HEWLETT-PACKARD
9870A CARD READER

OPERATING MANUAL

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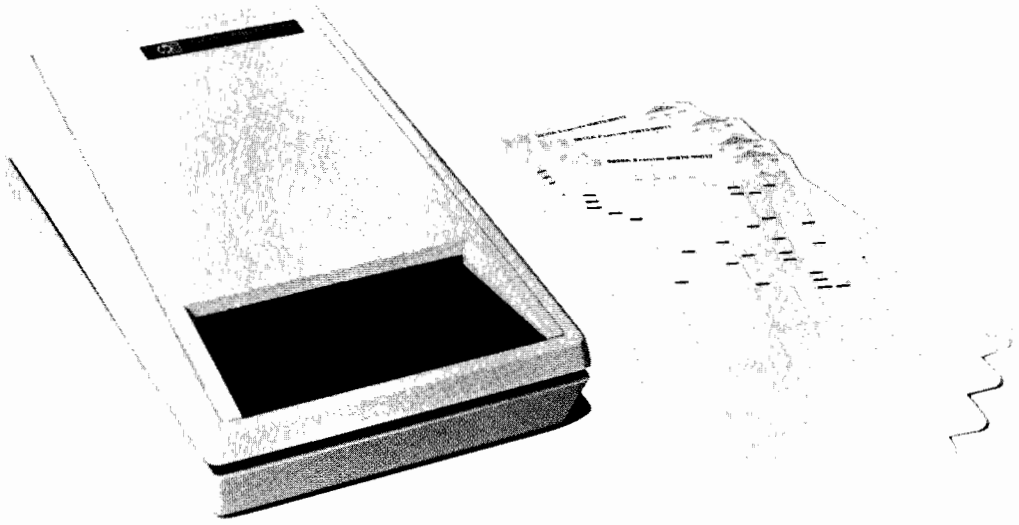

HEWLETT–PACKARD CALCULATOR PRODUCTS DIVISION
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(For World-wide Sales and Service Offices see rear of manual.)

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SPECIFICATIONS

Dimensions:
5.08 cm (2 inches) high by 10.8 cm (4¼ inches) wide by 19 cm (7½ inches) deep.

Weight:
Approximately 345 gm (12 oz.) – Card Reader only
Shipping: 1.36 kg (3 lbs.) – including Interface Cable

Power:
Power of 0.5 w is supplied from the calculator.

Temperature:
0°C to +40°C operating range
–40°C to +75°C storage range

Cards:
Reads cards whose dimensions and specifications conform to American National Standards Institute. Cards are specially printed with proper formats and are available; contact the nearest -hp- Sales and Service Office.

Card Length:
18.73 cm (7 3/8 inches) to 27.94 cm (11 inches)

Speed:
Cards 18.73 cm (7 3/8 inches) long containing 35 columns can be read in less than two seconds.

Chapter 1

GENERAL INFORMATION

The Model 9870A Card Reader provides the convenience of quickly entering data and programs encoded on cards into your 9810A, 9820A, 9821A or 9830A Calculator.

EQUIPMENT SUPPLIED

The equipment supplied with the Model 9870A Option 10, Option 20 or Option 30 is listed in Table 1.

Part No.	Qty.	Description
09870-90000	1	Operating Manual
See Table 2	1	Diagnostic card
9320-0595	50	Data card

Table 1. Equipment Supplied

Data cards may also be ordered in quantities of 2000 by ordering -hp- Part Number 9320-0595.

SERVICE CONTRACTS

Service contracts are available for the card reader. For further information, contact your local -hp- Sales and Service Office (addresses are provided at the back of this manual).

INITIAL INSPECTION

The card reader was carefully inspected, both mechanically and electrically, before shipment. It should be free of scratches and in perfect electrical order upon receipt. Carefully inspect the card reader for physical damage caused in transit and check for the accessories listed in Table 1. After installation, check the electrical performance as described in Electrical Inspection.

INSTALLATION

The Model Selector switch on the card reader I/O card should be positioned to indicate the calculator model being used. Figure 1 shows the switch positions.

Switch the calculator OFF and connect the card reader I/O card to the rear of the calculator. The I/O card is keyed and cannot be inserted incorrectly. It may be inserted into any one of the four I/O slots at the back of the calculator.

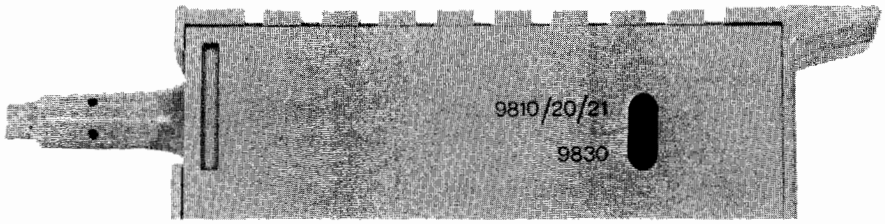


Figure 1. The Model Selector Switch

Switch the calculator ON. The card reader has no power switch; it receives its power from the calculator.

Extend the card holder (Figure 2), to hold the cards as they are read.

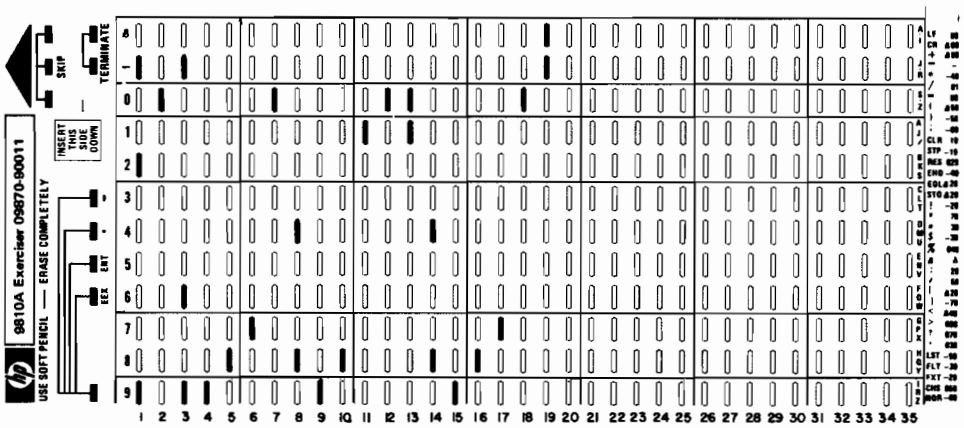
ELECTRICAL INSPECTION

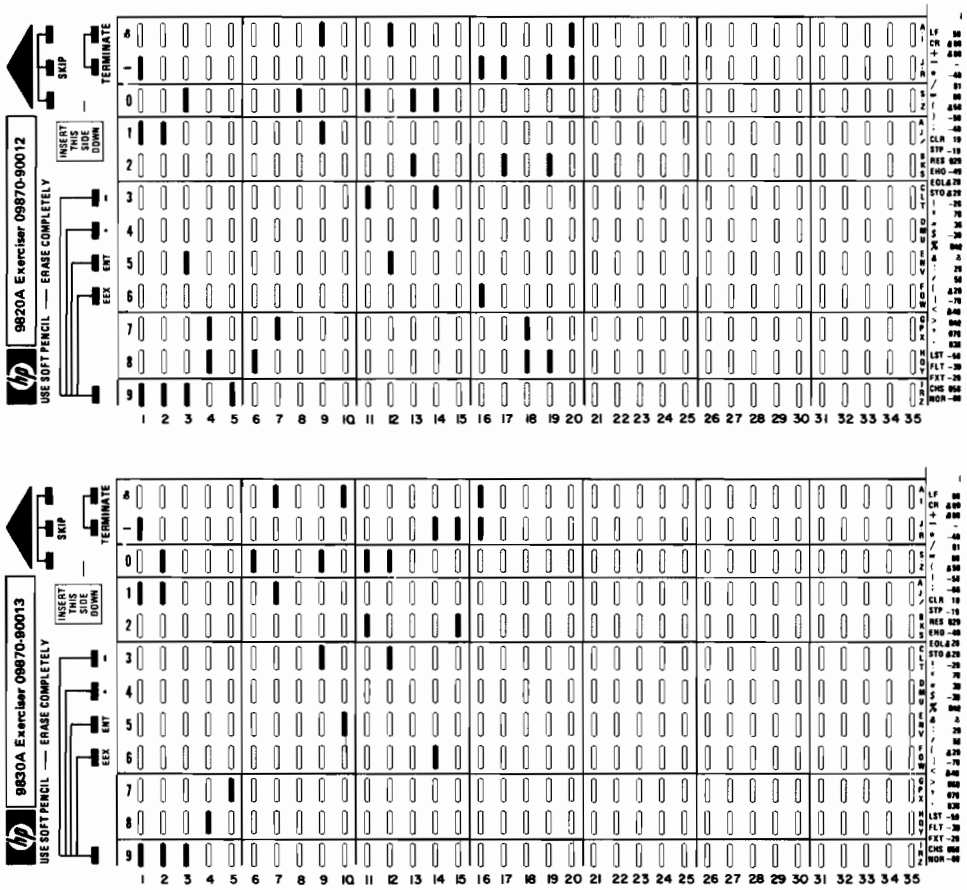
A printed exerciser card is shipped with the card reader. This card allows you to check your card reader for proper electrical and mechanical operation with your 9800 Series Calculator. Table 2 lists the exerciser cards and the appropriate calculator model(s) each card is used with.

9810A Exerciser	-hp- Part No. 09870-90011
9820A, 9821A Exerciser	-hp- Part No. 09870-90012
9830A Exerciser	-hp- Part No. 09870-90013

Table 2. The Exerciser Cards

The exerciser cards are shown below.





The following explains how to check the card reader with each calculator. First, verify operation of the calculator by running its exerciser program; instructions are contained in the appropriate calculator operating and programming manual.

If the card reader fails to operate correctly, carefully repeat the procedure. If the instrument still does not operate properly, contact the nearest -hp- Sales and Service Office for assistance (see the back of this manual).

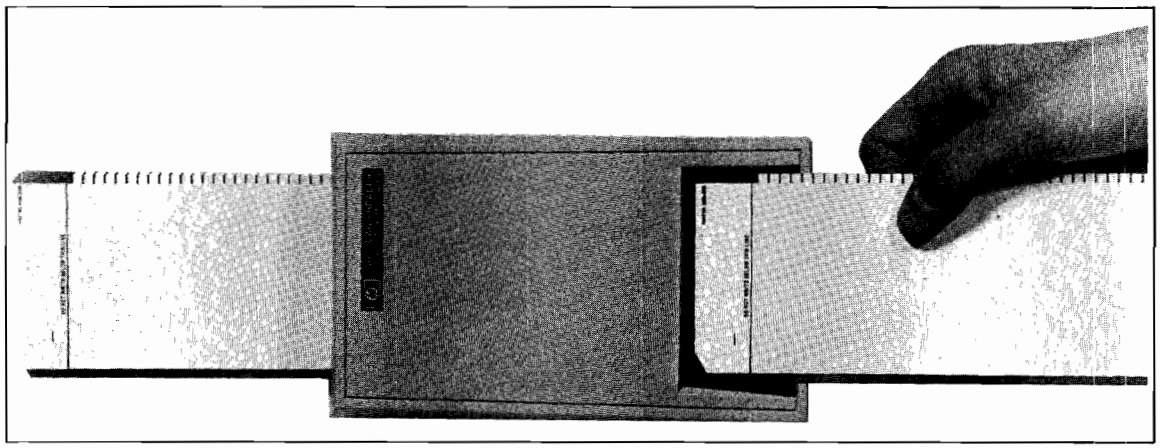
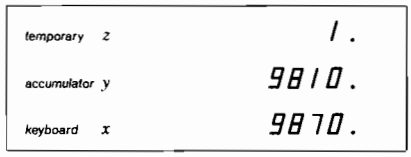


Figure 2. Inserting a Card

ELECTRICAL INSPECTION
(continued)

MODEL 9810 CALCULATOR

Ensure that the calculator is not in KEYLOG mode (KEYLOG light off). Next, press STOP and insert the exerciser card into the card reader, coded-side down, as shown in Figure 2. Correct card reader operation is indicated by the display shown below.



MODEL 9820 AND MODEL 9821 CALCULATORS

Ensure that the calculator is not in the TRACE mode. Insert the exerciser card coded-side down as shown in Figure 2. Correct card reader operation is indicated by the display shown below.

MODEL 9830 CALCULATOR

Ensure that the calculator is not in the TRACE mode. Insert the exerciser card coded-side down as shown in Figure 2. Correct card reader operation is indicated by the display shown below.

HOW CARDS ARE READ

When a card is inserted into the 9870A it will be drawn through the instrument by the card reader motor. The card is read, one column at a time, as it moves through the reader. Phototransistors sense the amount of infrared light transmitted through the card. A mark or punch on the card will cause the amount of light sensed to change and be interpreted as data. A strobe mark between each column enables the calculator to accept the preceding column of information, and then resets the card reader circuits to read the next column of information.

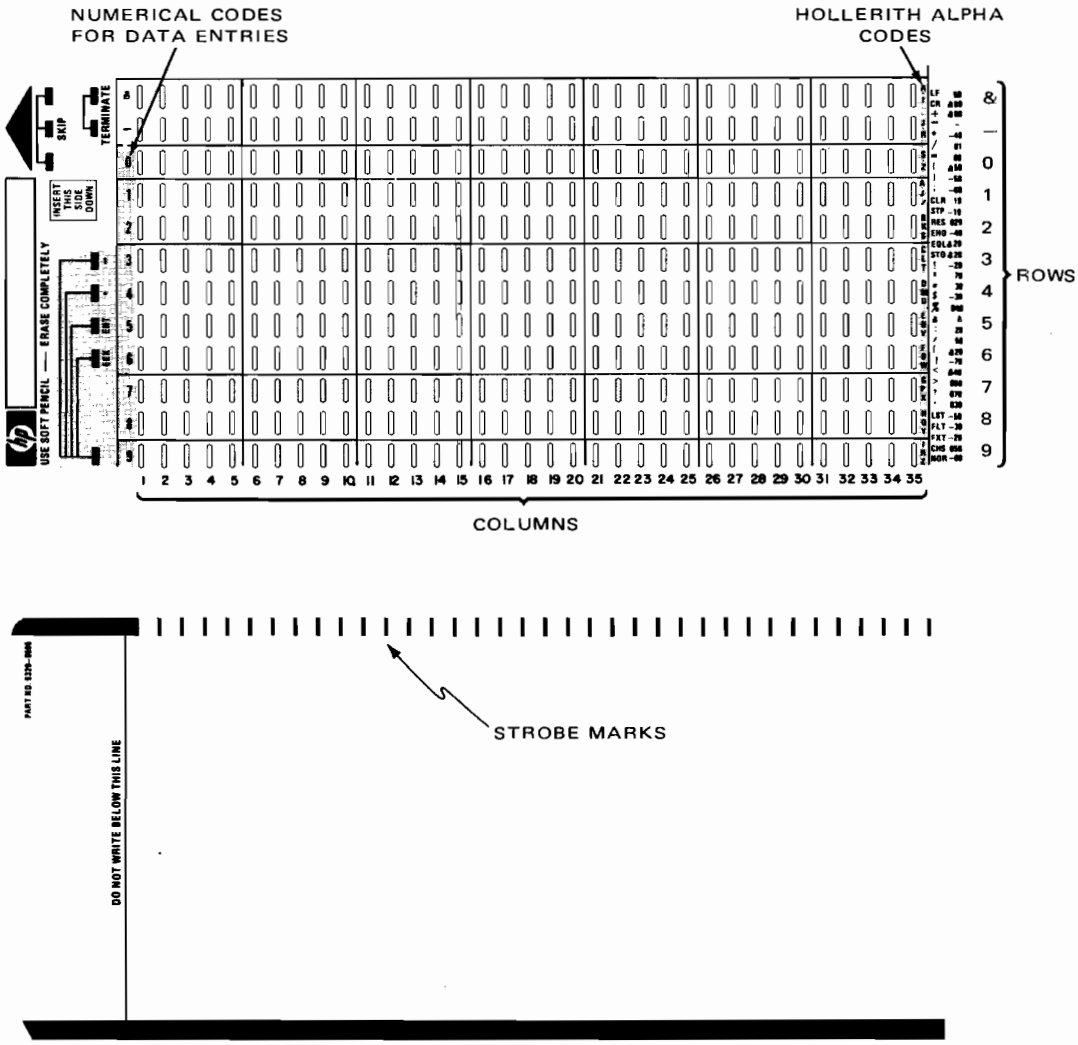


Figure 3. The Model 70 Card (Front and Back)

NOTE
Cards are inserted into the card reader coded-side down.

CODING THE MODEL 70 CARD

The Model 70 card may be either hand-marked or keypunched. When marking a card, always use a blunt, soft-graphite pencil. The card reader will sense marks as small as .025 inches wide (e.g., a single line drawn through a box with a blunt pencil will be read). It is recommended, however, that the box be completely filled when marking the card. Be sure that the line extends completely through the box (i.e., ▮). If you wish to mark two or more adjacent boxes in the same column, one continuous line may be drawn through the boxes . Marks should not be made with felt-tip pens because they might not be sensed, or they might be sensed improperly.

NOTE

When keypunching cards, punches must be offset slightly to the left of the column boxes (i.e., ▮).

The Model 70 card is marked in a Hollerith code. Most of the calculator keyboard keys have a corresponding Hollerith code. The codes for A-Z and 0-9 are standard Hollerith Code; they are indicated on the Model 70 card, and in Figure 4. See the operating section which describes operation with your particular calculator for keycodes not described here.

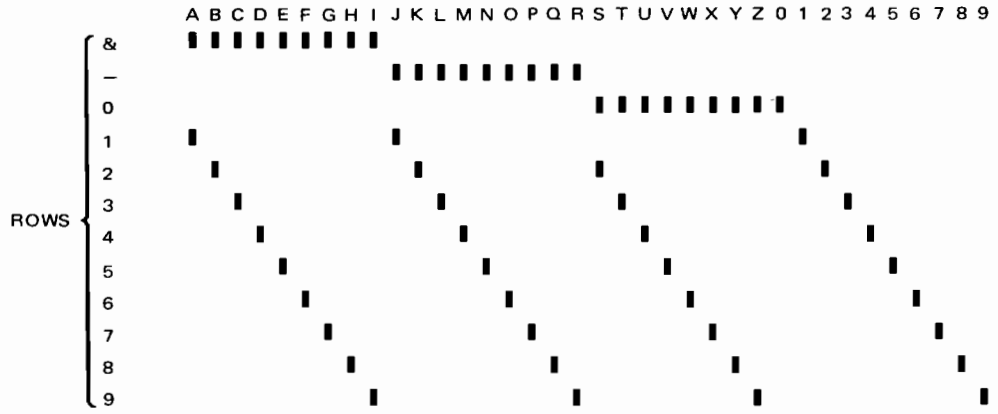


Figure 4. The Hollerith Code

Codes for *enter exponent, enter, decimal point, minus, skip and terminate* are indicated on the Model 70 card. A skip code marked in any column will cause the card reader to ignore any boxes that are marked in that column. Marking a skip code may be used as an alternative to erasing should you make an error. Marking the skip code to correct errors is useful when keypunching cards.

A terminate code marked in any column will cause the card reader to stop reading the card. This code should be marked in the column immediately following the last entry.

MODES OF OPERATION

The card reader may be operated in either the Interrupt mode, or the Data Demand mode.

INTERRUPT MODE:

In the Interrupt mode, the card reader acts like a remote keyboard. Program steps and data are coded on cards in the same sequence as if entered from the keyboard. When a card is inserted into the reader, the card reader motor starts, and the program steps or data are entered into the calculator.

Program Steps: cards are coded with appropriate Hollerith assigned keycodes. The program instructions on the card are loaded into successive calculator memory locations.

Data: cards are coded one digit per column. The data is entered into the calculator by using the appropriate 'enter' code after each item.

DATA DEMAND MODE:

This mode of operation requires either a Peripheral Control or Extended I/O plug-in block installed in the calculator. The calculator starts the card reader motor when data is required. Cards coded with one digit per column may then be inserted. A delimiter (e.g., line feed, carriage return) must be coded at the end of a data entry to signal the calculator that the entry is terminated.

The following sections of this manual describe the card reader operation with the 9810A, 9820A, 9821A and 9830A Calculators.

NOTES

Chapter 2

MODEL 10 OPERATION

The card reader may be used with the 9810A to load program steps into the calculator memory (the Interrupt Mode), and to enter data items (the Data Demand Mode). The following material is presented assuming that the reader is familiar with the 9810A operation.

INTERRUPT MODE

PROGRAM INPUT

Loading program steps from the card reader is similar to loading program steps from the keyboard. Program steps are encoded on cards in the same sequence as if entered from the keyboard. Then, before a program is loaded, the desired program starting address must be selected, and the calculator must be set to the PROGRAM mode. The program mode may be set from the keyboard, or by marking the program mode code on a card before the program steps.

Refer to Figure 5 for the 9810A keyboard codes when encoding cards .

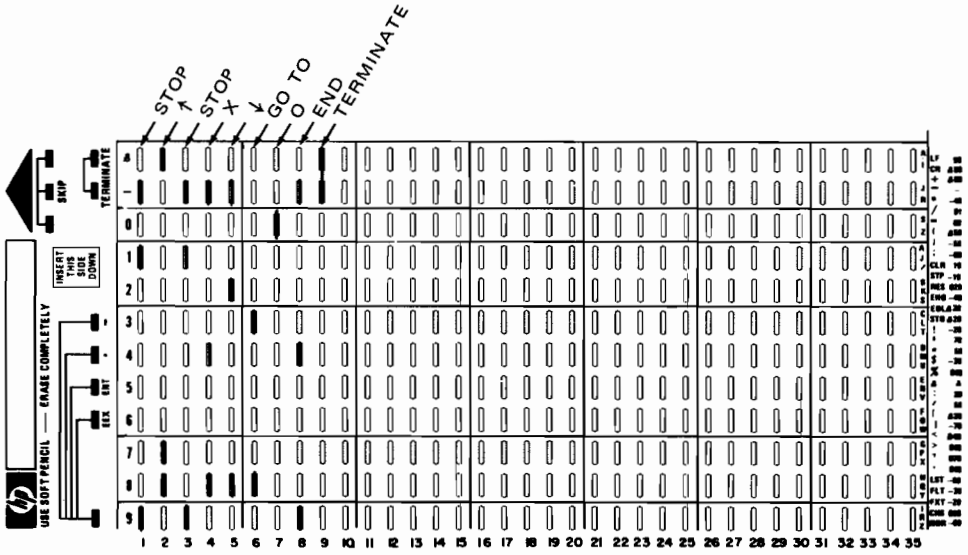
Mark a terminate code after the last program step to prevent any stray marks on the rest of the card from causing erroneous entries.

If a long program is being coded on more than one card, the terminate code should be the last entry on the last card.

Here is an example of using the card reader to load a program.

EXAMPLE

The program, shown below stops twice for a number to be entered, multiplies the two numbers, and then displays the result in the X-register. If you wish to run this program, mark a card as shown in the figure. Set the starting address to 0000, and switch the calculator to the PROGRAM mode.



INTERRUPT MODE
(continued)

After loading the card, the following program will be stored in memory.

```
0000--STP---41
0001--  UP---27
0002--STP---41
0003--  X  ---36
0004--  DN---25
0005--GTO---44
0006--  0  ---00
0007--END---46
```

To run the program, press: RUN, END, CLEAR, CONTINUE (these keys could also have been encoded on the card before the terminate code). Enter a number (press CONTINUE after each number), then enter a second number. The result will be displayed in the X-register.

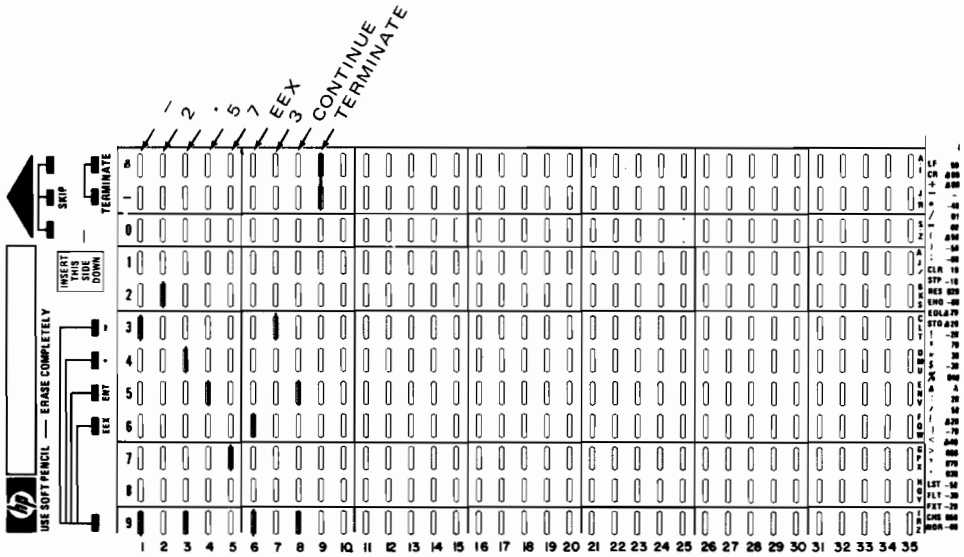
DATA INPUT

To enter data from the card reader, simply encode the data number on a card in the same form as if entered from the keyboard. A data entry must consist of only the digits 0 through 9, and if necessary, minus signs, a decimal point, and an enter exponent code.

From one to three data numbers can be encoded on a card. If more than one number is on a card, they must be separated from each other by an "↑". Mark a CONTINUE and a terminate code on the card following the last data number. This will start the program again after the data on the card has been entered. The program must contain STOPS to halt the program at the points where data is to be entered.

Here is an example of a data entry on a card.

EXAMPLE



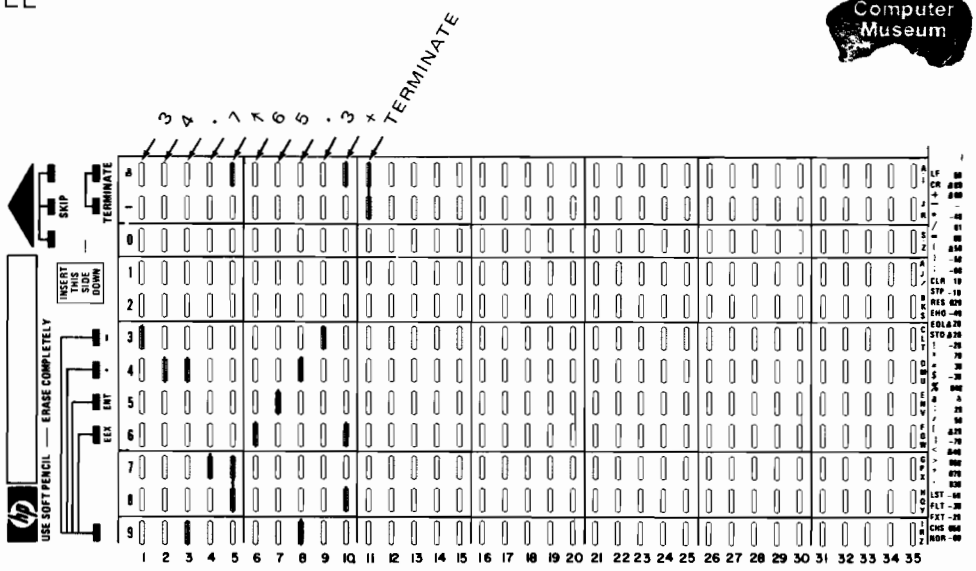
Now, encode two cards with a data entry, and use them to run the example program given in the Program Input presentation. The result should be the product of the two data entries.

KEYBOARD CALCULATIONS

It is possible to do keyboard calculations in the run mode with the card reader, however, precautions must be observed. Any Model 10 instruction which causes immediate activity on the part of the calculator such as LIST and PRINT should be the last code on the card. If other codes follow, some of them may be missed by the calculator while it is executing the earlier instruction. Skips may be encoded to give the calculator extra time to complete the previous operation. This practice is not recommended however, because the number of skips required is often difficult to predict.

Here is an example of a card used to do a calculation in the run mode.

EXAMPLE



The example card simply adds 34.7 and 65.3. The result (100) is displayed in the 'Y' register.

DATA DEMAND MODE

Data may also be entered using the Data Demand mode. To use this mode, either the 11252A or the 11264A Peripheral Control Block must be installed. Using the following syntax, the card reader motor can be started from a program or from the keyboard, and a data entry on a card can be entered.

FMT 3 1 2 · causes the card reader motor to start and allows the entry of data characters (i.e., digits, minus sign, decimal point, and enter exponent).

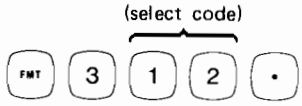
Data entries on the same card must be separated by delimiters such as continue, space, or comma. A comma (038 code) coded between data items will cause the calculator to do an '↑' operation and continue data input. Since each data entry is placed into the x-register, the '↑' will remove it from that register so that the next number can be read from the card. A CONTINUE must be marked after the last data entry to let the calculator know that the data entry is completed.

A terminate code must be the last entry marked on the card.

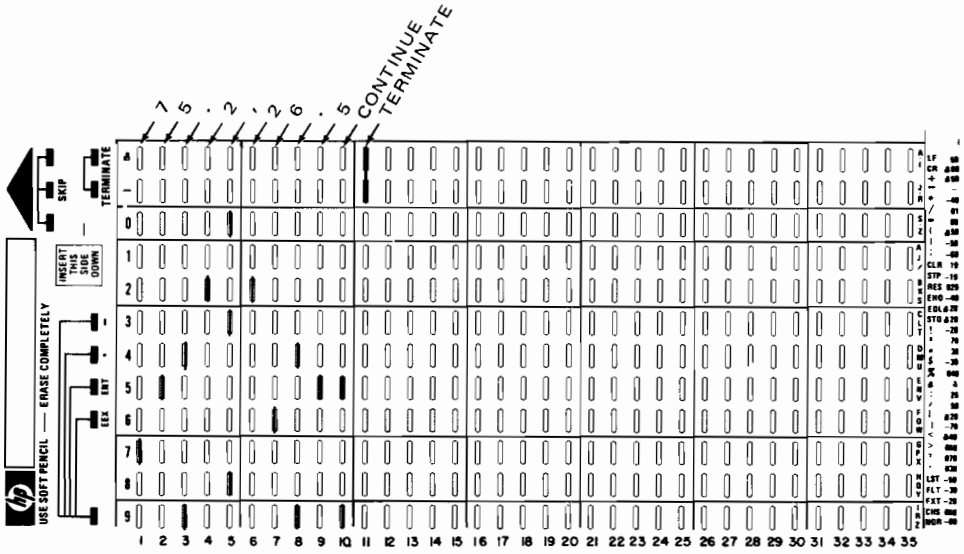
> **NOTE**
>
> The card reader motor must have stopped before another data input sequence is reached in a program. If the card reader motor is still running, the new data input sequence will not be recognized. It may be necessary to include PAUSEs in a program to allow time for the motor to stop before another data input sequence is executed.

Here is an example of a data entry using the Data Demand Mode.

EXAMPLE

To start the card reader motor, press: 

Encode the following information on a card and enter it.



With fixed two notation, the resulting display will be:

For more information about the Peripheral Control Block, refer to your PC Block Operating Manual.

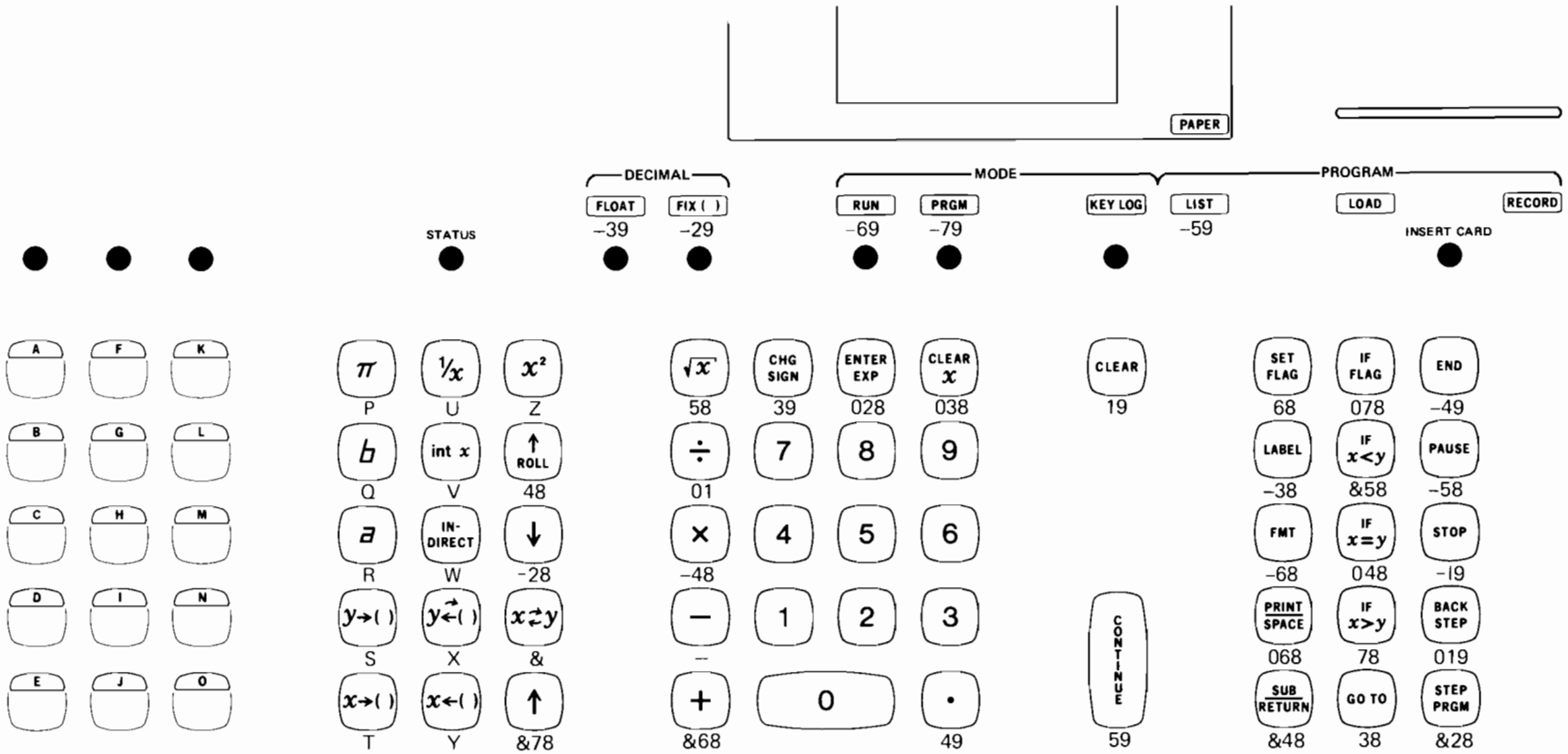


Figure 5. 9810A Keyboard Codes
(shown in color)

Chapter 3

MODEL 20 and 21 OPERATION

The card reader may be used with the 9820A or 9821A Calculators to store programs in the calculator memory or make keyboard calculations (the Interrupt Mode), and to enter data items (the Data Demand Mode).

The following material is presented assuming that the reader is familiar with the 9820A or 9821A operation.

INTERRUPT MODE

PROGRAM INPUT

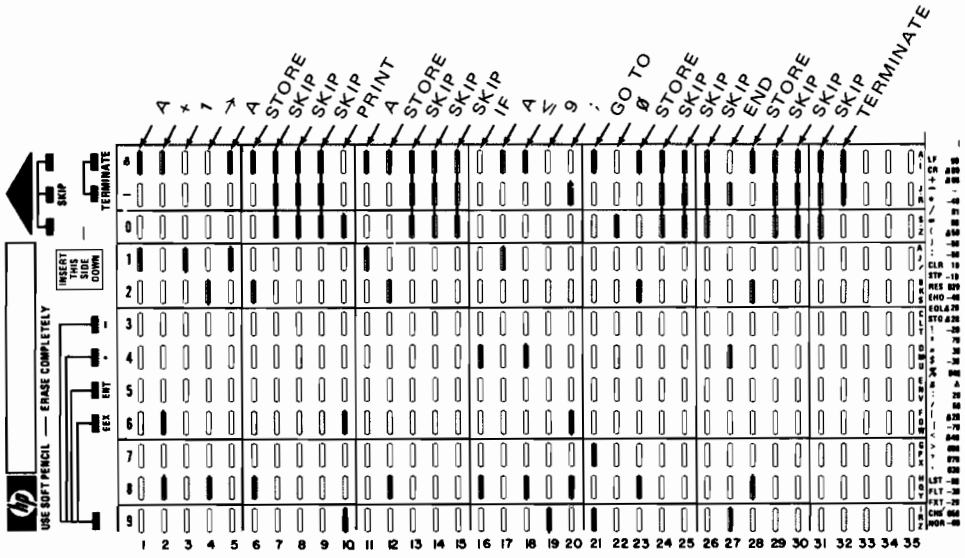
Storing program lines from the card reader is similar to storing program lines from the keyboard. Program lines are encoded on cards in the same sequence as if entered from the keyboard. Be sure to go to the desired starting address before a program is loaded. A STORE code followed by three skip codes must follow each program line coded on a card. The skips are required to allow the calculator time to store the previous program line before the next line is read. The skips are not required if only one program line is encoded per card. A terminate code must be marked after the last entry on a card to prevent any stray marks on the rest of the card from causing erroneous entries.

Refer to Figure 6 and Figure 7 for the 9820A and 9821A keyboard codes when encoding cards.

Here is an example of a program encoded on a card.

EXAMPLE

The card shown below is encoded with a simple counting program. If you wish to run this program, mark a card as shown. Start the program at location 0.



INTERRUPT MODE
(continued)

After loading the card, the following program will be stored in memory.

```
0:
A+1→A⊢
1:
PRT A⊢
2:
IF A≤9;GTO 0⊢
3:
END ⊢
```

To run the program press: (END) (RUN PROGRAM) . These keys could also have been encoded on the card after the last program step.

DATA INPUT

When an ENTER statement is encountered in a program, the data entry may be entered from a card instead of from the keyboard. Simply encode the data number on a card in the same manner as it would be if entered from the keyboard. A data entry must consist of only the digits 0 through 9, and if necessary, minus signs, a decimal point, and an enter exponent code. A RUN PROGRAM and a terminate code should be coded after the data entry. Only one data entry may be encoded on a card in this application. More than one data entry may be encoded on a card if the Data Demand Mode is used.

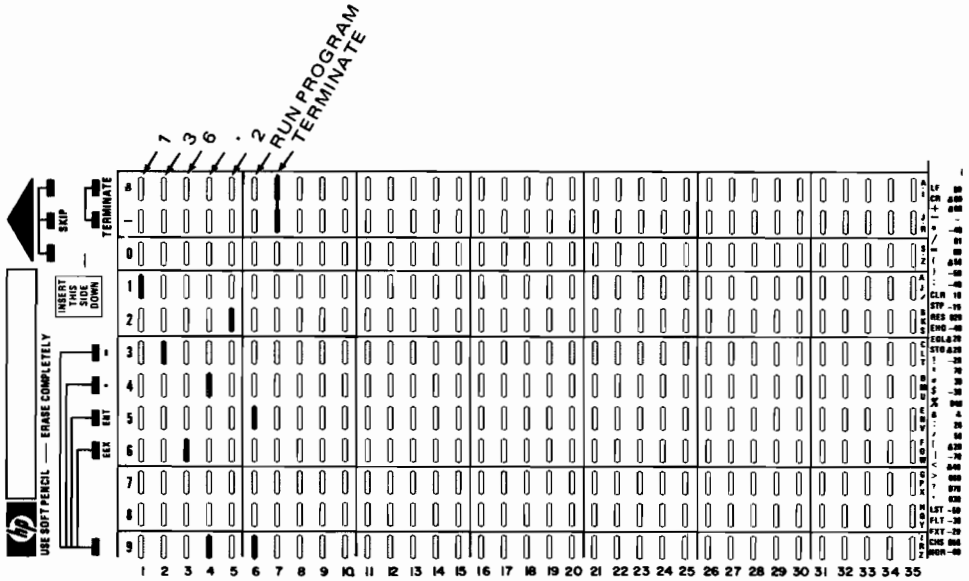
Here is an example of a data entry used with an ENTER statement.

EXAMPLE

If the following ENTER statement were encountered in a program,

```
ENT A
```

the following card may be entered to meet the ENTER statement requirements.



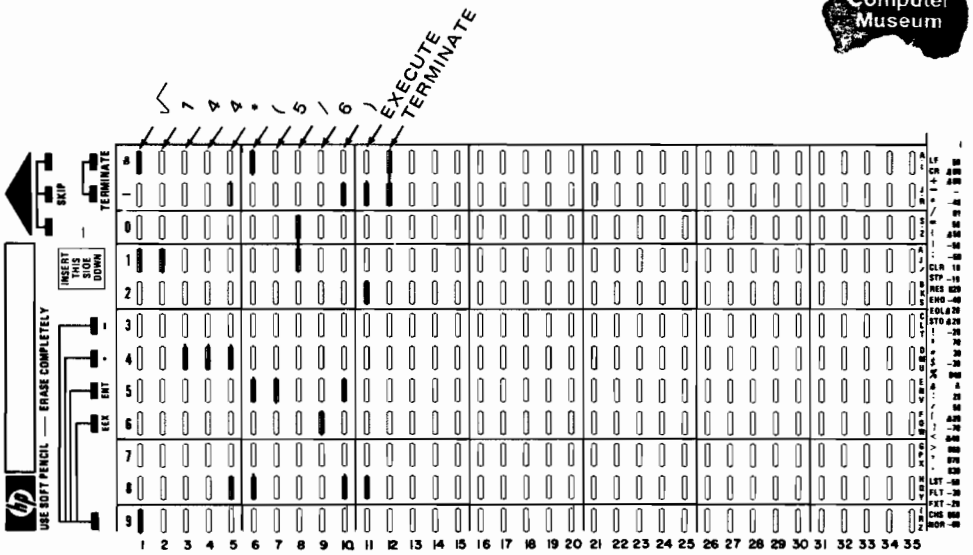
KEYBOARD CALCULATIONS

Calculations which can be performed from the keyboard can be performed using the card reader. Simply encode an expression, followed by an EXECUTE and terminate code, on the card and enter the card into the card reader. Instructions which cause immediate activity on the part of the calculator should be the last keycode on the card. If other codes follow, some of them may be missed by the calculator while it is executing the previous instruction.

The keys that have an execution time long enough to cause this problem are LIST, EXECUTE, and RUN PROGRAM. No more than one of these keys should be encoded on a card, and that should be the last keycode on the card. Again, a terminate code is needed after the last keycode.

Here is an example of a keyboard computation encoded on a card.

EXAMPLE



If you wish, encode the example card and enter it, the answer (10) will be displayed.

DATA DEMAND MODE

To operate the card reader in a Data Demand Mode, either the 11220A* or 11224A Peripheral Control Block must be installed. This mode uses the ROM's READ statement to call for data inputs from the card reader. Numerical data encoded on cards are then entered into the card reader. The READ statement can be used like the enter statement, from the keyboard or in a program. The card reader select code (12) must be specified in the READ statement.

The READ syntax:

(select code)

RED 12 , list

The READ statement may be referenced to a format statement, which will determine the form of each data item. The number of parameters in the list determines how many data items are read. Each item is stored in its corresponding register. The data items can assume the same form as any number which is entered from the keyboard. A delimiter (space) is required after each data item to separate the data items from each other, and to end the list. A terminate must be the last code marked on the card.

NOTE

The card reader motor must have stopped before another READ statement is reached in a program. If the motor is still running, the new READ statement will not be recognized. It may be necessary to include DISPLAY statements in a program to allow time for the motor to stop before another READ statement is executed.

Here is an example of entering data from the card reader using the READ statement.

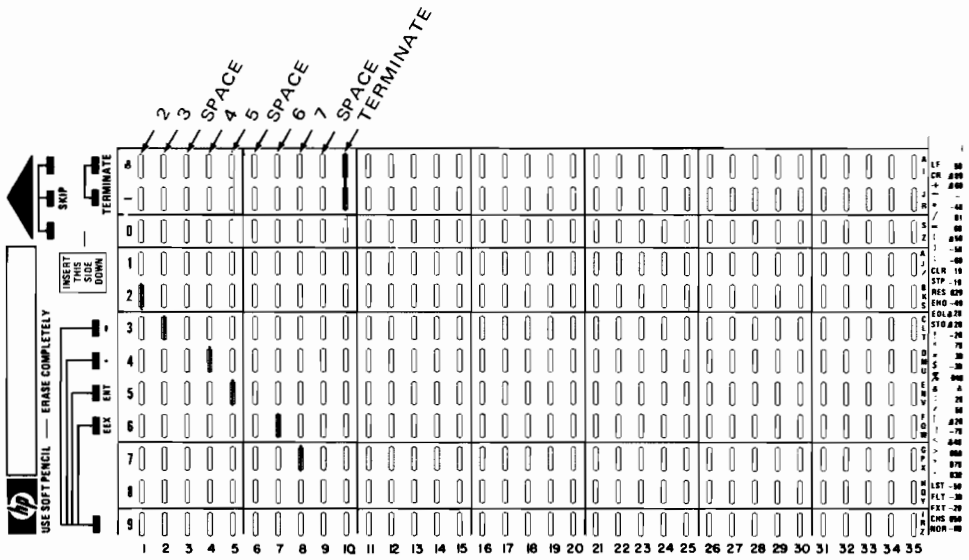
EXAMPLE

Execute the following line from the keyboard or in a program.

```
RED 12,A,B,C
```

When the card reader motor starts, enter the example card (below), which is encoded with 3 data items. After the card is read, the motor will stop. NOTE: In this example, the card reader motor will keep running until 3 data items are entered (unless stop is pressed). The data items will be stored in the A, B and C registers.

*The 11220A READ statement cannot be executed from the keyboard.



For more information on the use of the Peripheral Control Block, refer to your PC Block Operating Manual.

NOTE

When using the 11220A PC I ROM with the 9820A or 9821A, in the Data Demand Mode, it is necessary to encode only one data item per card. A terminate code should be marked only on the last data card of the series.

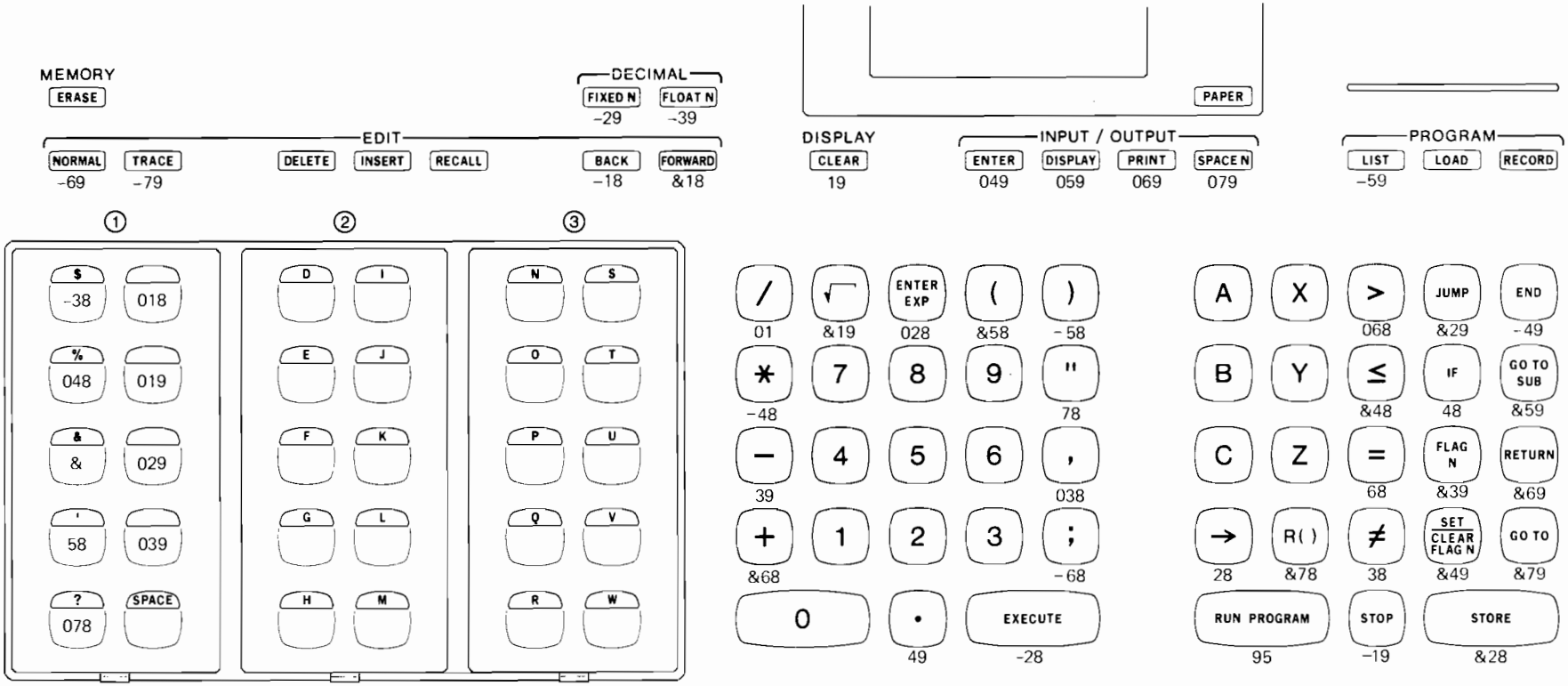


Figure 6. 9820A Keyboard Codes
(shown in color)

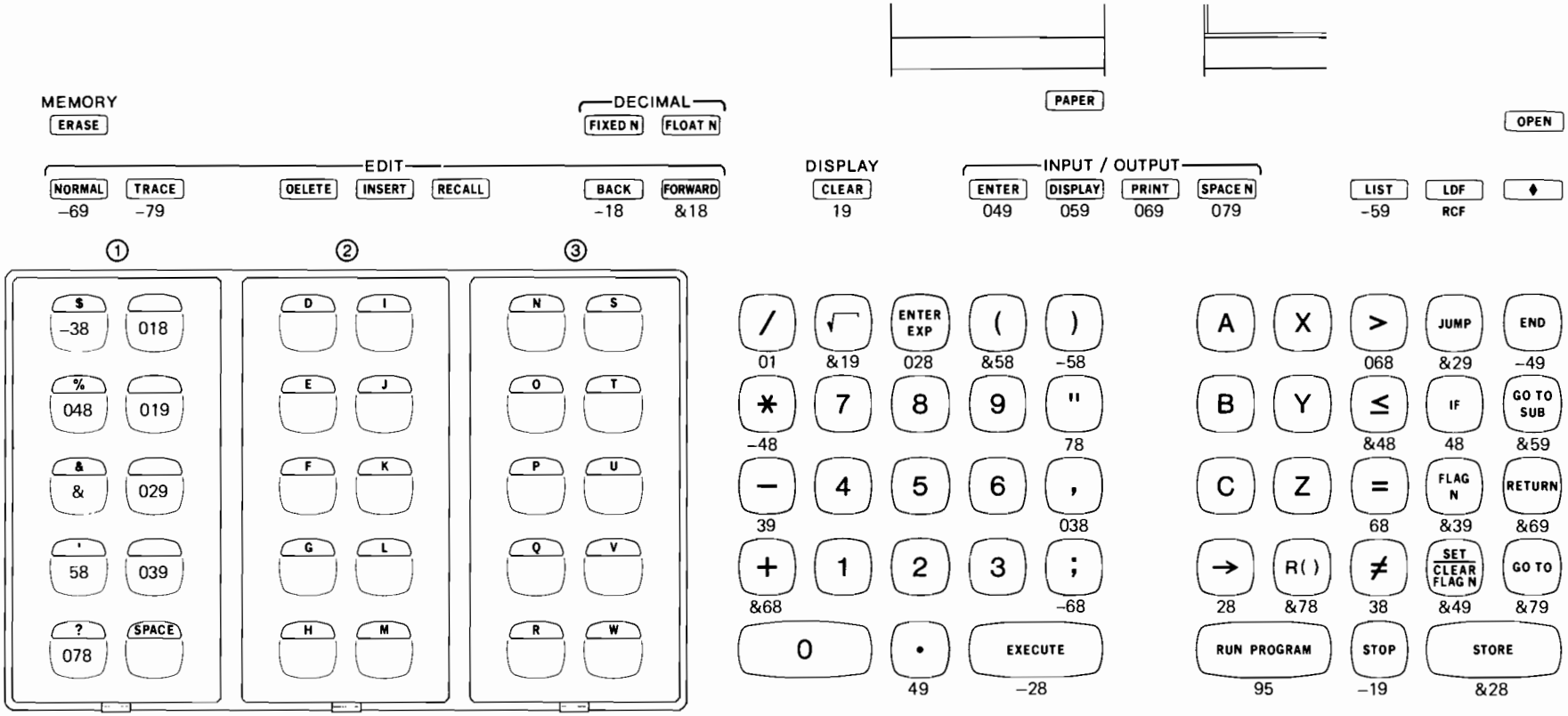


Figure 7. 9821A Keyboard Codes
(shown in color)

NOTES

Chapter 4

MODEL 30 OPERATION

The card reader can be used with the 9830A to enter programs (the Interrupt Mode) and data (the Data Demand Mode).

The following material is presented assuming that the reader is familiar with the 9830A operation.

INTERRUPT MODE

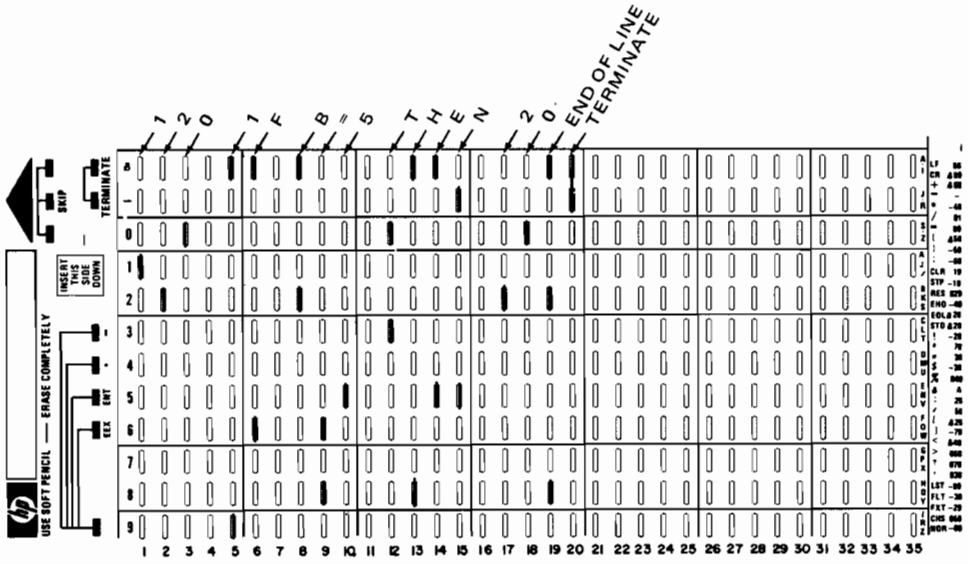
PROGRAM INPUT

Entering program lines from the card reader is similar to entering program lines from the keyboard. Cards are encoded with only one program line per card, followed by an End of Line code. A terminate code must be marked after the end of line code to prevent stray marks on the rest of the card from causing erroneous entries. The Program Line numbers may be encoded on the cards, or the auto number feature may be used. Refer to Figure 8 for the 9830A keyboard codes when encoding cards to be read.

Here is an example of a program line encoded on a card.

EXAMPLE

The example card enters an IF-THEN statement in line 120.



INTERRUPT MODE
(continued)

DATA INPUT

When an INPUT statement is encountered in a program, the data entry may be entered from a card instead of from the keyboard. Simply encode the data number on a card in the same manner as it would be if entered from the keyboard. A data entry must consist of only the digits 0 through 9, and if necessary, minus signs, a decimal point, and an enter exponent code. One or more data entries may be encoded on a card. The data entries must be separated by a comma. An EXECUTE and a terminate code must be marked after the last data entry.

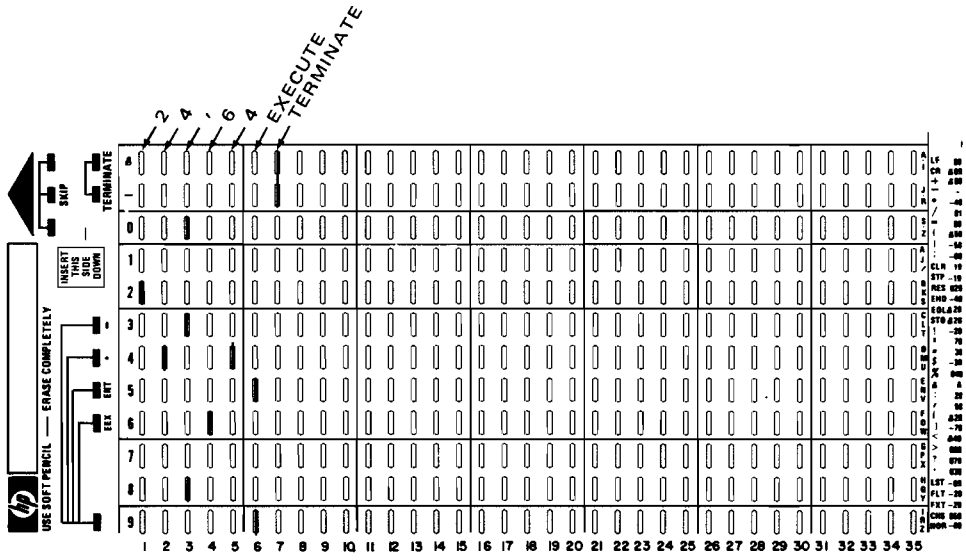
Here is an example of a data entry used with an INPUT statement.

EXAMPLE

If the following INPUT statement were encountered in a program;

```
INPUT A,B
```

the following card could be entered to meet the INPUT statement requirements.



The 2 data entries will be stored in the A and B registers.

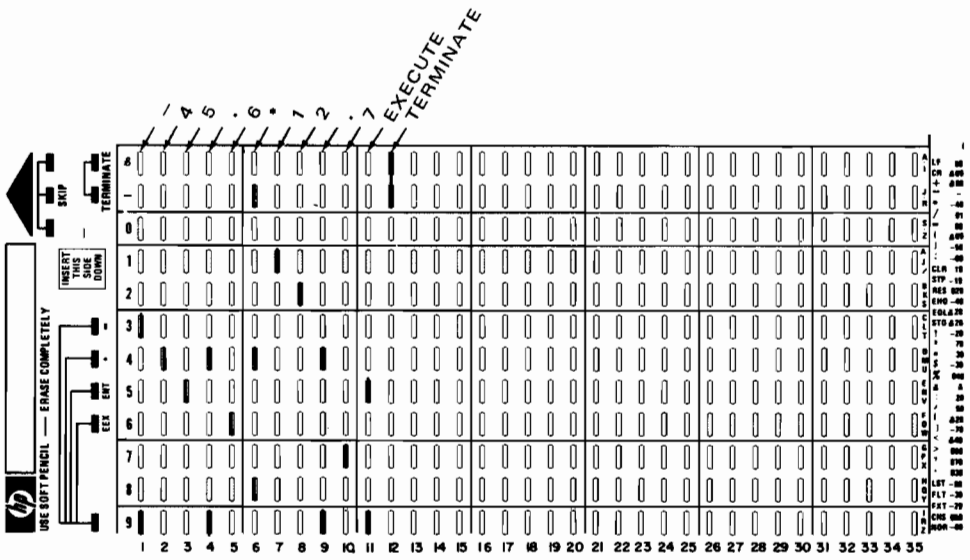
KEYBOARD CALCULATIONS

The card reader may be used to perform calculations which are manually done from the keyboard. The key sequence used in the calculation is encoded on a card in the same manner. Model 30 instructions which cause immediate activity on the part of the calculator, such as EXECUTE, CLEAR, or STEP, should be the last code on the card. If other codes follow, some of them may be missed by the calculator while it is executing the previous instruction. Skips may be encoded to give the calculator extra time to complete the previous operation. This practice is not recommended however, because the number of skips required is difficult to predict. Again, a terminate code should be marked after the last keycode entry.

Here is an example of a keyboard calculation encoded on a card.

EXAMPLE

The example card simply multiplies two numbers. The result, -579.12 is displayed.



DATA DEMAND MODE

In this mode of operation, the 11272B Extended I/O ROM must be installed in the 9830A. This mode uses the ROM's ENTER statement to call for data inputs from the card reader. Numerical data encoded on cards are then entered from the card reader. The ENTER statement can be used from the keyboard or in a program. The card reader select code (12) must be specified in the ENTER statement.

The ENTER syntax:

ENTER ($\overset{\text{(select code)}}{\overbrace{12}}$, *) variable list

The number of parameters in the list determines how many data items are read. Parameters in the list are separated by a comma. Each data item is stored in its corresponding register.

The data items can assume the same form as any number which is entered from the keyboard. A comma is required after each data item is encoded on a card to separate the items from each other. An EXECUTE code is marked after the last data item to end the list. A terminate is still the last entry on the card.

> **NOTE**
>
> The card reader motor must have stopped before another ENTER statement is reached in a program. If the motor is still running, the new ENTER statement will not be recognized. It may be necessary to include WAITs in a program to allow time for the motor to stop before another ENTER statement is executed.

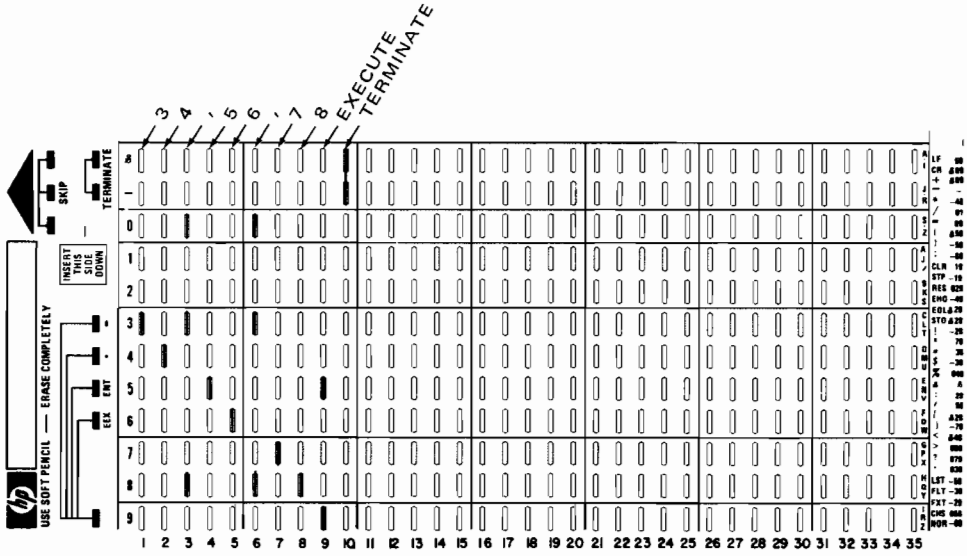
Here is an example of entering data from the card reader using the ENTER statement.

EXAMPLE

Execute the following line from the keyboard or in a program.

```
ENTER(12,*)A,B,C
```

The card reader motor will start; then enter the example card below which is encoded with 3 data items. After the card is read, the motor will stop. The data items will be stored in the A, B and C registers.



For further information on the use of the Extended I/O ROM, consult the 11272B Operating Manual.

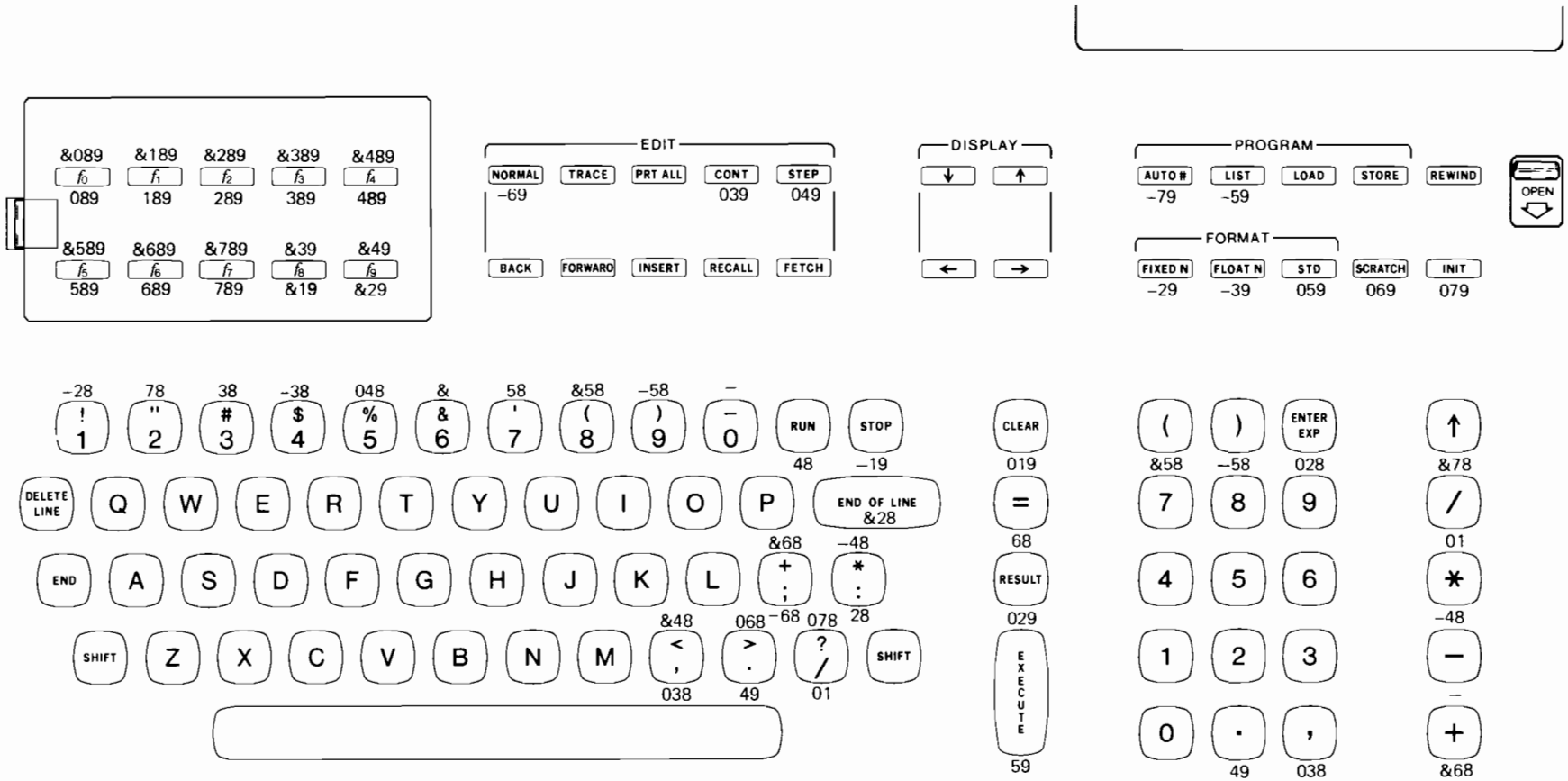


Figure 8. 9830A Keyboard Codes
(shown in color)

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