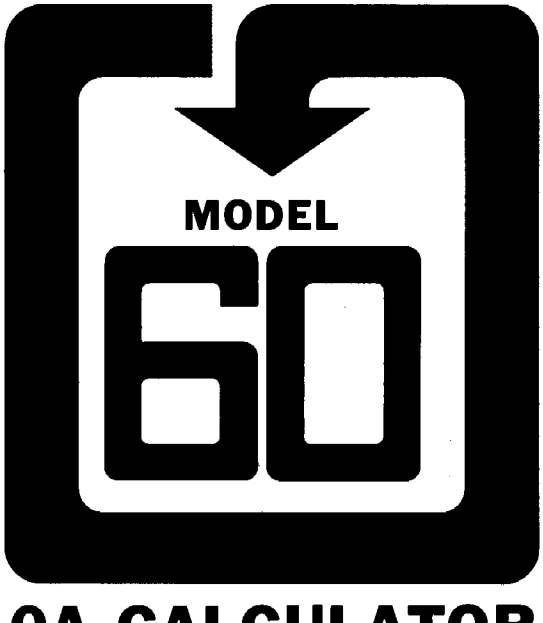
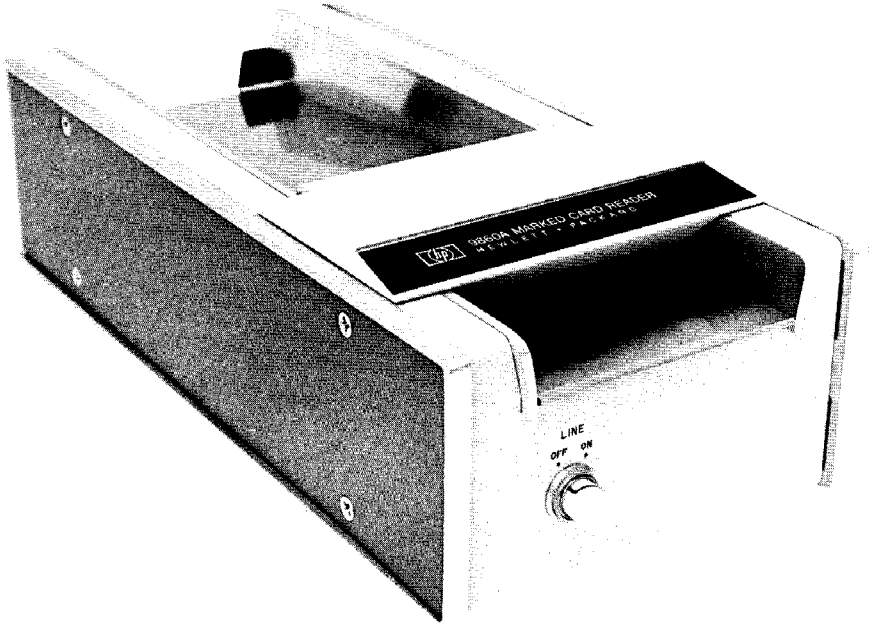
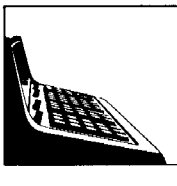


HEWLETT-PACKARD 9810A CALCULATOR MARKED CARD READER

OPERATING MANUAL

HEWLETT-PACKARD
MODEL 9860A MARKED CARD READER





HEWLETT–PACKARD CALCULATOR PRODUCTS DIVISION
P.O. Box 301, Loveland, Colorado 80537, Tel. (303) 667-5000
7 Rue du Bois-du-Lan, 1217 Meyrin, Geneva, Tel. (022) 41 54 00

TABLE OF CONTENTS

CHAPTERS

GENERAL INFORMATION
- General Description 1-1
- Accessories/Equipment Supplied 1-1
- Service Contracts 1-1
- Initial Inspection 1-1
- Power Requirements 1-1
- Grounding Requirements 1-2
- Installation 1-2
- Electrical Inspection 1-4

THE MODEL 60 CARD
- How the Model 60 Reads a Card 2-1
- Marking the Model 60 Card 2-1

PROGRAM MODE OPERATION
- Introduction 3-1
- Encoding the Model 60 Card 3-1
- Entering the Encoded Card 3-4

RUN MODE OPERATION
- Introduction 4-1

DATA INPUT
- The Calculator Data Card 4-1
- Encoding the Calculator Data Card 4-3

KEYBOARD INSTRUCTION INPUT
- Introduction 4-5
- Basic Calculator Instructions That Can Be Used 4-6

DATA AND KEYBOARD INSTRUCTION INPUT
- Introduction 4-7
- Example 4-7

RUN AND PROGRAM MODE OPERATION
- Introduction 5-1
- Example 5-1

SERVICE
- Changing the Lamp 6-1

TABLE OF CONTENTS

APPENDIX

Additional Run Mode Information
Sales and Service Offices

TABLES

1. Accessories/Equipment Supplied 1-1
2. Keyboard Instruction for RUN Mode Operation 4-6

FIGURES

1. Inserting Cards into the Reader 1-4
2. The Calculator Program Card 3-1
3. Model 9810A Key Codes 3-2
4. The Calculator Data Card 4-1

NOTES

GENERAL DESCRIPTION

The Model 9860A Marked Card Reader increases the efficiency and convenience of your Hewlett-Packard Calculator System. With the Reader, data or programs, which are easily encoded in pencil on cards, are entered into the system in seconds. Time spent at the calculator keyboard is reduced to a minimum, making available more system time for program execution.

ACCESSORIES EQUIPMENT SUPPLIED

The accessories and equipment supplied with each Model 9860A are listed in Table 1.

Table 1. Accessories/Equipment Supplied

PART NO.	QUANTITY	DESCRIPTION
09860-90001	2	Operating Manual
09160-67901	1	*Spare Lamp
09860-90002	1	Card-Diagnostic
11200A	1	Interface Cable Assembly
8120-1575	1	Cable Assembly AC Power
9320-2085	100	Program Card

*Located in the instrument, under the right side cover (see Service Chapter).

SERVICE CONTRACTS

Service contracts, which provide a fixed maintenance cost, are available for the Marked Card Reader. For further information, contact your local Hewlett-Packard Sales and Service Office.

INITIAL INSPECTION

The Marked Card Reader was carefully inspected, both mechanically and electrically, before shipment. It should be physically free of mars or scratches and in perfect electrical order upon receipt. Carefully inspect the Marked Card Reader for physical damage caused in transit and check for the accessories listed in Table 1. Also, check the electrical performance of the Marked Card Reader as described under ELECTRICAL INSPECTION; however, do not make this check prior to completing the INSTALLATION procedure.

POWER REQUIREMENTS

The Marked Card Reader requires either 120V or 240V ac, +5% −10%, 48 to 440 Hertz; maximum power requirements are 20VA. A slide switch, located on the rear of the Card Reader, selects either 120V or 240V operation.

POWER REQUIREMENTS (continued)

The 9860A can be rewired to operate on either 100V or 220V +5% −10% line voltages. For further information, contact your nearest Hewlett-Packard Sales and Service Office.

GROUNDING REQUIREMENTS

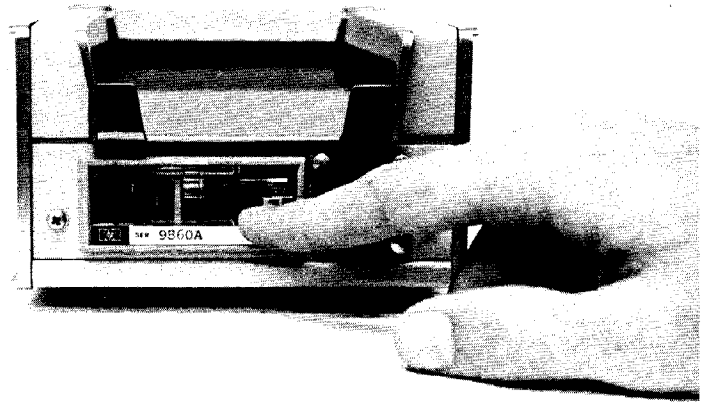
To protect operating personnel, the NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA) recommends that the Marked Card Reader cabinet be grounded. The Marked Card Reader is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the cabinet of the Marked Card Reader. The center pin on the power cable three-pronged connector is the ground connection.

CAUTION

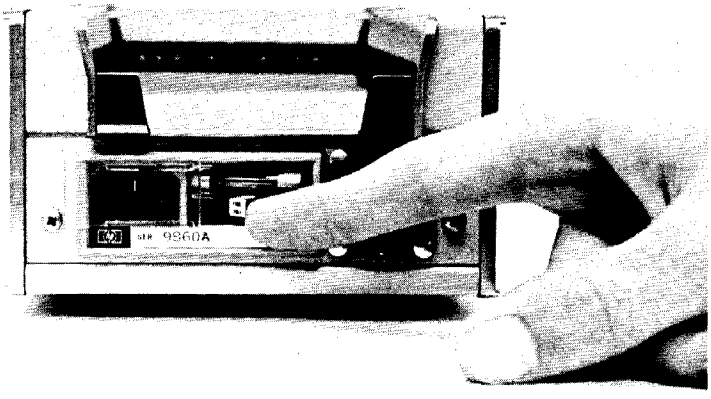
DO NOT APPLY OPERATING POWER TO THE MODEL 9860A MARKED CARD READER UNLESS THE LINE VOLTAGE SWITCH ON THE REAR PANEL IS IN THE PROPER POSITION, OTHERWISE, DAMAGE TO THE POWER TRANSFORMER MAY RESULT.

INSTALLATION

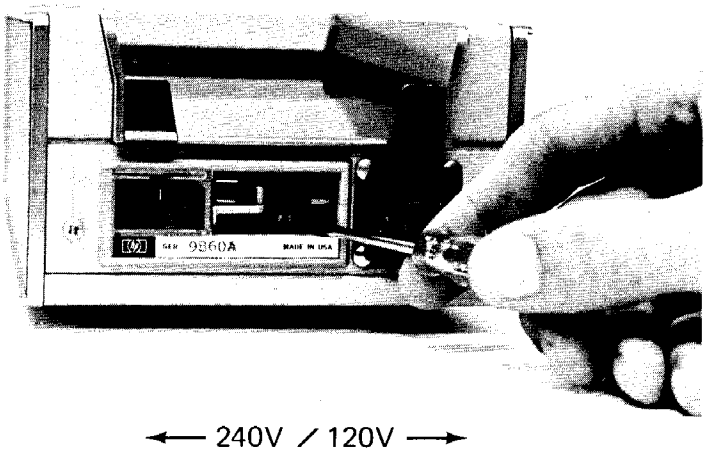
With the power cord removed from the Model 9860A, look through the clear plastic window of the power module located on the rear of the Card Reader. The small arrow switch should point to the line voltage (120 or 240) which will be used. If the switch is not set to the correct voltage, remove the fuse (simply pull the fuse lever and the fuse will be released from its holder) and position the switch so that the arrow points to the correct voltage to be used (120 or 240). Replace the fuse and connect the power cord to the rear of the Reader.



Remove the power cord, and move the window.



Pull the FUSE PULL lever to release the fuse.



← 240V / 120V →

Set the Line Voltage Switch to the proper position.

Next, connect the I/O Cable to the rear of the Card Reader. The cable is connected to the instrument by aligning the keys of the I/O Cable connector with the keyways on the instrument's connector. Once this is done, rotate the knurled barrel on the I/O connector clockwise. This will draw the two connectors together into full contact.

Turn the calculator OFF and connect the I/O Cable to the rear of the calculator. The connector is keyed and cannot be inserted incorrectly. It may be inserted into any one of the four I/O connectors on the rear of the calculator. Connect the Card Reader's power cord into one of the power receptacles on the rear of the calculator. Switch the calculator and Marked Card Reader ON. The Model 9860A is switched on by pressing the button on the front of the instrument. When power is applied, the button will light. Power is removed by pressing the button again.

ELECTRICAL INSPECTION

A printed card containing an exerciser program is shipped with the Model 9860A Marked Card Reader. This card allows you to check your instrument for proper electrical and mechanical operation. The following procedure explains how to use the exerciser card.

First, verify proper operation of the calculator by running its exerciser program. (Instructions are contained in the calculator operating manual.) Also, **ensure that the calculator is not in keylog mode.**

Next, press STOP and enter the printed exerciser card into the Reader. The card is inserted printed side up as shown in Figure 1.

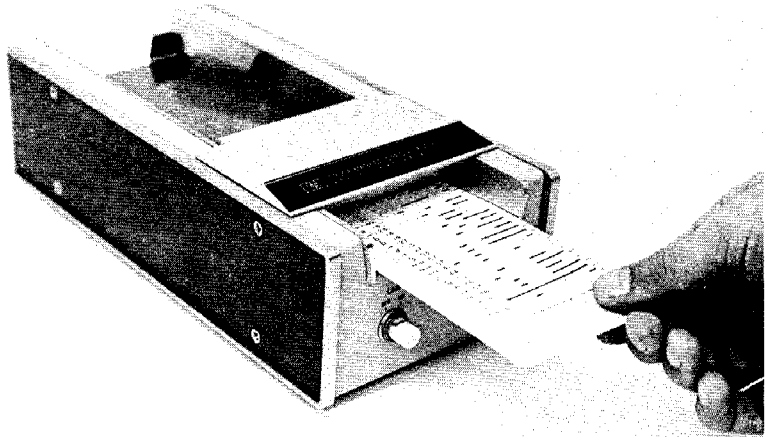


Figure 1. Inserting Cards into the Reader

Correct operation of the Model 9860A Marked Card Reader is indicated by a flashing calculator display. The display is shown below:

temporary z	1.0000
accumulator y	2.0000
keyboard x	3.0000

Should the Card Reader fail to operate correctly, carefully repeat the entire procedure to ensure that no error was made the first time. If the instrument still does not operate properly, check the bulb in the optical head (see SERVICE chapter). If the lamp is not defective, contact the nearest Hewlett-Packard Sales and Service office for assistance.

To stop the exerciser program press: STOP

To resume operation, press: CONTINUE

HOW THE MODEL 60 READS A CARD

> **NOTE**
>
> For the remainder of this manual the Model 9860A Marked Card Reader will be referred to as the Model 60 Marked Card Reader.

Inserting a card into the Model 60 will automatically start the motor, which will draw the card through the instrument. As the card is drawn through the instrument, it is viewed, across its width, by nine light sensitive photo cells located in the instrument's cover. The photo cells 'look' at the amount of light reflected from the card. Each photo cell views a different portion of the card width. To explain the portion of the card viewed by each photo cell, consider the Calculator Program Card (shown in Figure 2).

The Calculator Program Card has columns and rows of boxes, the columns are: SKIP, 100, 40, 20, 10, 4, 2 and 1. Each column is viewed by a photo cell. The remaining photo cell views the heavy black STROBE marks on the right edge of the card. As the card moves through the Model 60, each photo cell independently monitors the light reflected from its column. If a box is marked with a soft-graphite pencil, the light reflected from the card suddenly diminishes. The photo cell 'sees' this reduction in reflected light and remembers that a box has been marked. Thus, the card is read one frame (one row of boxes) at a time.

As the STROBE marks, located between the frames, pass under the STROBE photo cell, signals are generated which enable the calculator to accept the preceding frame of information and, after that, reset the photo cells so that they can accept the next frame of information from the card.

There are other columns on the Model 60 card; again, consider the Calculator Program Card, which has columns marked STEP and KEY. These columns have been provided for your use; the photo cells of the Card Reader, because of their location, do not see this portion of the card.

Encoding the Model 60 Calculator Program Card will be explained in the Program Mode Operation and Run Mode Operation sections; this section details some of the considerations concerning marking a card box, correcting an erroneously marked box and general care of a card.

MARKING THE MODEL 60 CARD

Always use a blunt, soft-graphite pencil to mark a card. If the pencil is sharp, you may gouge the surface of the card, making any required corrections impossible. A felt tip or ball point pen should never be used; marks made with some of these devices dry with a shiny surface. The photo cells respond only to a dull finish.

MARKING THE MODEL 60 CARD (continued)

It is not necessary for you to completely darken an entire box that you wish to mark. The photo cells can see a single mark as small as .5 mm (.02") in width. A single line drawn through the box with a blunt pencil will be seen. Be sure, however, that the line extends completely through the box and slightly extends through the vertical sides of the box.

If you wish to mark two or more adjacent boxes on the same row, simply draw one continuous line through the boxes. The photo cells do not view the area of the card between the boxes; therefore, only box marks will be seen.

Never mark between the STROBE marks because these marks will be read as STROBE marks and will cause incorrect operation.

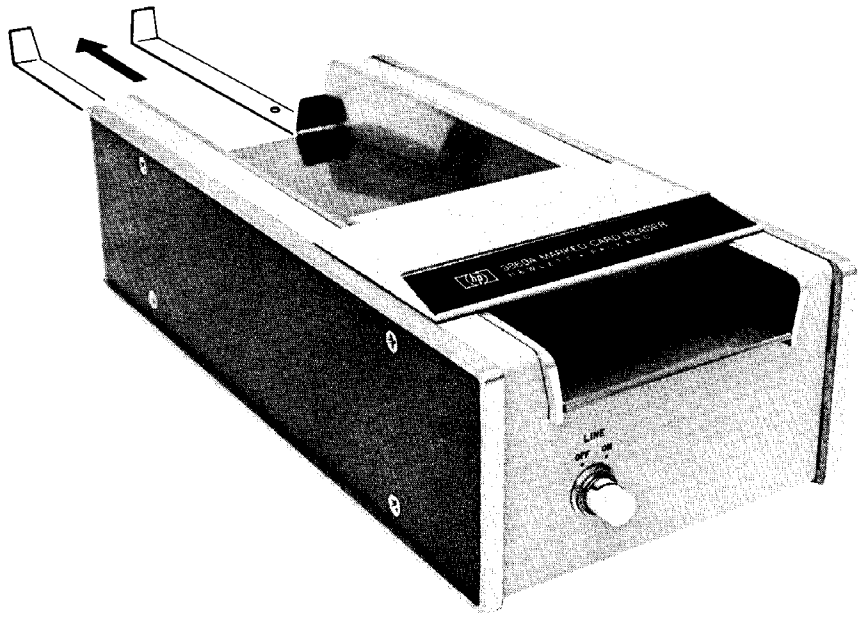
Errors may be corrected by completely erasing incorrect marks. Use a soft eraser. Hard ink erasers may roughen the surface of the card. A rough card surface will reflect less light than a smooth card surface and may be seen by the photo cells as a mark.

Never use a card that has become soiled, curled, or creased. The photo cells are sensitive and could interpret a smudge or crease as a mark.

OPTIONAL MODEL 60 CARDS

Both the Calculator Program Card (-hp- part number 9320-2085), shown in Figure 2, and the Calculator Data Card (-hp- part number 9320-2088), shown in Figure 4, are available in an optional format. The optional cards are similar to the standard cards except for length; the standard cards contain thirty frames, the optional format cards contain fifty frames. The part number of the Optional Calculator Program Card is 9320-2099. The part number of the Optional Calculator Data Card is 9320-2100. Standard and optional format cards can be ordered from your nearest Hewlett-Packard Sales and Service Office.

The Model 60 is equipped with an adjustable card stop. When the card stop is placed in its extended position, the Reader will accept the longer, optional cards. To extend the card stop, simply pull the stop into its extended position.


LINE
OFF
ON

NOTES

INTRODUCTION

When the calculator is in the PROGRAM mode, the Card Reader can be used to input calculator programs directly into the calculator's memory, bypassing the calculator's keyboard and magnetic card reader. This chapter describes how this operation is accomplished.

> **NOTE**
>
> The calculator must not be in the keylog mode of operation when cards are inserted into the Model 60. If the calculator is in the keylog mode of operation, some instructions on the Model 60 card will not be transferred to the calculator.

ENCODING THE MODEL 60 CARD

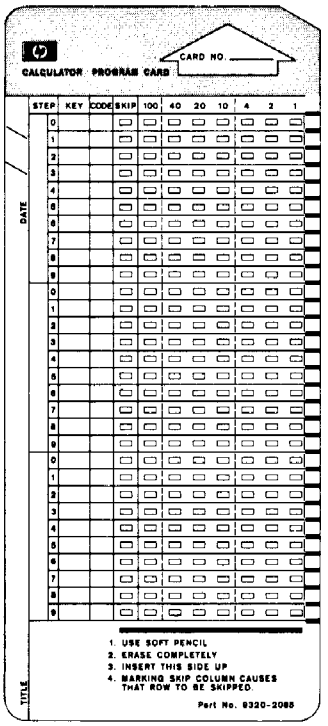


Figure 2. The Calculator Program Card

The Calculator Program Card (see Figure 2) is used to enter calculator program steps into the calculator's memory from the Card Reader.

ENCODING THE MODEL 60 CARD (continued)

The Calculator Program Card has two columns marked STEP; they are used to record the calculator memory location in which you plan to place each instruction (row). Generally, programs will be stored in the calculator's memory starting at location 0000.

The two columns marked KEY and CODE are used to record an instruction (i.e. ROLL ↑) and its key code (i.e. 22). These are the same codes that are seen in the display registers of the calculator when STEP PRGM is pressed in the PROGRAM mode.

The columns marked 40, 20, 10, 4, 2 and 1 are for marking the key code for an instruction. These boxes are marked so that the value of the boxes marked on a row, when totaled, equals the key code of the desired instruction. For example, if the instruction was ↑ (key code 27), you would mark the 20, 4, 2 and 1 boxes in that row (20 + 4 + 2 + 1 = 27). Figure 3 shows the key codes for your Model 9810A Calculator.

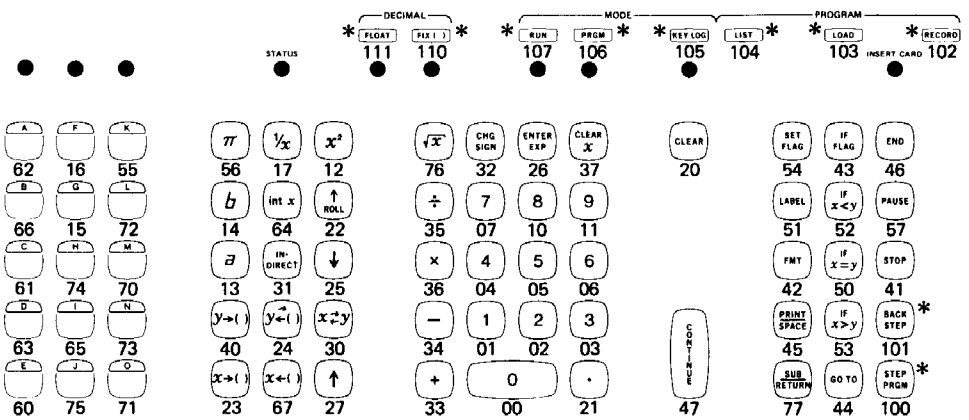


Figure 3. Model 9810A Key Codes

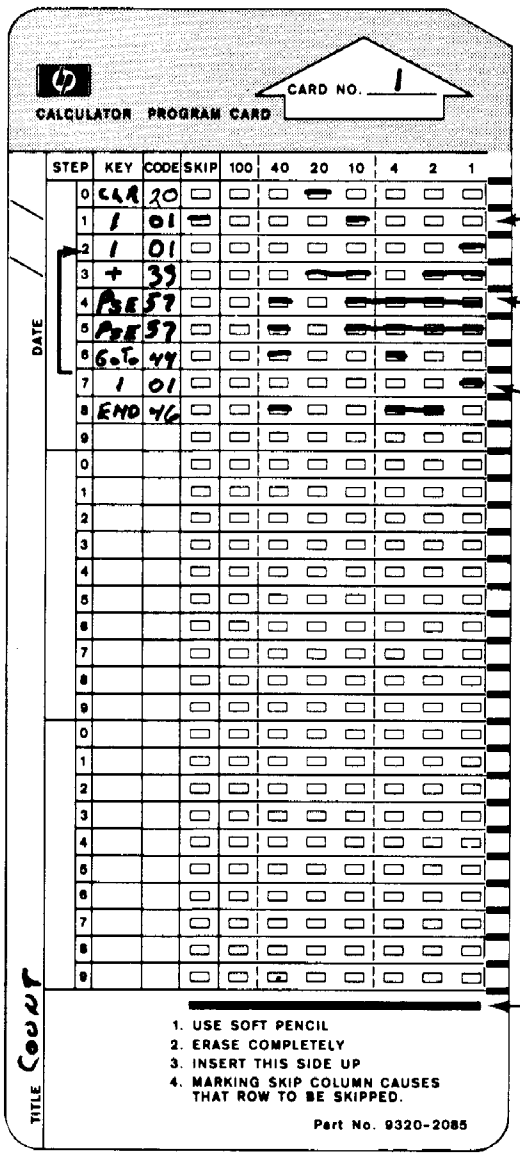
The SKIP column, if marked, will cause the Model 60 to ignore any boxes that are marked on that row. Marking the SKIP column can be used as an alternative to erasing; should you make an error in marking a row, you may either erase the error and correct it or mark the SKIP column. Notice that marking the SKIP column will cause the STEP column to be incorrect for the remainder of the card. This should be kept in mind when encoding programs which include branching instructions.

In order to create an example of a correctly marked Calculator Program Card, assume you have just written the following small counting program and wish to use the card reader to enter the program into the calculator's memory.

*These keys are not programmable and are, therefore, not recommended for use in this mode of operation. They are shown in Figure 3 only to provide, in one location, the key codes for the entire calculator keyboard. Operating instructions for these keys are contained in the RUN MODE OPERATION chapter and Appendix A.

STEP	KEY	KEY CODE
0000	CLEAR	20
0001	1	01
0002	+	33
0003	PAUSE	57
0004	PAUSE	57
0005	GO TO	44
0006	1	01
0007	END	46

Here is the program correctly marked on a Calculator Program Card:



Skip marked because an error was made in marking the code

Adjacent boxes may be marked with a single line.

Notice that the branch address does not agree with the STEP column; that is because the SKIP column was marked earlier.

SKIP 177

ENCODING THE MODEL 60 CARD (continued)

When this card is entered into the calculator's memory,(the starting address is 0000) the memory through 0028 will be changed (0029 if the one SKIP had not been marked). This program will occupy steps 0000 through 0007. Memory locations 0008 through 0028 will contain zeros because rows which are not marked will be read by the Model 60 as zeros.

The calculator does not recognize a row in which a SKIP has been marked and, therefore, the calculator's program counter is not advanced . In the example, the STEP column on the card agrees with the calculator's memory until step 1, when the SKIP was marked. Then, for the remainder of the card, the STEP column on the card and the calculator's memory disagree by one step. The END instruction at step 8 on the card was placed into the calculator's memory at location 0007.

Near the bottom of the card, there is a preprinted mark that intersects all of the channels on the card. This mark, SKIP 177, causes the reader to stop reading the card. When the SKIP 177 is seen by the reader, no instructions beyond that point on the card are transferred to the calculator and, the calculator's program counter is not further advanced by the reader. This prevents the possibility of any marks present near the bottom of the card (e.g. program remarks, etc.) being interpreted as instructions by the reader and transferred into the calculator memory.

The SKIP 177 may be marked anywhere on the card to stop the Model 60 from reading the remainder of the card. In the previous example, the SKIP 177 could have been marked in the row following the END instruction. If this had been done, the calculator's memory would have been unchanged in the area from 0007 through the remainder of the calculator memory. In the example, the calculator's program counter was advanced to location 0028. If the SKIP 177 had been marked in the row following the END instruction, the calculator's program counter would have been advanced only to location 0007. Because you must always mark the SKIP 177 immediately following the last instruction on a card that is entered into the reader when the calculator is in the RUN mode, we recommend that you also do this in PROGRAM mode operation.

ENTERING THE ENCODED CARD

To manually enter the encoded program card into the calculator's memory:

PRESS: [RUN] [END] [PRGM]

ENTER CARD into the Card Reader.

PRESS: [RUN] [END]

To run the example program:

PRESS: 

Longer programs, occupying more than one card, are encoded in the same way as the example. The cards are then entered sequentially one at a time into the reader. Remember, if you mark a SKIP, the STEP column on all succeeding cards will be in error, one step for each SKIP marked.

The RUN, PROGRAM, END and CONTINUE keys pressed in the example can be marked on the Model 60 Card. This is explained in the RUN AND PROGRAM MODE chapter.

NOTE

Marking an undefined key code (i.e. a key code larger than 111_8) on a Model 60 card will cause the calculator keyboard, with the exception of the STOP key, to become deactivated. Key codes, marked on the card following the undefined key code, will not be entered in the calculator. Once deactivated, full operation can be restored to the keyboard by pressing the STOP key.

NOTES

INTRODUCTION

When the calculator is in the RUN mode, the Card Reader can be used to input data into the calculator's X-register at STOP's in the calculator program and/or cause the calculator to execute certain keyboard instructions marked on the Calculator Data Card. For purposes of explanation in this chapter, these operations will first be covered individually then, as a composite.

> **NOTE**
>
> The calculator must not be in the keylog mode of operation when cards are inserted in the Model 60. If the calculator is in the keylog mode of operation some instructions on the Model 60 card will not be transferred to the calculator.

DATA INPUT

THE CALCULATOR DATA CARD

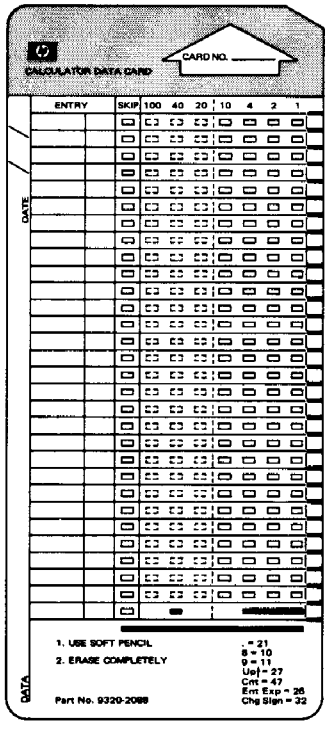


Figure 4. The Calculator Data Card

DATA INPUT

THE CALCULATOR DATA CARD (continued)

The Calculator Data Card (See Figure 4) is used to input data into the calculator's X-register from the Card Reader at STOP's in the calculator program. This allows the variables for the program to be premarked on one or more Calculator Data Cards. These are entered into the Card Reader when the calculator program stops, allowing the calculator's keyboard to be bypassed for variable data entry.

The Calculator Data Card has two columns marked ENTRY; they are used to record the digit marked on a row and its key code. The following table lists the keyboard instructions used to input data into the calculator and their key codes.

KEY	KEY CODE
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7

KEY	KEY CODE
8	10
9	11
.	21
ENTER EXP	26
CHG SIGN	32
π	56
CONTINUE	47

The columns marked 10, 4, 2 and 1 are for marking the key code for a digit. The dotted boxes, 40 and 20 are used with the 10, 4, 2 and 1 boxes for encoding π, CHG SIGN, decimal point (.), CONTINUE, and ENTER EXP. (The 100 box is used to encode other instructions which are covered under KEYBOARD INSTRUCTION INPUT.) These boxes are marked so that the value of the boxes marked on a row, when totaled, equal the key code for the desired entry. For example, if the digit were 7 (key code 7) you would mark the 4, 2 and 1 boxes (4 + 2 + 1 = 7).

The SKIP column, if marked, will cause the Card Reader to ignore any boxes marked on that row. Marking the SKIP column can be used as an alternative to erasing; should you make an error in marking a row, you may either erase the error and correct it or mark the SKIP column.

DATA INPUT

ENCODING THE CALCULATOR DATA CARD

In order to create an example of a correctly marked Calculator Data Card, assume you have just written the following calculator program which solves the equation:

$$C = \frac{(A \times B)}{(A + B)}$$

and you wish to use the Model 60 to enter the variables A and B at STOP's in the program.

STEP	KEY	KEY CODE	DISPLAY			REMARKS
			X	Y	Z	
0000	CLEAR	20	0	0	0	
0001	STOP	41	A	0	0	9860 enters A and restarts program.
0002	ROLL ↑	22	0	A	0	
0003	STOP	41	B	A	0	9860 enters B and restarts program.
0004	×	36	B	(AB)	0	Compute (AB)
0005	$x \rightleftarrows y$	30	(AB)	B	0	
0006	↑	27	(AB)	(AB)	B	
0007	ROLL ↑	22	B	(AB)	(AB)	
0008	÷	35	B	A	(AB)	Recover B
0009	+	33	B	(A+B)	(AB)	Compute (A+B)
0010	ROLL ↑	22	(AB)	B	(A+B)	
0011	ROLL ↑	22	(A+B)	(AB)	B	
0012	÷	35	(A+B)	C	B	Compute C
0013	ROLL ↑	22	B	(A+B)	C	
0014	−	34	B	A	C	Recover A
0015	$x \rightleftarrows y$	30	A	B	C	
0016	END	46	A	B	C	Display

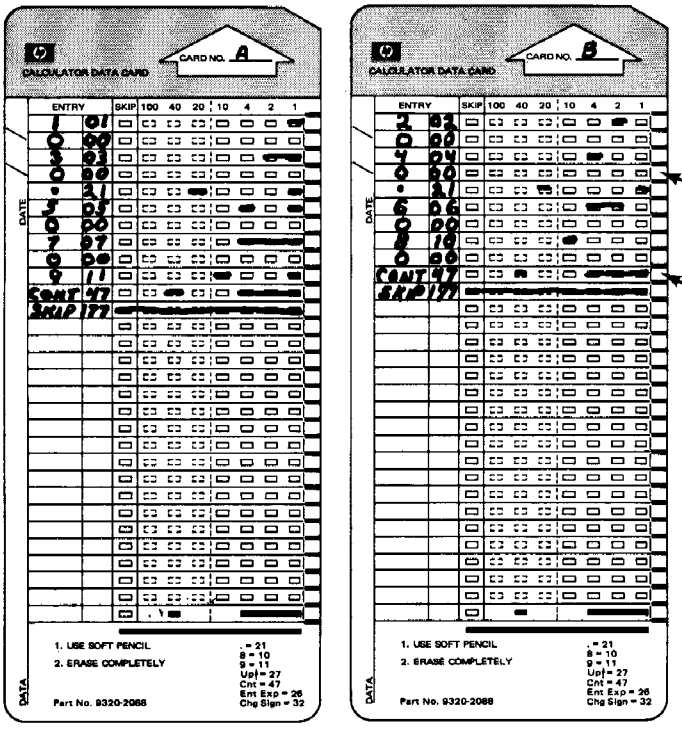
Key the example program into the calculator's memory starting with location 0000.

To demonstrate encoding the Calculator Data Card, assign values for A and B; let A = 1030.50709 and B = 2040.6080, these values will make C = 684.7223078.

DATA INPUT

ENCODING THE CALCULATOR DATA CARD (continued)

Here are the Calculator Data Cards, properly marked, ready for use with the example program.



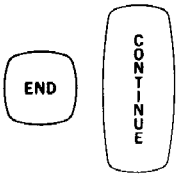
Notice the CONTINUE instruction marked on each of the cards immediately following the last digit on the card. The CONTINUE instruction will automatically restart the program. Immediately following the CONTINUE instruction a SKIP 177 has been marked. The SKIP 177 will prevent the possibility of marks present near the bottom of the card being interpreted as calculator instructions. The SKIP 177 must be marked on the card in the row immediately following the last instruction. If it is not, improper system operation may be experienced.

> **NOTE**
>
> A SKIP 177 must be marked immediately following the last instruction on a card; otherwise, improper system operation may be experienced.

Near the bottom of the card there is a preprinted CONTINUE and SKIP 177 instruction. These instructions have been provided for the case when you might fill the card with instructions.

DATA INPUT

To enter the encoded Calculator Data Cards into the example program:

PRESS: 

When the program stops, insert Card A into the Card Reader.

When the program stops the second time, insert card B into the Card Reader.

DISPLAY:

temporary	z	6.847223078 02
accumulator	y	2.040608000 03
keyboard	x	1.030507090 03

KEYBOARD INSTRUCTION INPUT

The Model 60 Card Reader can be used to input, to the calculator, certain calculator keyboard instructions other than those previously discussed. In this mode of operation, the key codes of the instructions are marked on the Calculator Data Card, or Calculator Program Card, which is then fed into the Card Reader.

Special timing considerations must be given to some keyboard instructions that are to be marked on a card. To understand why this is so, we must discuss how the Card Reader transfers keyboard instructions to the calculator and how the calculator acts on these instructions.

The Card Reader transfers one instruction to the calculator every .03 seconds. Some time after the calculator receives the instruction (as much as .025 seconds later), it begins executing the instruction. While the calculator is executing an instruction, it ignores any input from the card reader.

Because of their complexity, some calculator keyboard instructions require more than .005 seconds of calculator execution time. If the Card Reader transfers an instruction that requires more than .005 seconds of execution time, then the calculator will miss the next instruction (or instructions) marked on the card.

KEYBOARD INSTRUCTION INPUT

INTRODUCTION (continued)

Instructions which require more than .005 seconds of calculator execution time can be marked on a card provided that a delaying technique is used. This can be done by marking the SKIP channel enough times to allow the calculator to complete a keyboard instruction before the Card Reader inputs the next. The following formula will allow you to determine the number of SKIP channel marks, if any, that are required following any calculator instruction. Use the formula only when the calculator execution time (ET) for an instruction is greater than .005 seconds.

$$\text{The integer value of } \left[\frac{\text{ET (in seconds)} + .025}{.03}\right] = \text{The number of SKIP channel marks required.}$$

for ET > .005

BASIC CALCULATOR INSTRUCTIONS THAT CAN BE USED

The following table lists the basic calculator keyboard instructions that are recommended for use in this mode of operation. Also included in the table are the number of SKIP channel marks (if any) that are required following the instruction on a card.

Although the Card Reader can, in this mode of operation, input to the calculator any instruction available on the calculator keyboard, some are not recommended for use as they are either meaningless or too awkward to use conveniently. These are not shown in Table 2; however, where the missing instructions are needed Appendix A provides the rules of operation.

Table 2. Keyboard Instructions for RUN mode operation.

KEY	KEY CODE	NUMBER OF SKIPS
x^2	12	2
$\overline{a}$	13	0
$\overline{b}$	14	0
$1/x$	17	2
CLEAR	20	0
ROLL ↑	22	0
$x\rightarrow(\ )$	23	0
$y\overrightarrow{\leftarrow}(\ )$	24	0
↓	25	0
↑	27	0
$x\overrightarrow{\leftarrow}y$	30	0
+ *	33	0
− *	34	0
÷ *	35	2
× *	36	2

KEY	KEY CODE	NUMBER OF SKIPS
CLEAR x	37	0
$y\rightarrow(\ )$	40	0
GO TO	44	0
END	46	0
CONTINUE	47	0
SET FLAG	54	0
int x	64	0
$x\leftarrow(\ )$	67	0
$\sqrt{x}$	76	3
SUB / RETURN	77	0
PRGM	106	0
RUN	107	0
FIX ( )	110	0
FLOAT	111	0

*Display register operations only. See Appendix A for operations involving Data Storage Registers.

DATA AND KEYBOARD INSTRUCTION INPUT

INTRODUCTION

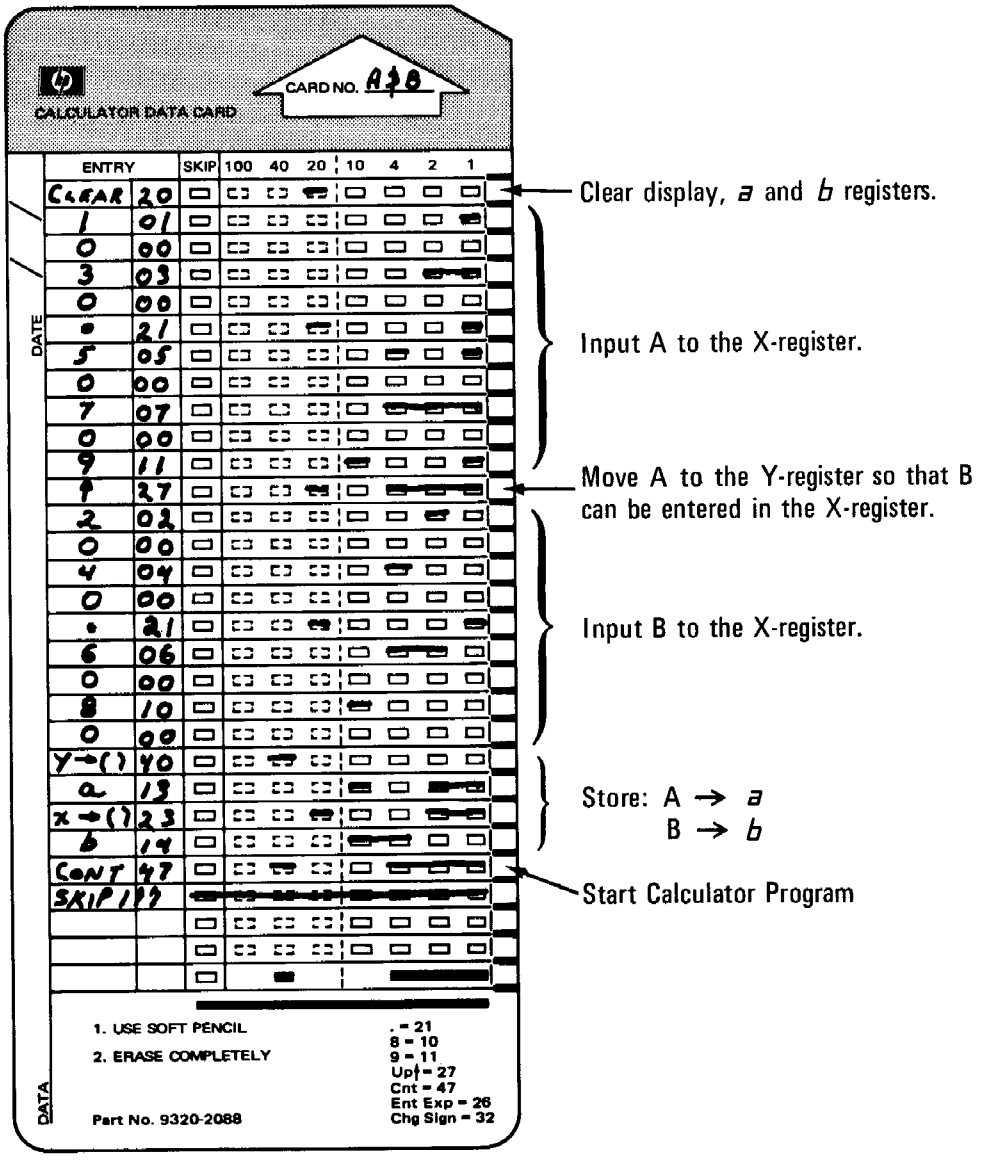
Data and keyboard instructions combined on a card allow more than one data point to be marked on a card. This can easily be demonstrated using the example presented earlier under DATA INPUT. That example solved the problem:

$$C = \frac{(A \times B)}{(A + B)}$$

in which A = 1030.50709 and B = 2040.6080.

EXAMPLE

In this example, we will enter both A and B via the same card, and also store A and B in the *a* and *b* registers. Here is the card, properly marked, ready to enter into the calculator program which will be presented shortly.



DATA AND KEYBOARD INSTRUCTION INPUT

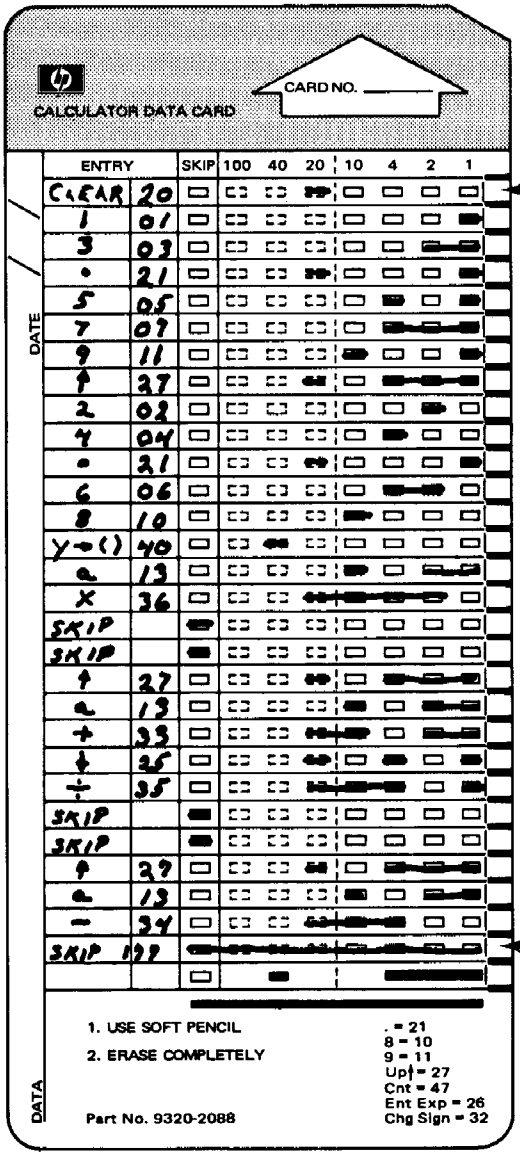
Once this card is read, A will be in the Y and *a* registers and B will be in the X and *b* registers. Realizing this, the calculator program can be written.

STEP	KEY	KEY CODE	DISPLAY			REMARKS
			X	Y	Z	
0000	×	36	B	(AB)	0	Compute (AB)
0001	↑	27	B	B	(AB)	
0002	*a*	13	A	B	(AB)	Recall A
0003	+	33	A	(A+B)	(AB)	Compute (A+B)
0004	↓	25	(A+B)	(AB)	(AB)	
0005	÷	35	(A+B)	C	(AB)	Compute C
0006	*b*	14	B	(A+B)	C	Recall B
0007	↑	27	B	B	C	
0008	*a*	13	A	B	C	Recall A
0009	END	46	A	B	C	Display

If A and B contain fewer digits, the entire operation can be marked on one card. To show this, assume A = 13.579 and B = 24.68, this will make C = 8.759500248. Here is a Calculator Data Card marked so as to enter the data points and solve for C.

Notice the SKIP channel marks following the multiply and divide instructions; they allow time for the calculator to complete the multiply and divide operations before the next instruction is transferred to the calculator. Notice also the SKIP 177 code marked following the last instruction on the card; it was marked on the card so that the Card Reader would not read the preprinted CONTINUE instruction near the bottom of the card.

DATA AND KEYBOARD INSTRUCTION INPUT



Clears display, *a* and *b* registers.

Enter A

Enter B

Store A in *a* register.

Compute (AB). Mark 2 Skips to allow for execution time.

Compute (A + B)

Compute C. Mark 2 Skips to allow for execution time.

Recover B

Skip 177 causes Card Reader to stop reading card. Preprinted CONTINUE at bottom of card will not be transferred to calculator.

NOTE

Marking an undefined key code (i.e. a key code larger than 111_8) on a Model 60 card will cause the calculator keyboard, with the exception of the STOP key, to become deactivated. Key codes, marked on the card following the undefined key code, will not be entered in the calculator. Once deactivated, full operation can be restored to the keyboard by pressing the STOP key.

NOTES

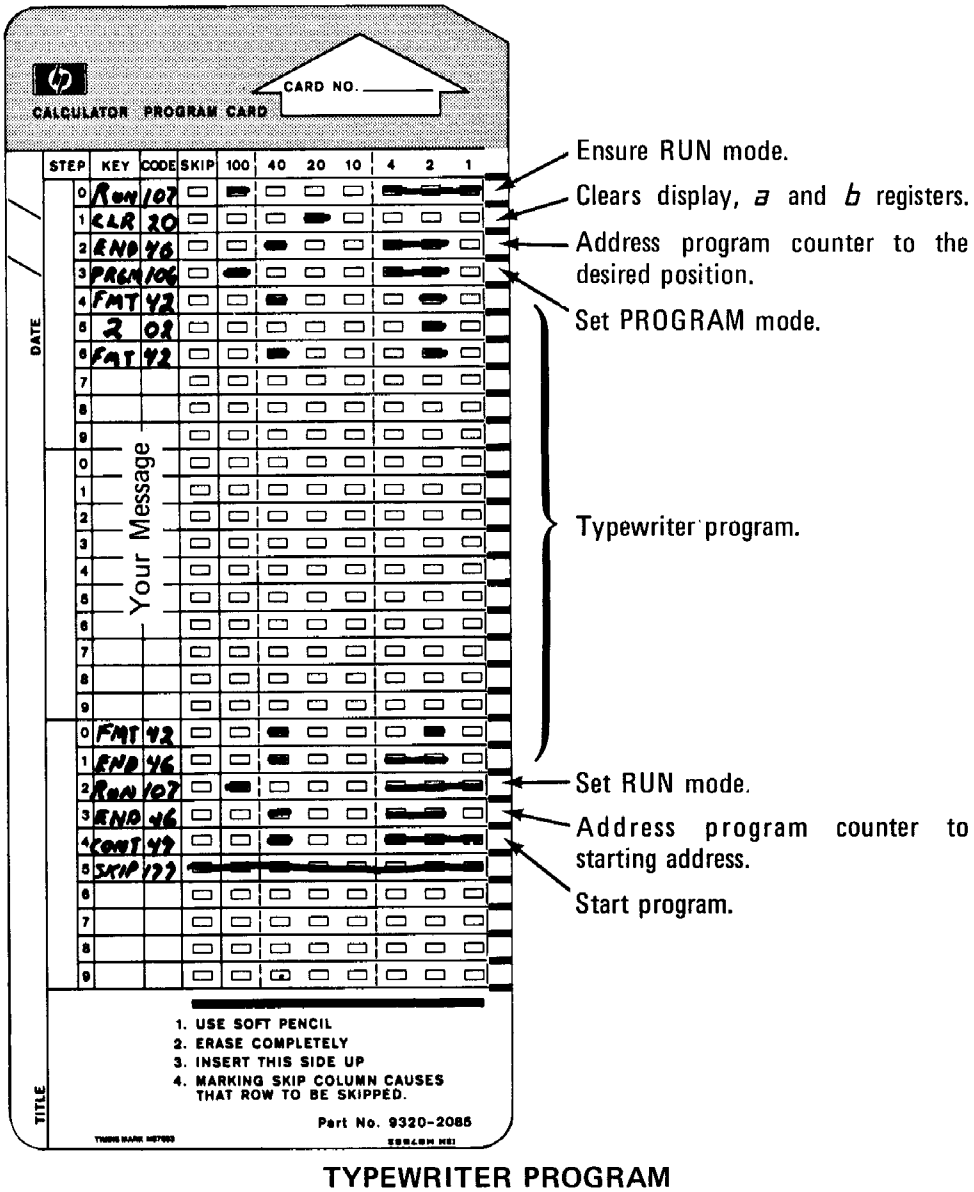
RUN AND PROGRAM MODE OPERATION

INTRODUCTION

The Card Reader can set RUN and PROGRAM modes of operation in the calculator. Combining these two modes of operation provides the very best way of using the programmable keyboard instructions that are not recommended for use in the RUN mode.

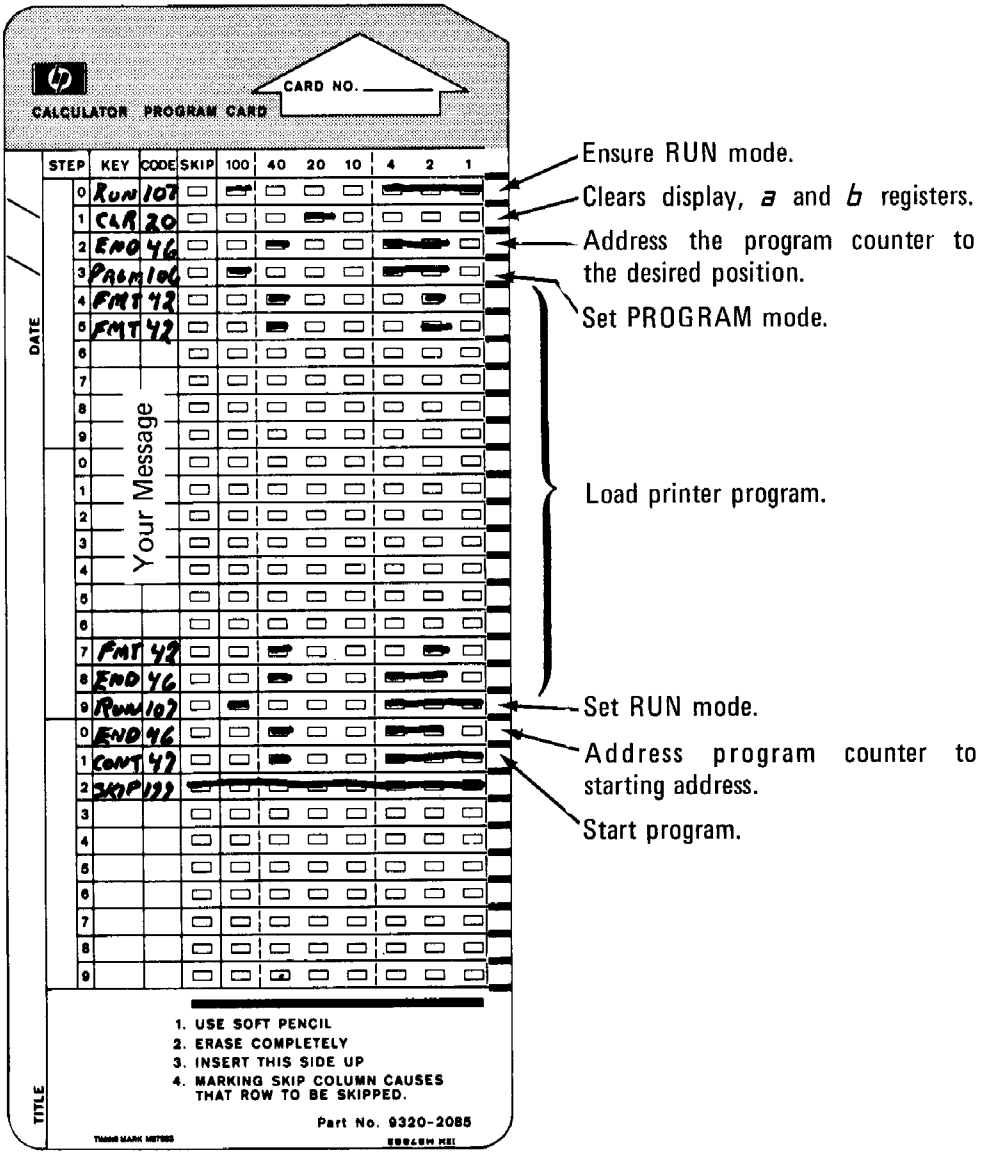
EXAMPLE

To illustrate combining the modes of operation, assume that you wished to type a heading on the Model 61 typewriter, or on the printer from a card. To do this, you would mark your card as follows:



TYPEWRITER PROGRAM

EXAMPLE (continued)



PRINTER PROGRAM

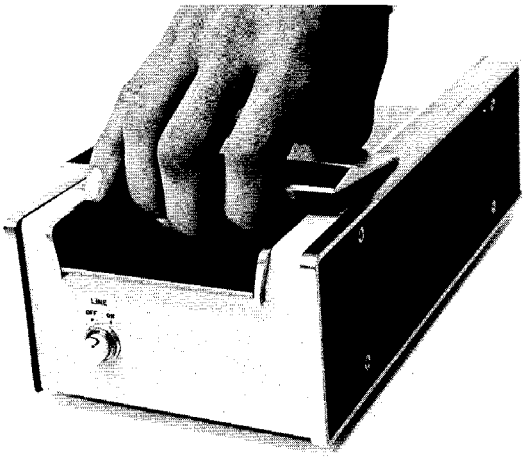
The basic principle is to enter the instructions, which were not recommended for use in the RUN mode, into the calculator's memory as a program. Then, when the program is executed, timing problems which may have been encountered in the RUN mode are solved by the calculator. This technique allows you to easily operate output devices (plotter, typewriter, etc.), which require the instructions not recommended for use in the RUN mode, from the Card Reader.

CHANGING THE LAMP

Occasionally the lamp which lights the card will require replacing. A defective lamp will prevent the motor, which draws the card through the Card Reader, from operating. Always check first for a burned out lamp when cards fail to feed properly. Light from a correctly functioning lamp can be seen when looking into the card slot with the calculator and Card Reader turned on.

If the card fails to feed and the lamp glow is not visible in the card slot, replace the lamp by following these instructions.

Access to the lamp in the card reading assembly is obtained by grasping the top of the card slot with your hand and pulling upward. The top of the Card Reader is hinged and will pivot up to reveal the lamp.



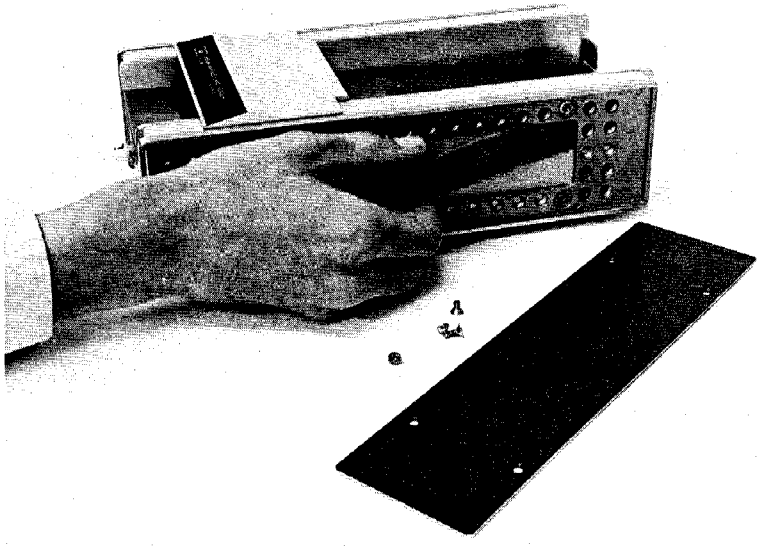
A replacement lamp is located inside the Card Reader behind the right side panel. Remove the sponge plastic cushion which protects the spare lamp.

CHANGING THE LAMP (continued)

CAUTION

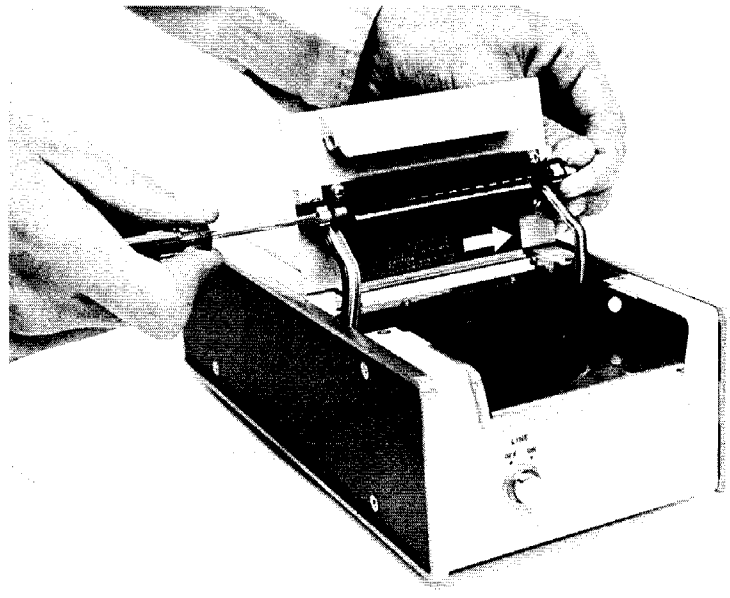
THE LAMP IS VERY FRAGILE. ONE SIDE OF THE CUSHION HAS A SLIT CONTAINING THE LAMP.

Pull the cushion toward the front of the Card Reader at a very shallow angle. Pulling the cushion at right angles to the side frame will break the lamp.



Remove the lamp from the card reader assembly. To prevent breakage, do not grasp the lamp by the glass cylinder. Instead, using a screwdriver or similar instrument, placed against the lamp's left metal cap, push the lamp toward the right until both metal caps clear their spring clamps and the lamp is released.

To install the replacement lamp, position each metal cap over its spring clamp with the small spring in the glass cylinder to your left; then, simultaneously press both metal caps into the spring clamps. Do not press against the glass cylinder; that may break the new lamp.



Return the top cover to its original position by pushing down. Replace the cushion, the side cover and the four retaining screws. You will probably want to order a new lamp at this time from your local Hewlett-Packard office. Then you will always have a spare lamp on hand.

After replacing the lamp run the Card Reader exerciser to verify proper operation.

APPENDIX A

This information is provided for the user who needs to use instructions that were not recommended for use in RUN mode.

KEYLOG

No SKIPS are required following a KEYLOG instruction on the card; however, any following instructions (so long as KEYLOG mode is maintained) will require, in addition to the SKIPS that may be normally required for the particular instruction, an additional 15 SKIPS marked on the card following the particular instruction to allow for printing time.

LIST-LOAD-RECORD

Must be the last instruction, other than SKIP 177, marked on a card. Do not insert another card into the reader until the operation has been completed.

IF FLAG — IF X<Y — IF X=Y — IF X>Y

If true (e.g. X < Y), the calculator's program counter will be addressed to the location specified by the four digits on the card following the "IF", instruction. If true, and operations (not digits) follow the "IF", then, the calculator will perform the operations. SKIPS that may be required for any of the operations must be marked on the card.

If false (e.g. X $\not<$ Y), the calculator's program counter will be advanced four locations. Numbers located in the four frames following the "IF" will be entered in the X register. If false, and operations (not digits) follow the "IF", the calculator will perform them. SKIPS that may be required for any of the operations must be marked on the card.

PAUSE

A PAUSE, marked on a card will cause the next instruction on the card to be missed. If a PAUSE is desired, mark 8 SKIPS following the PAUSE on the card; then, the next following instruction will be read.

STOP

If the calculator is running a program, a STOP instruction on a card will STOP the program execution provided the STOP instruction is transferred to the calculator while the calculator is performing a PAUSE. In all other circumstances, a STOP marked on a card will have no effect on the calculator.

APPENDIX A

BACK STEP
BACK STEP will decrement the program counter.

STEP PRGM
STEP PRGM will increment the program counter's location. The instruction in that memory location will be executed. SKIPS may be required depending on the execution time required for that instruction.

FMT – PRINT
FMT and PRINT control other peripherals.

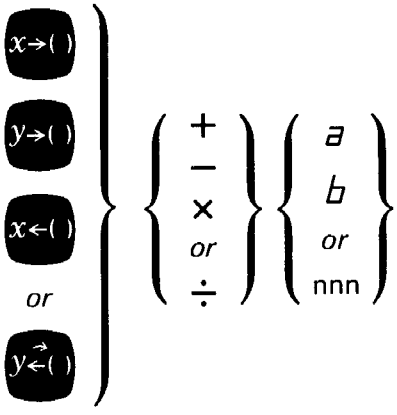
Controlling the printer from the Card Reader
15 SKIPS are required following: each PRINT, the 16th alphameric character in a string, each CR/LF and the terminating FMT of an alpha message.

Controlling the Model 61 Typewriter from the Card Reader.
A FMT 2 *w.d* sequence requires no SKIP channel marks. Mark 5 SKIPS after each alpha character. PRINT and all typewriter functions (e.g. carriage return/line feed) must be the last instruction marked on a card.

Controlling the Model 62 Plotter from the Card Reader.
Plotter instructions (FMT ↑, FMT ↓) must be the last instruction marked on a card.

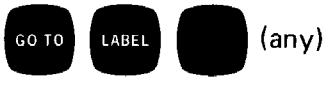
APPENDIX A

Data Storage Register Arithmetic



Place two SKIPS following the address on the card. DO NOT use short-form addressing.

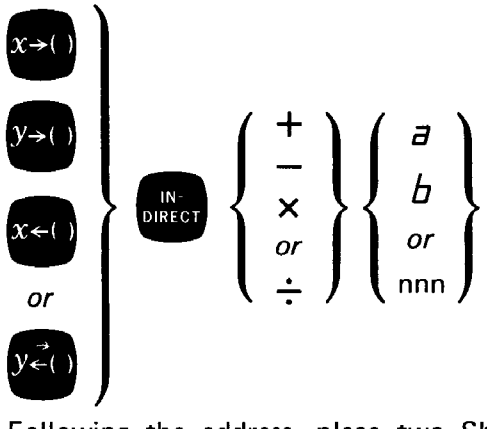
Label Addressing



(any)

Place four SKIPS following a label 'any' on the card.

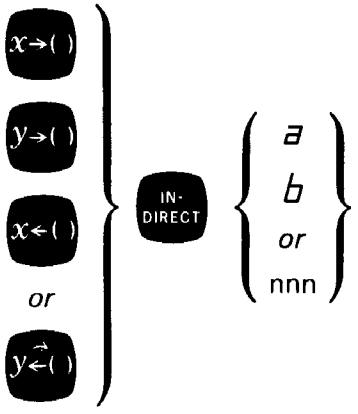
Indirect Arithmetic



Following the address, place two SKIPS for the mathematical operation and one SKIP for each INDIRECT instruction used in the instruction sequence. DO NOT use short-form addressing.

APPENDIX A

Indirect Addressing



Place one SKIP for each INDIRECT instruction used in the instruction sequence on the card, following the address. DO NOT use short-form addressing.

HEWLETT hp PACKARD

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA
P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 252-5061
TWX: 910-951-1330

5737 East Broadway
Tucson 85716
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA
1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO
7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT
508 Tolland Street
East Hartford 06108
Tel: (203) 289-9394
TWX: 710-425-3416

111 East Avenue
Norwalk 06851
Tel: (203) 853-1251
TWX: 710-468-3750

FLORIDA
P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 20007
Herndon Station 32814
621 Commonwealth Avenue
Orlando
Tel: (305) 841-3970
TWX: 810-850-0113

GEORGIA
P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

ILLINOIS
5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA
3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA
P.O. Box 856
1942 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
24315 Northwestern Highway
Southfield 48075
Tel: (313) 353-9100
TWX: 810-224-4882

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

2812 South Brentwood Blvd.
St. Louis 63144
Tel: (314) 962-5000
TWX: 910-760-1670

NEW JERSEY
W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

1060 N. Kings Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

NEW MEXICO
P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2485
TWX: 910-983-0550

NEW YORK
1702 Central Avenue
Albany 12205
Tel: (518) 869-8462
TWX: 710-441-8270

1219 Campville Road
Endicott 13760
Tel: (607) 754-0050
TWX: 510-252-0890

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

1025 Northern Boulevard
Roslyn, Long Island 11576
Tel: (516) 869-8400
TWX: 510-223-0811

5858 East Molloy Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

NORTH CAROLINA
P.O. Box 5188
1923 North Main Street
High Point 27262
Tel: (919) 885-8101
TWX: 510-926-1516

OHIO
25575 Center Ridge Road
Cleveland 44145
Tel: (216) 835-0300
TWX: 810-427-9129

3460 South Dixie Drive
Dayton 45439
Tel: (513) 298-0351
TWX: 810-459-1925

1120 Morse Road
Columbus 43229
Tel: (614) 846-1300

OKLAHOMA
2919 United Founders Boulevard
Oklahoma City 73112
Tel: (405) 848-2801
TWX: 910-830-6862

OREGON
Westhills Mall, Suite 158
4475 S.W. Scholls Ferry Road
Portland 97225
Tel: (503) 292-9171
TWX: 910-464-6103

PENNSYLVANIA
2500 Moss Side Boulevard
Monroeville 15146
Tel: (412) 271-0724
TWX: 710-797-3650

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

RHODE ISLAND
873 Waterman Ave.
East Providence 02914
Tel: (401) 434-5535
TWX: 710-381-7573

TEXAS
P.O. Box 1270
201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101
TWX: 910-867-4723

P.O. Box 22813
6300 Westpark Drive
Suite 100
Houston 77027
Tel: (713) 781-6000
TWX: 910-881-2645

231 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH
2890 South Main Street
Salt Lake City 84115
Tel: (801) 487-0715
TWX: 910-925-5681

VERMONT
P.O. Box 2287
Kennedy Drive
South Burlington 05401
Tel: (802) 658-4455
TWX: 510-299-0025

VIRGINIA
P.O. Box 6514
2111 Spencer Road
Richmond 23230
Tel: (703) 285-3431
TWX: 710-956-0157

WASHINGTON
433-108th N.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2303

***WEST VIRGINIA**
Charleston
Tel: (304) 768-1232

FOR U.S. AREAS NOT LISTED:
Contact the regional office nearest you: Atlanta, Georgia . . . North Hollywood, California . . . Paramus, New Jersey . . . Skokie, Illinois. Their complete addresses are listed above.

*Service Only

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11745 Jasper Ave.
Edmonton
Tel: (403) 482-5561
TWX: 610-831-2431

BRITISH COLUMBIA
Hewlett-Packard (Canada) Ltd.
4519 Canada Way
North Burnaby 2
Tel: (604) 433-8213
TWX: 610-922-5059

MANITOBA
Hewlett-Packard (Canada) Ltd.
511 Bradford Ct.
St. James
Tel: (204) 786-7581
TWX: 610-671-3531

NOVA SCOTIA
Hewlett-Packard (Canada) Ltd.
2745 Dutch Village Rd.
Suite 203
Halifax
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO
Hewlett-Packard (Canada) Ltd.
880 Lady Ellen Place
Ottawa 3
Tel: (613) 722-4223
TWX: 610-562-1952

Hewlett-Packard (Canada) Ltd.
50 Galaxy Blvd.
Rexdale
Tel: (416) 677-9611
TWX: 610-492-4246

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20607

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Pointe Claire, at the complete address listed above.

CENTRAL AND SOUTH AMERICA

ARGENTINA
Hewlett-Packard Argentina S.A.C.e.I
Lavalle 1171 - 3°
Buenos Aires
Tel: 35-0436, 35-0627, 35-0431
Telex: 012-1009
Cable: HEWPACKARG

BRAZIL
Hewlett-Packard Do Brasil I.e.C Ltda.
Rua Frei Caneca 1119
Sao Paulo - 3, SP
Tel: 288-7111, 287-5858
Cable: HEWPACK Sao Paulo

Hewlett-Packard Do Brasil
Praca Dom Feliciano 78, 8° andar salas 806/808
Porto Alegre
Rio Grande do Sul (RS)-Brasil

Hewlett-Packard Do Brasil I.e.C. Ltda.
Rua da Matriz 29
Botafogo ZC-02
Rio de Janeiro, GB
Tel: 246-4417
Cable: HEWPACK Rio de Janeiro

Hewlett-Packard Do Brasil Indústria e Comercia Ltda.
Praca Dom Feliciano 78
Salas 806-8
Porto Alegre RGS

CHILE
Héctor Calcagni y Cia, Ltda.
Bustos, 1932-3er Piso
Casilla 13942
Santiago
Tel: 4-2396
Cable: Calcagni Santiago

COLOMBIA
Instrumentacion
Henrik A. Langebaek & Kier Ltda.
Carrera 7 No. 48-59
Apartado Aereo 6287
Bogota, 1 D.E.
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogota
Telex: 044-400

COSTA RICA
Lic. Alfredo Gallegos Gurdián
Apartado 3243
San José
Tel: 21-86-13
Cable: GALGUR San José

ECUADOR
Laboratorios de Radio-Ingenieria
Calle Guayaquil 1246
Post Office Box 3199
Quito
Tel: 12496
Cable: HORVATH Quito

EL SALVADOR
Electrónica
Apartado Postal 1589
27 Avenida Norte 1133
San Salvador
Tel: 25-74-50
Cable: ELECTRONICA
San Salvador

MEXICO
Hewlett-Packard Mexicana, S.A. de C.V.
Moras 439
Col. del Valle
Mexico 12, D.F.
Tel: 575-46-49, 575-80-20, 575-80-30

NICARAGUA
Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 3451, 3452
Cable: ROTERAN Managua

PANAMA
Electrónico Balboa, S.A.
P.O. Box 4929
Ave. Manuel Espinosa No. 13-50
Bldg. Alina
Panama City
Tel: 230833
Telex: 3481003, Curundu, Canal Zone
Cable: ELECTRON Panama City

PERU
Compañia Electro Medica S.A.
Ave. Enrique Canaual 312
San Isidro
Casilla 1030
Lima
Tel: 22-3900
Cable: ELMED Lima

PUERTO RICO
San Juan Electronics, Inc.
P.O. Box 5167
Ponce de Leon 154
Pda. 3-Pta. de Tierra
San Juan 00906
Tel: (809) 725-3342, 722-3342
Cable: SATRONICS San Juan
Telex: SATRON 3450 332

SURINAME
Surtel-Radio Holland N.V.
P.O. Box 155
Paramaribo

URUGUAY
Pablo Ferrando S.A.
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Cable: RADIUM Montevideo

VENEZUELA
Hewlett-Packard De Venezuela C.A.
Apartado 50933
Caracas
Tel: 71.88.05, 71.88.69, 71.99.30
71.88.76, 71.82.05
Cable: HEWPACK Caracas

FOR AREAS NOT LISTED, CONTACT:
Hewlett-Packard
INTERCONTINENTAL
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 493-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8461

EUROPE

AUSTRIA
Unilabor GmbH
Wissenschaftliche Instrumente
Rummelhardtgasse 6
P.O. Box 33
A-1095 **Vienna**
Tel: (222) 42 61 81, 43 13 94
Cable: LABORINSTRUMENT Vienna
Telex: 75 762

BELGIUM
Hewlett-Packard S.A. Benelux
348 Boulevard du Souverain
1160 **Brussels**
Tel: 72 22 40
Cable: PALOBEN Brussels
Telex: 23 494

DENMARK
Hewlett-Packard A/S
Datavej 38
DK-3460 **Birkerød**
Tel: (01) 81 66 40
Cable: HEWPACK AS
Telex: 66 40

Hewlett-Packard A/S
Torvet 9
DK-8600 **Silkeborg**
Tel: (06) 827-840

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P.O. Box 12185
Helsinki 12
Tel: 13-730
Cable: HEWPACKOY-Helsinki
Telex: 12-1563

FRANCE
Hewlett-Packard France
Quartier de Courtaboeuf
Boîte Postale No. 6
91 Orsay
Tel: 1-920 88 01
Cable: HEWPACK Orsay
Telex: 60048

Hewlett-Packard France
4 Quai des Etroits
69 **Lyon** 5ème
Tel: 78 42 63 45
Cable: HEWPACK Lyon
Telex: 31617

Hewlett-Packard France
29 rue de la Gare
F-31 **Blagnac**
Tel: (61) 85 82 29
Telex: 51957

GERMANY
Hewlett-Packard Vertriebs-GmbH
Berliner Strasse 117
Postfach 560/40
D6 Nieder-Eschbach/Ffm 56
Tel: (0611) 50 10 64
Cable: HEWPACKSA Frankfurt
Telex: 41 32 49 FRA

Hewlett-Packard Vertriebs-GmbH
Wilmersdorfer Strasse 113/114
D-1000 **Berlin W.** 12
Tel: (0311) 3137046
Telex: 18 34 05

Hewlett-Packard Vertriebs-GmbH
Herrenbergerstrasse 110
D7030 **Böblingen**, Württemberg
Tel: 07031-6671
Cable: HEPAG Böblingen
Telex: 72 65 739

Hewlett-Packard Vertriebs-GmbH
Vogelsanger Weg 38
D4 **Düsseldorf**
Tel: (0211 63 80 31/35
Telex: 85/86 533

Hewlett-Packard Vertriebs-GmbH
Wendenstr. 23
D2 **Hamburg** 1
Tel: (0411) 24 05 51/52
Cable: HEWPACKSA Hamburg
Telex: 21 53 32

Hewlett-Packard Vertriebs-GmbH
Reginfriedstrasse 13
D8 **München** 9
Tel: (0811) 69 59 71/75
Cable: HEWPACKSA München
Telex: 52 49 85

GREECE
Kostas Karayannis
18, Ermou Street
Athens 126
Tel: 230301,3,5
Cable: RAKAR Athens
Telex: 21 59 62 RKAR GR

IRELAND
Hewlett-Packard Ltd.
224 Bath Road
Slough, Bucks, England
Tel: Slough 753-33341
Cable: HEWPIE Slough
Telex: 84413

ITALY
Hewlett-Packard Italiana S.p.A.
Via Amerigo Vespucci 2
20124 **Milano**
Tel: (2) 6251 (10 lines)
Cable: HEWPACKIT Milan
Telex: 32046

Hewlett-Packard Italiana S.p.A.
Palazzo Italia
Piazza Marconi 25
00144 **Rome** - Eur
Tel: 6-591 2544
Cable: HEWPACKIT Rome
Telex: 61514

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
Amsterdam, Z 11
Tel: 020-42 77 77
Cable: PALOBEN Amsterdam
Telex: 13 216

NORWAY
Hewlett-Packard Norge A/S
Box 149
Nesveien 13
N-1344 **Haslum**
Tel: 2-53 83 60
Cable: HEWPACK Oslo
Telex: 16621

PORTUGAL
Telectra
Empresa Tecnica de Equipamentos
Electricos, S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
Lisbon 1
Tel: 68 60 72
Cable: TELECTRA Lisbon
Telex: 1598

SPAIN
Ataio Ingenieros SA
Enrique Larreta 12
Madrid, 16
Tel: 215 35 43
Cable: TELEATAIO Madrid
Telex: 27249E

Ataio Ingenieros SA
Ganduxer 76
Barcelona 6
Tel: 211-44-66
Cable: TELEATAIO BARCELONA

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 1-3
Fack
S-161 20 **Bromma** 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS Stockholm
Telex: 10721

Hewlett-Packard Sverige AB
Hagakersgatan 9C
Box 4028
S 431 04 **Mölndal** 4
Tel: 031 - 27 68 00
Telex: 21 312 hpmindl

SWITZERLAND
Hewlett Packard Schweiz AG
Zurcherstrasse 20
CH-8952 **Schlieren** Zurich
Tel: (051) 98 18 21/24
Cable: HPAG CH
Telex: 53933

Hewlett Packard Schweiz A.G.
Rue du Bois-du-Lan 7
1217 Meyrin 2 **Geneva**
Tel: (022) 41 54 00
Cable: HEWPACKSA Geneva
Telex: 2 24 86

TURKEY
Telekom Engineering Bureau
P.O. Box 376
Karakoy
Istanbul
Tel: 49 40 40
Cable: TELEMATION Istanbul

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
Slough, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413

Hewlett-Packard Ltd.
The Graftons
Stamford New Road
Altrincham, Cheshire
Tel: 061 928-8626
Telex: 668068

YUGOSLAVIA
Belram S.A.
83 avenue des Mimosas
Brussels 1150, Belgium
Tel: 34 33 32, 34 26 19
Cable: BELRAMEL Brussels
Telex: 21790

SOCIALIST COUNTRIES PLEASE CONTACT:
Correspondence Office for Eastern Europe
Innstrasse 23/2
Postfach
A1204 **Vienna**, Austria
Tel: (222) 3366 06/09
Cable: HEWPACK Vienna
Telex: 75923

ALL OTHER EUROPEAN COUNTRIES CONTACT:
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
1217 Meyrin 2 **Geneva**
Switzerland
Tel: (022) 41 54 00
Cable: HEWPACKSA Geneva
Telex: 2.24.86

AFRICA, ASIA, AUSTRALIA

ANGOLA
Telectra Empresa Técnia de Equipamentos Eléctricos SAR
Rua de Barbosa Rodrigues 42-1°
Box 6487
Luanda
Cable: TELECTRA Luanda

AUSTRALIA
Hewlett-Packard Australia Pty. Ltd.
22-26 Weir Street
Glen Iris, 3146
Victoria
Tel: 20.1371 (6 lines)
Cable: HEWPARD Melbourne
Telex: 31024

Hewlett-Packard Australia Pty. Ltd.
61 Alexander Street
Crows Nest 2065
New South Wales
Tel: 43.7866
Cable: HEWPARD Sydney
Telex: 21561

Hewlett-Packard Australia Pty. Ltd.
97 Churchill Road
Prospect 5082
South Australia
Tel: 65.2366
Cable: HEWPARD Adelaide

Hewlett Packard Australia Pty. Ltd.
2nd Floor, Suite 13
Casablanca Buildings
196 Adelaide Terrace
Perth, W.A. 6000
Tel: 21-3330
Cable: HEWPARD Perth

Hewlett-Packard Australia Pty. Ltd.
10 Woolley Street
P.O. Box 191
Dickson A.C.T. 2602
Tel: 49-8194
Cable: HEWPARD Canberra ACT

Hewlett-Packard Australia Pty. Ltd.
75 Simpsons Road
Bardon
Queensland, 4068
Tel: 36-5411

CEYLON
United Electricals Ltd.
P.O. Box 681
Yahala Building
Staples Street
Colombo 2
Tel: 5496
Cable: HOTPOINT Colombo

CYPRUS
Kypronics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
Nicosia
Tel: 6282-75628
Cable: HE-I-NAMI

ETHIOPIA
African Salespower & Agency Private Ltd., Co.
P. O. Box 718
58/59 Cunningham St.
Addis Ababa
Tel: 12285
Cable: ASACO Addisababa

HONG KONG
Schmidt & Co. (Hong Kong) Ltd.
P.O. Box 297
1511, Prince's Building 15th Floor
10, Chater Road
Hong Kong
Tel: 240168, 232735
Cable: SCHMIDTCO Hong Kong

INDIA
Blue Star Ltd.
Kasturi Buildings
Jamshedji Tata Rd.
Bombay 20BR, India
Tel: 29 50 21
Telex: 2156
Cable: BLUEFROST

Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 25DD, India
Tel: 45 73 01
Telex: 2156
Cable: BLUESTAR

Blue Star Ltd.
14/40 Civil Lines
Kanpur, India
Tel: 6 88 82
Cable: BLUESTAR

Blue Star, Ltd.
7 Hare Street
P.O. Box 506
Calcutta 1, India
Tel: 23-0131
Telex: 655
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House,
34 Ring Road
Lajpat Nagar
New Delhi 24, India
Tel: 62 32 76
Telex: 463
Cable: BLUESTAR

Blue Star Ltd.
17-C Ulsoor Road
Bangalore-8

Blue Star, Ltd.
96 Park Lane
Secunderabad 3, India
Tel: 7 63 91
Cable: BLUEFROST

Blue Star, Ltd.
23/24 Second Line Beach
Madras 1, India
Tel: 2 39 55
Telex: 379
Cable: BLUESTAR

Blue Star, Ltd.
1B Kaiser Bungalow
Dindli Road
Jamshedpur, India
Tel: 38 04
Cable: BLUESTAR

INDONESIA
Bah Bolon Trading Coy. N.V.
Djalah Merdeka 29
Bandung
Tel: 4915 51560
Cable: ILMU
Telex: 809

IRAN
Telecom, Ltd.
P. O. Box 1812
240 Kh. Saba Shomali
Teheran
Tel: 43850, 48111
Cable: BASCOM Teheran

ISRAEL
Electronics & Engineering Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 38941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: Bastel Tv 033-569

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
59 Yoyogi 1-chrome
Shibuya-ku, Tokyo
Tel: 03-370-2281/7
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724

Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: 23-1641
Telex: 385-5332 YHPOSAKA

Yokogawa-Hewlett-Packard Ltd.
Ito Building
No. 59, Kotori-cho
Nakamura-ku, Nagoya City
Tel: 551-0215

Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2300 Shinohara-cho,
Kohoku-ku
Yokohama 222
Tel: (405) 432-1504/5

KOREA
American Trading Co., Korea, Ltd.
Seoul P.O. Box 1103
7th & 8th floors, DaeKyung Bldg.
107 Sejong Ro
Chongro-Ku, Seoul
Tel: 75-5841 (4 lines)
Cable: AMTRACO Seoul

LEBANON
Constantin E. Macridis
Clemenceau Street
P.O. Box 7213
Beirut
Tel: 220846
Cable: ELECTRONUCLEAR Beirut

MALAYSIA
MECOMB Malaysia Ltd.
2 Lorong 13/6A
Section 13
Petaling Jaya, Selangor
Cable: MECOMB Kuala Lumpur

MOZAMBIQUE
A. N. Goncalves, LDA.
4.I Apt. 14 Av. D. Luis
P.O. Box 107
Lourenco Marques
Cable: NEGON

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
32-34 Kent Terrace
P.O. Box 9443
Wellington, N.Z.
Tel: 56-559
Cable: HEWPACK Wellington

Hewlett Packard (N.Z.) Ltd.
Box 51092
Pukuranga
Tel: 573-733

PAKISTAN (EAST)
Mushko & Company, Ltd.
Zirat Chambers
31, Jinnah Avenue
Dacca
Tel: 280058
Cable: NEWDEAL Dacca

PAKISTAN (WEST)
Mushko & Company, Ltd.
Oosman Chambers
Victoria Road
Karachi 3
Tel: 511027, 512927
Cable: COOPERATOR Karachi

PHILIPPINES
Electromex Inc.
Makati Commercial Center
2129 Pasong Tamo
Makati, Rizal D 708
P.O. Box 1028
Manila
Tel: 89-85-01
Cable: ELEMEX Manila

SINGAPORE
Mechanical and Combustion Engineering Company Ltd.
9, Jalan Kilang
Red Hill Industrial Estate
Singapore, 3
Tel: 642361-3
Cable: MECOMB Singapore

SOUTH AFRICA
Hewlett Packard South Africa (Pty.), Ltd.
P.O. Box 31716
Braamfontein Transvaal
Milnerton
30 De Beer Street
Johannesburg
Tel: 725-2080, 725-2030
Telex: 0226 JH
Cable: HEWPACK Johannesburg

Hewlett Packard South Africa (Pty.), Ltd.
Breecastle House
Bree Street
Cape Town
Tel: 3-6019, 3-6545
Cable: HEWPACK Cape Town
Telex: 5-0006

Hewlett Packard South Africa (Pty.), Ltd.
308 Glenwood Centre
Corner Hunt & Moore Roads
P.O. Box 99
Overport, Natal
Tel: 347536

TAIWAN REP. OF CHINA
Hewlett Packard Taiwan
39 Chung Shiao West
Sec. 1
Overseas Insurance
Corp. Bldg. 7th Floor
Taipei
Tel: 579-605, 579-610, 579-613
Telex: c/o Bankamerica TP 339
Cable: HEWPACK Taipei

THAILAND
The International Engineering Co., Ltd.
P. O. Box 39
614 Sukhumvit Road
Bangkok
Tel: 910722 (7 lines)
Cable: GYSOM
TLX INTENCO BK-226 Bangkok

VIETNAM
Peninsular Trading Inc.
P.O. Box H-3
216 Hien-Vuong
Saigon
Tel: 20805, 93398
Cable: PENTRA, SAIGON 242

ZAMBIA
R. J. Tilbury (Zambia) Ltd.
P.O. Box 2792
Lusaka
Zambia, Central Africa

MEDITERRANEAN AND MIDDLE EAST COUNTRIES NOT SHOWN PLEASE CONTACT:
Hewlett-Packard Correspondence Office
Piazza Marconi 25
I-00144 Rome-Eur, Italy
Tel: (6) 59 40 29
Cable: HEWPACKIT Rome
Telex: 61514

Hewlett-Packard Far East Area Office
P.O. Box 87
Alexandra Post Office
Singapore 3
Tel: 633022
Cable: HEWPACK SINGAPORE

OTHER AREAS NOT LISTED, CONTACT:
Hewlett-Packard INTERCONTINENTAL
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 326-7000
(Feb. 71 493-1501)
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8461