLAGS]	XROM 29,11	[NORM]	XROM 29,31
[PRKEYS]	XROM 29,12	[PRTOFF]	XROM 29,32
[PRP]	Not Programmable	[PRTON]	XROM 29,33
[PRPLOT]	XROM 29,14	[RESETP]	XROM 29,34
[PRPLOTP]	XROM 29,15	[STARTU]	XROM 29,35
[PRREG]	XROM 29,16	[STOPU]	XROM 29,36
[PRREGX]	XROM 29,17	[TESTP]	XROM 29,37
[PRΣ]	XROM 29,18	[TRACE]	XROM 29,38
[PRSTK]	XROM 29,19		

A

Care, Warranty, and Service Information

Module Care

CAUTION

Always turn off the calculator before installing or removing the module. Failure to do so may result in damage to the calculator or module, or in disruption of system operation.

- Keep the contact area of the module 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.
- Store the module in a clean, dry place.
- Keep the infrared window clean and free of scratches.
- Always turn off the calculator before connecting or disconnecting the module. Follow the procedures described in chapter 1.
- Observe the following temperature specifications:
  - Operating: 0° to 45° C (32° to 113° F).
  - Storage: −20° to 60° C (−4° to 140° F).

Answers to Common Questions

Question: My printer is not printing.

Answer: Your module or your printer may be malfunctioning, but the problem may be much simpler. Refer to the troubleshooting procedure in "Determining If the Module Requires Service" later in this chapter.

Question: My printer is not printing the characters I expect when I execute the [ACCHR] function.

Answer: You may be in the wrong character-set mode. Refer to the discussion of [MAPON] and [MAPOFF] in "Accumulating Characters" in chapter 4.

Question: My program works with an HP 82143A Thermal Printer (or an HP 82162A Thermal Printer) but not with the Infrared Printer Module and HP 82240A Thermal Printer.

Answer: Make sure you are in MAPON mode (by executing [MAPON]). If your program accumulates characters 4, 10, or 27, your program will work properly only if you are in MAPON mode.

The [ADV] function left-justifies some types of information that your program may require to be right-justified.

The HP 82240A Thermal Printer has a 166 column line. If your program contains a [SKPCOL] instruction for 167 or 168 columns, the program will not work.

Refer to appendix E for a discussion of differences between your infrared printing system and the earlier thermal printing systems.

Limited One-Year Warranty

What Is Covered

The module is warranted by Hewlett-Packard against defects in materials and workmanship for one year from the date of original purchase. If you sell your unit or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to a Hewlett-Packard service center.

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

What Is Not Covered

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than an authorized Hewlett-Packard service center.

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. **ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE ONE-YEAR DURATION OF THIS WRITTEN WARRANTY.** Some states, provinces, or countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. **IN NO EVENT SHALL HEWLETT-PACKARD COMPANY BE LIABLE FOR CONSEQUENTIAL DAMAGES.** Some states, provinces, or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Products are sold on the basis of specifications applicable at the time of manufacture. Hewlett-Packard shall have no obligation to modify or update products once sold.

Consumer Transactions In the United Kingdom

This warranty shall not apply to consumer transactions and shall not affect the statutory rights of a consumer. In relation to such transactions, the rights and obligations of Seller and Buyer shall be determined by statute.

Determining If the Module Requires Service

Your module may require service if any one of the following conditions occurs when you attempt to execute a print function:

- No information is printed.
- Unreadable information is printed.
- Your calculator displays **PRINT ERROR**.

If one of the three conditions described above occurs, use the following procedure to determine if the module requires service:

1. Make sure that the calculator and printer are turned on. Make sure the calculator and printer are positioned within the limits specified by figures 1-2 and 1-3 in chapter 1. If the calculator and printer are turned on and properly positioned, move to step 2.
2. Refer to the description of the print function in this manual. If you are executing the print function correctly, move to step 3.
3. Execute the [RESETP] function, then turn the printer off, then on again. Now try to execute the print function. If you continue to have difficulty, move to step 4.
4. Execute the printer self-test, described on page 14 of the owner's manual for your printer. If your printer fails the self-test, it requires new batteries or service. If your printer passes the self-test, move to step 5. (Do *not* attempt to send information to the printer during execution of the self-test. This may damage the printer.)
5. Execute the [TESTP] (*module self-test*) function. If the calculator displays **BAD**, the module requires service. If the calculator displays **OK**, try again to execute the print function. If you continue to have difficulty, move to step 6.

6. Turn the calculator off. Turn the printer off. Remove the module from the calculator. Insert it again after several minutes. Turn the calculator and printer on. Execute the [TESTP] function. If the calculator now displays **BAD**, the module requires service. If the calculator displays **OK**, try again to execute the print function. If you continue to have difficulty, the module *or* printer requires service. You will have to return *both* products to a service center.

If this procedure does confirm that service is required, read the following section, "If the Module Requires Service".

If the Module Requires Service

Hewlett-Packard maintains service centers in many countries. These centers will service a module whether it is under warranty or not. There is a charge for service after the warranty period. Modules normally are serviced and reshipped within 5 working days of receipt.

Obtaining Service

- **In the United States:** Send the module to the Calculator Service Center listed on the inside of the back cover.
- **In Europe:** Contact your HP sales office or dealer or HP's European headquarters for the location of the nearest service center. *Do not ship the module for service without first contacting a Hewlett-Packard office.*

  Hewlett-Packard S.A.
  150, Route du Nant-d'Avril
  P.O. Box CH 1217 Meyrin 2
  Geneva, Switzerland
  Telephone: (022) 82 81 11

- **In other countries:** Contact your HP sales office or dealer or write to the U.S. Calculator Service Center (listed on the inside of the back cover) for the location of other service centers. If local service is unavailable, you can ship the module to the U.S. Calculator Service Center for repair.

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

Service Charge

There is a standard repair charge for out-of-warranty service. The Calculator Service Center (listed on the inside of the back cover) can tell you how much this charge is. The full charge is subject to the customer's local sales or value-added tax wherever applicable.

Calculator products damaged by accident or misuse are not covered by the fixed service charges. In these cases, charges are individually determined based on time and material.

Shipping Instructions

If your module requires service, ship it to the nearest authorized service center or collection point. (You must pay the shipping charges for delivery to the service center, whether or not the module is under warranty.) Be sure to:

- Include your return address and description of the problem.
- Include proof of purchase date if the warranty has not expired.
- Include a purchase order, check, or credit card number plus expiration date (Visa or MasterCard) to cover the standard repair charge. In the United States and some other countries, the serviced module will be returned C.O.D. if you do not pay in advance.
- Ship the module in adequate protective packaging to prevent damage. Such damage is not covered by the warranty, so we recommend that you insure the shipment.
- Pay the shipping charges for delivery to the Hewlett-Packard service center, whether or not the module is under warranty.

Warranty on Service

Service is warranted against defects in materials and workmanship for 90 days from the date of service.

Service Agreements

In the U.S., a support agreement is available for repair and service. Refer to the form in the front of the manual. For additional information, contact the Calculator Service Center (see the inside of the back cover).

Regulatory Information

Radio Frequency Interference

U.S.A. The HP 82242A Infrared Printer Module generates and uses radio frequency energy and may interfere with radio and television reception. The module complies with the limits for a Class B computing device as specified in Subpart J of Part 15 of FCC Rules, which provide reasonable protection against such interference in a residential installation. In the unlikely event that there is interference to radio or television reception (which can be determined by turning the calculator off and on with the module installed), try:

- Reorienting the receiving antenna.
- Relocating the printing system with respect to the receiver.

For more information, consult your dealer, an experienced radio/television technician, or the following booklet, prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-TV Interference Problems.* This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 004-000-00345-4. At the first printing of this manual, the telephone number was (202) 783-3238.

Air Safety Notice (U.S.A.)

The HP-41C, CV, and CX calculators, the HP 82242A Module and the HP 82240A printer comply with the requirements of RTCA (Radio Technical Commission for Aeronautics) Docket 160B, Section 21. Many airlines permit the use of calculator products in flight based on such a qualification. However, before boarding a flight, check with an airline representative regarding use of these products in flight.

B

Annotated [PRPLOT] Program Listing

Following is a listing of the [PRPLOT] plotting program. With the Infrared Printer Module installed in your calculator, you can load this program into the calculator's program memory using the [COPY] function. The [PRPLOT] program requires 77 registers of program memory. Refer to the owner's manual for your calculator for more information about [COPY].

Prompts for inputs, checks data, and stores the input values.

```
01▶LBL "PRPLOT"
02 AON
03 "NAME ?"
04 PROMPT
05 AOFF
06 ASTO 11
07▶LBL 11
08 "Y MIN ?"
09 PROMPT
10 STO 00
11 "Y MAX ?"
12 PROMPT
13 STO 01
14 X<=Y?
15 GTO 11
16▶LBL 12
17 "AXIS ?"
18 CF 23
19 PROMPT
20 STO 04
21 FS? 23
22 ASTO 04
23 RCL 01
24 X<0?
25 GTO 12
26 CLX
27 RCL 00
28 X>Y?
29 GTO 12
30▶LBL 13
31 "X MIN ?"
32 PROMPT
33 STO 08
34 "X MAX ?"
35 PROMPT
36 STO 09
37 X<=Y?
38 GTO 13
39 "X INC ?"
40 PROMPT
41 STO 10
```

Prints the name of the function being plotted.

```
42▶LBL "PRPLOTP"
43 CF 12
44 ADV
45 6
46 SKPCHR
47 "PLOT OF "
48 ARCL 11
49 ACA
50 PRBUF
```

Calculates and prints the X units.

```
51 RCL 08
52 RCL 09
53 "X"
54 XEQ 09
55 STO 07
56 0
57 ACCOL
58 16
59 ACCOL
60 32
61 ACCOL
62 127
63 ACCOL
64 X<>Y
65 ACCOL
66 RCL Z
67 ACCOL
68 PRBUF
```

Sets plot field width to 130 columns.

```
69 130
70 STO 02
```

Calculates Y units and completes the plot label.

```
71 XROM "PRAXIS"
```

Checks X INC for positive or negative sign.

```
72 RCL 10
73 X>0?
74 GTO 00
```

Calculates *x* increment value (the number of increments) if X INC is negative.

```
75 RCL 09
76 RCL 08
77 -
78 RCL 10
79 ABS
80 /
81 STO 10
```

Determines print format for *x*−axis labels

```
82▶LBL 00
83 RCL 09
84 RCL 08
85 ABS
86 0<Y?
87 X<>Y
88 RCL 07
89 /
90 LOG
91 INT
92 2
93 -
94 STO 05
```

Sets first *x* value equal to X MIN (the initial value).

```
 95 RCL 08
 96 STO 06
```

Sets print format and accumulates *x*-axis label.

```
 97▶LBL 14
 98 FIX IND 05
 99 RCL 07
100 /
101 RND
102 ACX
103 2
104 SKPCOL
```

Calculates and prints one point.

```
105 RCL 06
106 XEQ IND 11
107 REGPLOT
```

Increments *x* value and checks for completion of plot.

```
108 RCL 10
109 ST+ 06
110 RCL 09
111 RCL 06
112 X<=Y?
113 GTO 14
```

Resets display mode.

```
114 FIX 4
115 RTN
```

Calculates and prints *y*-axis label.

```
116▶LBL "PRAXIS"
117 CF 12
118 RCL 00
119 RCL 01
120 "-"
121 XEQ 09
122 STO 06
123 141
124 ACCHR
125 PRBUF
```

Converts *nnn.aaa* to *nnn* and checks *nnn*.

```
126 RCL 02
127 INT
128 ABS
129 STO 02
130 166
131 X<Y?
132 GTO 10
```

Skips to Y MIN label.

```
133 -
134 SKPCOL
```

Formats and accumulates Y MIN label.

```
135 RCL 02
136 RCL 00
137 RCL 06
138 /
139 RND
140 ACX
```

Calculates and skips the number of columns between the Y MIN and Y MAX labels.

```
141 XEQ 05
142 RCL 01
143 XEQ 04
144 +
145 -
146 7
147 X<=Y?
148 RDN
149 SKPCOL
```

Accumulates the Y MAX label and prints the *y*-axis labels.

```
150 RCL 01
151 RCL 06
152 /
153 RND
154 ACX
155 PRBUF
```

Calculates axis column location (if printed).

```
156 166
157 RCL 02
158 -
159 SKPCOL
160 RCL 04
161 SIGN
162 X=0?
163 GTO 03
164 LASTX
165 RCL 00
166 X<Y?
167 GTO 10
168 -
169 RCL 01
170 RCL 00
171 -
172 X<Y?
173 GTO 10
174 /
175 RCL 02
176 1
177 -
178 *
179 .5
180 +
181 INT
182 STO Y
```

Positions and prints axis label.

```
183 RCL 02
184 RCL 04
185 XEQ 04
186 -
187 R^
188 STO 05
189 LASTX
190 2
191 /
192 -
193 X<0?
194 CLX
195 X>Y?
196 X<>Y
197 SKPCOL
198 RCL 04
199 RCL 06
200 /
201 RND
202 ACX
203 PRBUF
```

Skips to beginning of *y*-axis.

```
204 166
205 RCL 02
206 -
207 SKPCOL
```

Calculates position of axis mark and prints *y*-axis.

```
208 XEQ 08
209 RCL 05
210 X=0?
211 GTO 00
212 RCL 02
213 1
214 -
215 X=Y?
216 GTO 00
217 X<>Y
218 1
219 -
220 XEQ 06
221 RCL 05
222 1
223 +
224 GTO 01
225▶LBL 03
226 XEQ 08
227▶LBL 00
228 RCL 02
229 2
230▶LBL 01
231 -
232 XEQ 06
233 PRBUF
```

Resets display format.

```
234 RCL 02
235 RCL 05
236 -
237 +
238 1 E3
239 /
240 +
241 ENTER^
242 CHS
243 X<>Y
244 RCL 04
245 SIGN
246 X=0?
247 RDN
248 RDN
249 STO 02
```

Formats label value into actual value.

```
250 FIX 4
```

```
251 RTN
```

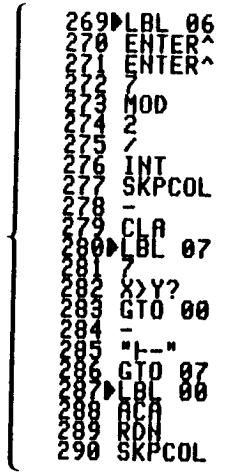
Calculates number of columns required for a label.

```
252▶LBL 04
253 RCL 06
254 /
255 RND
```

Fills in axis with dashes between label marks.

```
256▶LBL 05
257 ABS
258 INT
259 X≠0?
260 LOG
261 INT
262 RCL 05
263 +
264 3
265 +
266 7
267 *
268 RTN
```

Puts *nnn.aaa* in R_{02}.

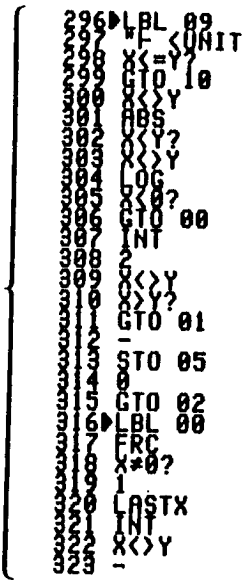


```
269▶LBL 06
270 ENTER^
271 ENTER^
272 7
273 MOD
274 2
275 /
276 INT
277 SKPCOL
278 -
279 CLA
280▶LBL 07
281 7
282 X<>Y?
283 GTO 00
284 -
285 "⊢-"
286 GTO 07
287▶LBL 00
288 ACA
289 RDN
290 SKPCOL
```

Accumulates a label mark.

```
291▶LBL 08
292 127
293 ACCOL
294 R^
295 RTN
```

Calculates multiplier value and places that value into X. Accumulates "units" line.



```
296▶LBL 09
297 "F-<UNITS="
298 X<=Y?
299 GTO 10
300 X<>Y
301 ABS
302 0<Y?
303 X<>Y
304 LOG
305 X<0?
306 GTO 00
307 INT
308 2
309 0<>Y
310 X>Y?
311 GTO 01
312 -
313 STO 05
314 0
315 GTO 02
316▶LBL 00
317 ERR
318 X≠0?
319 1
320 LASTX
321 INT
322 X<>Y
323 -
```

Calculates multiplier value and places that value into X. Accumulates "units" line. (Continued)

```
324▶LBL 01
325 "E"
326▶LBL 02
327 4
328 SKPCHR
329 ACA
330 FIX 0
331 RDN
332 X=0?
333 GTO 00
334 ACX
335 10^X
336 2
337 STO 05
338 FIX 2
339 RDN
340 GTO 01
341▶LBL 00
342 1
343 ACX
344 FIX IND 05
345▶LBL 01
346 ">"
347 ACA
348 RTN
```

Generates **DATA ERROR** message for bad inputs.

```
349▶LBL 10
350 0
351 /
352 END
```

C

Storage Space In the Print Buffer

The print buffer has 200 bytes of storage space. The buffer can fill and overflow if:

- Long strings of text, or text and graphics, are accumulated without execution of [ADV] or [PRBUF].
- Information is sent to the printer too rapidly (by setting [DELAY] too short).

In either case, information may be lost. If this happens, the "▚" character is printed, and your printer may require a linefeed command ([ADV] or [PRBUF]) to resume printing.

The following table summarizes the space occupied in the print buffer by printer operations. This table will be helpful to you if you are accumulating a long string of information and wish to keep account of how much space the string occupies in the buffer.

Operation	Number of Bytes
[ACA]	The number of characters in the ALPHA register.
[ACCHR]	1
[ACCOL]	■ N + 2 × [1 + INT{(N − 1)/26}], where N is the number of consecutive [ACCOL] executions. ■ N, if executed as part of a specified length graphics sequence.
[ACSPEC]	Same as 7 consecutive [ACCOL] commands.
[ACX]	The number of characters in the calculator display, plus 1 for the leading sign.
[SKPCHR]	The number value specified in the X-register.
[SKPCOL]	■ 3 + INT{(N−1)/7)} + (N − 1)MOD7, where N is the number value specified in the X-register. ■ N, if executed as part of a specified length graphics sequence.
[STARTU], [STOPU]	2
[SF] 12, [CF] 12	2

D

Table of Standard Characters

Following is a listing of the HP 82240A Thermal Printer's standard characters in both MAPON and MAPOFF mode, with corresponding character codes.

CODE	CHAR (MAPON)	CHAR (MAPOFF)	CODE	CHAR (MAPON)	CHAR (MAPOFF)
0	▶		19	Å	
1	–		20	å	
2	–		21	Ä	
3	←		22	ä	
4	α	C→	23	Ö	
5	β		24	ö	
6	–		25	Ü	
7	–		26	ü	
8	–		27	É	ESC
9	–		28	≥	
10	▶	LF	29	≠	
11	–		30	£	
12	μ		31	▮	
13	∡		32		
14	–		33	!	!
15	–		34	"	"
16	ø		35	#	#
17	–		36	$	$
18	–		37	%	%

CODE	CHAR (MAPON)	CHAR (MAPOFF)	CODE	CHAR (MAPON)	CHAR (MAPOFF)
38	&	&	69	E	E
39	'	'	70	F	F
40	(	(	71	G	G
41	)	)	72	H	H
42	*	*	73	I	I
43	+	+	74	J	J
44	,	,	75	K	K
45	-	-	76	L	L
46	.	.	77	M	M
47	/	/	78	N	N
48	0	0	79	O	O
49	1	1	80	P	P
50	2	2	81	Q	Q
51	3	3	82	R	R
52	4	4	83	S	S
53	5	5	84	T	T
54	6	6	85	U	U
55	7	7	86	V	V
56	8	8	87	W	W
57	9	9	88	X	X
58	:	:	89	Y	Y
59	;	;	90	Z	Z
60	<	<	91	[	[
61	=	=	92	\	\
62	>	>	93	]	]
63	?	?	94	^	^
64	@	@	95	_	_
65	A	A	96	`	`
66	B	B	97	a	a
67	C	C	98	b	b
68	D	D	99	c	c

CODE	CHAR (MAPON)	CHAR (MAPOFF)	CODE	CHAR (MAPON)	CHAR (MAPOFF)
100	d	d	131	∫	∫
101	e	e	132	∫	∫
102	f	f	133	Σ	Σ
103	g	g	134	▶	▶
104	h	h	135	π	π
105	i	i	136	∂	∂
106	j	j	137	≤	≤
107	k	k	138	≥	≥
108	l	l	139	≠	≠
109	m	m	140	α	α
110	n	n	141	→	→
111	o	o	142	←	←
112	p	p	143	μ	μ
113	q	q	144	↳	↳
114	r	r	145	▪	▪
115	s	s	146	«	«
116	t	t	147	»	»
117	u	u	148	⊢	⊢
118	v	v	149	ı	ı
119	w	w	150	ƨ	ƨ
120	x	x	151	ƨ	ƨ
121	y	y	152	ȝ	ȝ
122	z	z	153	ı	ı
123	π	{	154	j	j
·124	∠	|	155	⋯	⋯
125	→	}	156	ı	ı
126	Σ	~	157	j	j
·127	⊢	▮	158	k	k
128			159	n	n
129	÷	÷	160	∠	∠
130	×	×	161	Å	Å

CODE	CHAR (MAPON)	CHAR (MAPOFF)	CODE	CHAR (MAPON)	CHAR (MAPOFF)
162	Â	Â	193	ê	ê
163	È	È	194	ô	ô
164	Ê	Ê	195	û	û
165	Ë	Ë	196	á	á
166	Î	Î	197	é	é
167	Ï	Ï	198	ó	ó
168	´	´	199	ú	ú
169	`	`	200	à	à
170	^	^	201	è	è
171	¨	¨	202	ò	ò
172	~	~	203	ù	ù
173	Ù	Ù	204	ä	ä
174	Û	Û	205	ë	ë
175	£	£	206	ö	ö
176	¯	¯	207	ü	ü
177	Ý	Ý	208	Å	Å
178	ý	ý	209	î	î
179	▪	▪	210	ø	ø
180	Ç	Ç	211	Æ	Æ
181	ç	ç	212	å	å
182	Ñ	Ñ	213	í	í
183	ñ	ñ	214	ß	ß
184	¡	¡	215	æ	æ
185	¿	¿	216	Ä	Ä
186	¤	¤	217	ì	ì
187	£	£	218	Ö	Ö
188	¥	¥	219	ü	ü
189	§	§	220	É	É
190	ƒ	ƒ	221	ï	ï
191	¢	¢	222	β	β
192	â	â	223	ô	ô

CODE	CHAR (MAPON)	CHAR (MAPOFF)	CODE	CHAR (MAPON)	CHAR (MAPOFF)
224	Á	Á	240	Þ	Þ
225	Ã	Ã	241	þ	þ
226	ã	ã	242	·	·
227	Đ	Đ	243	µ	µ
228	đ	đ	244	¶	¶
229	ĩ	ĩ	245	¼	¼
230	Ì	Ì	246	–	–
231	ó	ó	247	¼	¼
232	ò	ò	248	½	½
233	õ	õ	249	¹	¹
234	õ	õ	250	º	º
235	š	š	251	«	«
236	ÿ	ÿ	252	■	■
237	ú	ú	253	»	»
238	ÿ	ÿ	254	±	±
239	ÿ	ÿ	255		

Some points to note:

- Characters 1, 2, 6-9, 11, 14, 15, 17, and 18 from the standard character set of the HP 82143A Thermal Printer and HP 82162A Thermal Printer are not included in standard character set of the HP 82240A Thermal Printer. In MAPON mode, the "_" character is substituted for these characters.
- In MAPON mode, character 124 is obtained from the standard character set of the *HP 82162A Thermal Printer.* (Character 124 in the standard character set of the HP 82143A Thermal Printer is a different character.)

* In earlier HP 82240A Thermal Printers, characters 13, 124, and 127 are replaced with the "_" character in MAPON mode. To determine if your printer replaces characters 13, 124, and 127 with "_", perform the printer self-test. (See pages 14-15 of the owners manual for your printer for instructions on how to perform the printer self-test.) If your printer does *not* print a capital letter on the last line of the character printout, then "_" will be substituted for characters 13, 124, and 127.

- In MAPOFF mode character codes 4, 10, and 27 are *control* codes. When you accumulate these codes in the buffer of your printer, a *printer operation* is performed: accumulation of character code 4 causes a linefeed that leaves the printhead on the right edge of the paper, accumulation of character code 10 causes a line feed that leaves the printhead on the left edge of the paper, and accumulation of character code 27 starts an escape sequence. Refer to pages 22 and 23 in the owner's manual for your HP 82240A Thermal Printer for additional information. Note that a program written for the HP 82143A Thermal Printer or the HP 82162A Thermal Printer that accumulates characters 4, 10, or 27 during program execution *will not execute properly* in MAPOFF model You must edit such a program and substitute a new character code if you wish to execute the program in MAPOFF mode.

E

If You've Used an HP Thermal Printer...

The print functions and system control functions of the HP 82242A Infrared Printer Module/HP 82240A Thermal Printer printing system are similar to those of two earlier HP thermal printing systems, the HP 82143A Thermal Printer and the HP 82160A HP-IL Module/HP 82162A Thermal Printer. If you have worked with either of these two systems, you may wish to use this appendix as your primary reference guide for operation of your new infrared system.

Common Flags and Functions

Common Flags

Calculator flags 12, 13, and 21 control printer operations in your new printer system as they do in the earlier thermal printer systems. Their effects are summarized in table 2-1.

Common Functions

The following print functions from the earlier printing systems have been implemented in your infrared system. In some cases, your new system executes these functions differently, as noted.

Function	Differences in Execution
[ACA]	
[ACCHR]	[ACCHR] accepts character codes up to 255.
[ACCOL]	The *eighth* dot in each column can be accumulated.
[ACSPEC]	
[ACX]	
[ADV]	[ADV] *left-justifies*: ■ Any character string greater than 27 total bytes. ■ Strings that contain information accumulated with the [ACCOL] or [ACSPEC] functions, unless the [ACCOL]- or [ACSPEC]-accumulated information *begins* the string. ■ Any [ACCOL]- or [ACSPEC]-accumulated string that contains mode change instructions ([STARTU], [STOPU], [SF] 12, [CF] 12).
[AVIEW]	
[BLDSPEC]	
[CAT]	
[FMT]	[FMT] cannot format any string that [ADV] left-justifies.
[LIST]	Program listings are printed left-justified in NORM mode. A *triangular* pointer is printed at each label.

Function	Differences In Execution
PRA	Programs are printed left-justified in NORM mode. A triangular pointer is printed at each label.
PRAXIS	
PRBUF	
PRFLAGS	
PRKEYS	
PROMPT	
PRP	
PRPLOT	
PRPLOTP	
PRREG	
PRREGX	
PRΣ	
PRSTK	
PRX	
REGPLOT	
SKPCHR	
SKPCOL	The maximum skip column number is 166. (The HP 82240A Thermal Printer has a 166 column line. The earlier systems have a 168 column line.)
SKPLOT	
VIEW	

Additional Functions

Your infrared printing system executes the following functions *not available* in the earlier thermal printing systems. Note that a program containing any of the functions discussed in this section will not work with the earlier thermal printing systems.

Turning Print Functions On and Off

When you install the Infrared Printer Module and turn your calculator on, or when you execute the PRTON or RESETP functions, print functions are executed normally. When you execute the PRTOFF function, all printing operations are suppressed. Refer to "Turning Print Functions On and Off" in chapter 2, and "Printing During Program Execution" in chapter 7, for more information.

Setting the Print Mode

The print mode is selected by setting the appropriate state of flags 15 and 16, or by executing the MAN, NORM, or TRACE function. Refer to table 2-2 and "Setting the Print Mode", in chapter 2, for more information.

Remapping the Character Set

When you install the Infrared Printer Module and turn your calculator on, or when you execute the [MAPON] or [RESETP] functions, the HP 82240A Thermal Printer's standard character set is *remapped*. It becomes compatible with the HP 82143A Thermal Printer and HP 82162A Thermal Printer's standard character set. The [MAPON] function enables you to execute programs that have been written for the earlier thermal printer systems and utilize their extended character set. When you execute the [MAPOFF] function, character remapping is turned off. The character set in MAPOFF mode matches that in the HP 82240A Thermal Printer owners manual, pages 18-19. Refer to "Accumulating Characters" in chapter 4, and appendix D, for more information.

Underlining Characters

When you execute the [STARTU] function, a "start underlining" instruction is accumulated in the print buffer; all subsequently printed characters are underlined until you execute the [STOPU] function or turn your printer off, then on. Refer to "Accumulating Underline" in chapter 4 for more

Setting the Delay

The [DELAY] function enables you to set the time that your calculator waits between sending lines of information to your printer. Refer to "Setting the Delay" in chapter 2 for more information.

Resetting the System Control Flags and Functions

When you execute the [RESETP] function, the system control flags and functions are returned to their default state. Refer to "Functions That Control Printer Operations" in chapter 2 and "Printing the Contents of the Print Buffer" in chapter 4 for more information.

Testing the Module

When you execute the [TESTP] function, the module performs a self-test. Refer to "Determining If the Module Requires Service" in appendix A.

Using Control Characters

In MAPOFF mode, characters 4, 10, and 27 are control characters. Refer to "Graphics in MAPOFF Mode" in chapter 5, and appendix D for more information.

Features Not Available

Your infrared printing system does *not* have the following features available in the earlier thermal printing systems:

From the Standard Character Set

Characters 1, 2, 6-9, 11, 14, 15, 17 and 18 from the earlier printers' standard character set are not available in the HP 82240A Thermal Printer's standard character set. In MAPON mode, a "_" is substituted. Refer to appendix D for additional information.

Print Mode Switch

The HP 82240A Thermal Printer does not have the print mode switch found on the earlier thermal printers. It is replaced by the [MAN], [TRACE], and [NORM] functions (and, alternately, flags 15 and 16) described previously in this appendix and in chapter 2.

Paper Advance Button

The HP 82240A Thermal Printer's paper advance button will advance the paper only. (The paper advance button on the earlier thermal printers also enters the [ADV] function into a program when your calculator is in program mode.)

Paper Detection

The infrared printing system does not detect the "out-of-paper" condition in the HP 82240A Thermal Printer.

Bar Code Printing

The Infrared Printer Module does not support bar-code printing functions.

Error Messages

This appendix contains a list of error messages that you may encounter during the operation of your printer system.

For most error conditions, the function being attempted is not performed. However, for those conditions and functions indicated by * below, the operation may be partially performed.

Error	Functions	Meaning
ALPHA DATA	*-all-*	ALPHA characters are in a register where a number is required—either in a stack register or a data storage register.
DATA ERROR	[ACCHR] / [ACCOL]	|x| > 255.
	[BLDSPEC]	|x| > 127.
	[DELAY]	|x| > 1.9.
	[PRAXIS]	YMAX ≤ YMIN, AXIS > YMAX, AXIS < YMIN, or |*nnn*| > 166.
	*[PRPLOT]	XMAX ≤ XMIN, YMAX ≤ YMIN, AXIS > YMAX, or AXIS < YMIN.
	[PRREGX]	|x| > 999.
	[REGPLOT] / [STKPLOT]	YMAX ≤ YMIN, *nnn* < 10, or |*nnn*| > 166.
	[SKPCHR]	|x| > 24.
	[SKPCOL]	|x| > 166.

NONEXISTENT	*-all-*	The HP 82242A Module is not installed.
	PRPLOT PRPLOTP PRAXIS	One or more of the specified registers has not been allocated. Increase allocation to SIZE 12.
	*PRPLOTP *PRPLOT PRP	Specified program or function program does not exist. Check program name.
	PRP	An attempt was made to list a ROM function that was not written in user code.
	*PRREGX	Specified registers exceed highest data storage register. Check *bbb.eee* format in X-register.
PRINT ERROR	**-all-*	Module may be malfunctioning. Refer to "Determining If the Module Requires Service" in appendix A.
PRIVATE	*-all-*	An attempt was made to list, trace, edit, or view a private program.
PRTOFF MODE	*-all-*	Print operation attempted in PRTOFF mode.

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Function Index

Page numbers in **bold** type indicate primary references; page numbers in normal type indicate secondary references.

Function	Description	Page
[ACA]	Accumulate contents of ALPHA register into print buffer.	**27, 78**
[ACCHR]	Accumulate standard character into print buffer.	**29, 78**
[ACCOL]	Accumulate graphics column into print buffer.	**37, 78**
[ACSPEC]	Accumulate special character into print buffer.	**39, 78**
[ACX]	Accumulate contents of X-register into print buffer.	**28, 78**
[ADV]	Print contents of print buffer and advance paper one line.	**18, 32, 40, 41, 78**
[AVIEW]	View and print contents of ALPHA register.	**18, 78**
[BLDSPEC]	Build special character in X- and Y-registers.	**38, 78**
[CAT]	View and print specified catalog. (Not programmable.)	**18, 78**
[DELAY]	Set time that calculator waits between sending lines of information to printer.	**15, 80**
[FMT]	Specify formatting option for printed output.	**33, 40, 41, 78**
[LIST]	List program lines. (Not programmable.)	**22, 78**

Function	Description	Page
[MAN]	Set print mode to MAN (*manual*).	14, 79
[MAPOFF]	Set character-set mode to MAPOFF.	29–30, 80
[MAPON]	Set character-set mode to MAPON.	29, 80
[NORM]	Set print mode to NORM (*normal*).	14, 79
[PRA]	Print contents of ALPHA register.	19, 79
[PRAXIS]	Print and label *y*-axis of plot.	49, 79
[PRBUF]	Print contents of print buffer left-justified.	33, 79
[PRKEYS]	Print list of reassigned keys.	24, 79
[PROMPT]	View and print ALPHA prompt.	18, 79
[PRP]	Print program. (Not programmable.)	22, 79
[PRPLOT]	Plot function interactively.	47, 79
[PRPLOTP]	Plot function noninteractively.	48, 79
[PRREG]	Print contents of all storage registers.	19, 79
[PRREGX]	Print contents of specified storage registers.	20, 79
[PRΣ]	Print contents of statistics registers.	20, 79
[PRSTK]	Print contents of X-, Y-, Z-, T-registers.	19, 79
[PRTOFF]	Suppress all printing operations.	13, 79
[PRTON]	Execute printing operations normally.	13, 79
[PRX]	Print contents of X-register.	19, 79
[REGPLOT]	Plot single function value using storage registers.	50, 79
[RESETP]	Reset system control flags and functions.	16, 34, 80
[SKPCHR]	Accumulate skipped characters into print buffer.	30, 79
[SKPCOL]	Accumulate skipped dot columns into print buffer.	38, 79
[STARTU]	Underline all subsequently printed information.	31, 80
[STKPLOT]	Plot single function value using stack registers.	50, 79
[STOPU]	Stop underlining all subsequently printed information.	31, 80
[TESTP]	Execute printer self-test.	57, 80
[TRACE]	Set print mode to TRACE.	14, 79
[VIEW]	View and print specified register.	17, 79

Contacting Hewlett-Packard

For Information About Using the Module. If you have questions about how to use the module, first check the Table of Contents, the Subject Index, and the Function Index. If you can't find an answer in the manual, you can contact the Calculator Technical Support department:

Hewlett-Packard
Calculator Technical Support
1000 N.E. Circle Blvd.
Corvallis, OR 97330, U.S.A.

(503) 757-2004
8:00 a.m. to 3:00 p.m. Pacific time
Monday through Friday

For Service. If your module doesn't seem to work properly, see appendix A to determine if the module requires service. Appendix A also contains important information about obtaining service. If your module does require service, mail it to the Calculator Service Center:

Hewlett-Packard
Calculator Service Center
1030 N.E. Circle Blvd.
Corvallis, OR 97330, U.S.A.

(503) 757-2002

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