HEWLETT-PACKARD

Model 46

Operating Guide

Introduction

Now that you own an HP-46, take a little time to read this guide to reassure yourself that you've bought the best. Your HP-46 has far more computing power than other small desktop calculators on the market. In fact, its 10–digit accuracy exceeds the precision to which most of the physical constants of the universe are known.

For example, there are about 10^{74} *atoms* in the known universe. With the HP-46, you could calculate the number of atoms in ten trillion trillion universes, if you had to, because it handles numbers up to 10^{100} (also down to 10^{-99}), automatically places the decimal point, and allows you to round the display to settings ranging from zero to nine decimal places.

It also provides you with an impact printer with special alphanumeric capability, which gives you clear, easy-to-read symbols for every operation you perform, making your hard copy a truly valuable, permanent record. In addition, you can work with transcendental functions, such as logarithms, sines and cosines as well as a variety of built-in constants, polar/rectangular coordinate conversions, selective operating and display modes, and multiple storage locations.

If you are a beginner, you will appreciate the step-by-step explanations in this guide. But even if you are an old hand at using calculators, you can minimize the time you spend calculating by following the helpful hints presented throughout.

This guide replaces the Model 46 Operating Guide, hp - part no. 00046-90000.

Table of Contents

CAUTION

THE MODEL 46 CAN BE SEVERELY DAMAGED IF IT HAS NOT BEEN SET TO THE CORRECT VOLTAGE; IF IN DOUBT, PLEASE REFER TO APPENDIX A.

1 Fundamental Operations

Getting Started

Your HP-46 is shipped fully assembled and is ready to operate after making a few simple checks. If you have just received your calculator, please be sure to immediately inspect it before switching it on (refer to Appendix A of this manual for both inspection and turn-on procedures). To install a roll of printing paper, see Appendix B. But if the calculator has already been running in your area, simply do the following:

- If the calculator is not plugged in, plug one end of the power cord into the rear panel of the calculator; plug the other end into a suitable power outlet.
- If the calculator is switched off, check to see that the two-position switch PRT OFF is in the up position (the printer is switched on). Then press and lock LINE down. The word **CLEAR** should be printed; if it is not, see 'Service', Appendix D.

Keyboard

Figure I illustrates the keyboard layout. Almost every key performs two distinct functions: the symbol for the primary function appears on the key-top; the symbol for the alternate function appears on the front side of the key.

To use the primary function, merely press the selected key. To use the alternate function, press the [ ] key immediately before pressing the selected key.

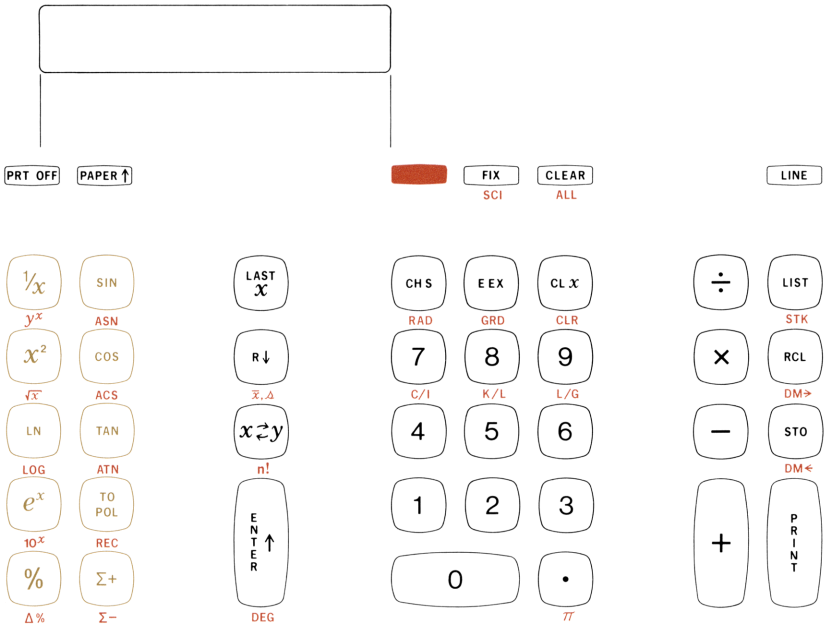


Figure 1. The HP-46 Keyboard †

Printer

The printer provides a written record of all calculations, using an easy-to-understand notation for each function. In addition, the HP-46 prints various messages. Some of these indicate the status of the machine while others tell you of illegal calculations, such as division by zero.††

PAPER ↑ controls the paper. Press it to manually advance the paper without printing.

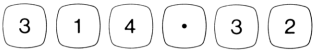
PRT OFF controls the printer. When the key is pressed the printer is turned off. When the key is pressed again, it releases and turns the printer on. With the printer turned off, nothing is printed and paper cannot be advanced manually.

†Use the Key Index on page 64 to locate a particular function.

†† A complete list of 'Operating Notes' is on the inside back cover of this guide.

Keying In and Entering Numbers

Number keys are arranged conveniently as in an adding machine. Key in numbers from left to right and include the decimal point if it is a part of the number. For example, **314.32** would be keyed in as:



Check the number you have keyed in by pressing 

. The small light in the display window simply indicates that the machine is doing an operation, in this case **PRINT**, and that the keyboard is inoperative while the machine is busy. While most operations take less than a second, a few of the more complicated ones may take from 1 to 2 seconds.

If you find that you have made a mistake when keying in a number, clear the entire number by pressing 

.† Then key in the number correctly. Before keying in a second number, save the first by pressing 

. Now key in the new number. You can save up to four numbers this way.

Display Option

With a display option installed, you should see a display of

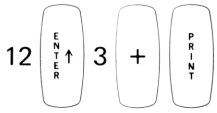
when you switch on the HP-46. Numbers keyed in and the results of all calculations appear in the display. Press **PRINT** when you need to retain a particular result. And to conserve paper, press **PRT OFF**; nothing is printed.

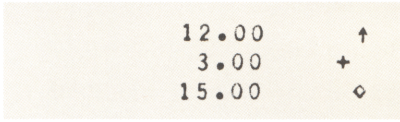
†There are four 'clear' functions. These are explained briefly in Appendix C, and on the label affixed to the underside of the lid. They are discussed specifically as they become necessary to the operations.

Performing Simple Arithmetic

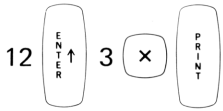
In the HP-46 arithmetic answers are calculated and then printed by pressing +, –, x, or ÷ and then pressing **PRINT**. For any problem having two numbers and one arithmetic operator — you key in the first number and save it by pressing **ENTER↑**; then you key in the second number and follow it by the arithmetic operator.

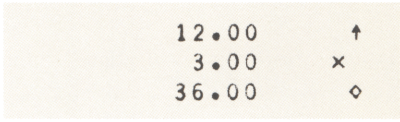
For example, add 12 and 3 by pressing:





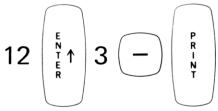
To multiply 12 by 3, press:

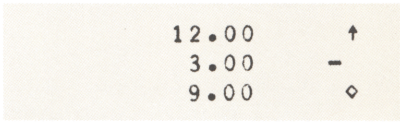




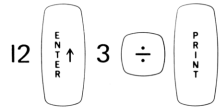
The calculator uses the last number saved and the last entry: it adds the last entry to the number saved; it subtracts the last entry from the number saved; it multiplies the last entry by the number saved; and it divides the last entry into the number saved.

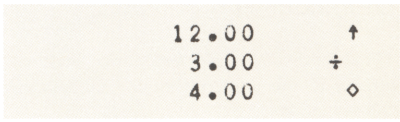
For example, subtract 3 from 12 by pressing:





To divide 12 by 3, press:





You can see a few of the printer symbols from the problems above. They were selected to be as logical and descriptive as possible to aid you in later reference.

In the HP-46 the last number used in an operation is automatically stored in an internal location labeled 0. You can recall and print that last number by simply pressing LAST x . In the simple problems shown above, the number is always 3. By pressing LAST x after any of the above problems you get a printout that looks like this:

```
                    ← 0
              3.00
```

The result of the operation is automatically saved just as if you'd pressed **ENTER↑**.

Rounding Numbers

After the calculator is switched on, numbers are printed with two places shown to the right of the decimal point. But you can change this using the **FIX** key. Press FIX and follow it with a numerical key between **0** and **9**. If you press **FIX 5**, numbers will be printed rounded to show five places after the decimal point. The possible formats for the number 1.23456789 are shown below:

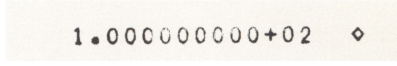
FIX 9	1.234567890 ◇
FIX 8	1.23456789 ◇
FIX 7	1.2345679 ◇
FIX 6	1.234568 ◇
FIX 5	1.23457 ◇
FIX 4	1.2346 ◇
FIX 3	1.235 ◇
FIX 2	1.23 ◇
FIX 1	1.2 ◇
FIX 0	1. ◇

To ensure greater accuracy, the HP-46 internally performs all calculations using a ten-digit number and a power of ten (whether or not all the digits are visible in your printing format). Expressing values as numbers multiplied by powers of 10 is called 'scientific notation' (i.e., 23712.45 = 2.371245 x 10^4 in scientific notation).

Scientific notation can be specified as a format and is helpful when you are working with very large or small numbers. Press [shift] [FIX / SCI] and follow it with a numerical key between **0** and **9**. For example, [shift] **SCI 5** specifies scientific notation with the number rounded to show 5 places after the decimal point. In this format, 2.371245 x 10^4 would look like this:

If a number is too large for the printing format specified, the calculator automatically prints the number in scientific notation. For example, if you have pressed **FIX 8**, and key in the number **100**, the calculator will print the number in scientific notation because there is not enough room to print three places before the decimal point:

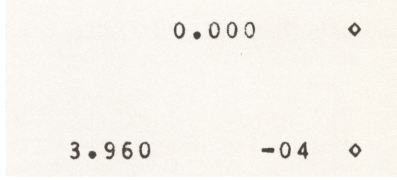
Press: [FIX] 8 100 [PRINT]



Numbers that are too small to be seen in the specified **FIX** format are printed as zero. For example, print the number .000396 in **FIX 3** format and [shift] **SCI 3** format:

Press : [FIX] 3 .000396 [PRINT]

[shift] [FIX / SCI] 3 [PRINT]



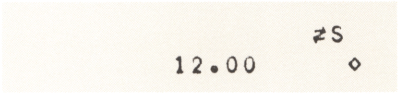
Negative Numbers

To key in a negative number, press CHS (change sign) after keying in the positive value. Negative numbers are printed in red. For example, to key in -12: (first change the format setting back to **FIX 2**.)

Press: 12 CHS PRINT

To change the sign of a negative or positive number, press CHS . For example, to change the previous number back to a positive 12:

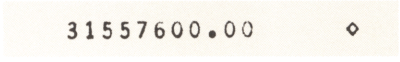
Press: CHS PRINT



Entering Exponents

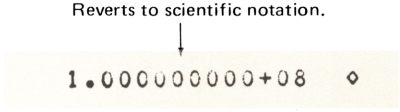
Even with a **FIX** format, you can enter numbers using scientific notation by pressing EEX (enter exponent). For example, to enter the number of seconds in a year, 3.15576×10^7:

Press: FIX 2 3.15576 EEX 7 PRINT



To enter exact powers of ten simply press **EEX** and then the desired power of ten. For example, the number of angstroms in a centimeter is 100,000,000 (10^8). To enter this number

Press : EEX 8 PRINT



To enter negative powers of ten, key in the number, press **EEX** and then **CHS** to change the sign of the exponent. Now key in the power of ten. For example, to enter Planck's constant — roughly 6.625×10^{-27}:

Press: 

3

6.625 EEX CHS 27 PRINT

2 The Operational Stack

Temporary Storage Locations

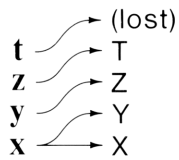
There are four temporary storage locations in the HP-46 labeled X, Y, Z, and T. They are arranged in a 'stack' with X being on the bottom (see below).

Contents	Location
t	T
z	Z
y	Y
x	X

To avoid confusion between the name of a location and its contents, the location is designated in this manual by a capital letter, and the contents by a small letter. Thus, x, y, z, and t are the contents of X, Y, Z, and T.

When you key in a number, it goes into X. When you press **ENTER↑**, this number is also reproduced in Y. At the same time y is transferred to Z, z is transferred to T, and t is lost (see below):

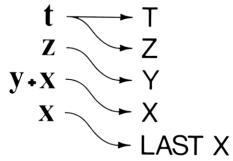
Press ENTER↑



The HP-46 can save a number in each of the four locations. By pressing STK LIST you can list the current contents at any time. The numbers are printed as they are shown in the above diagrams.

Arithmetic and the Stack

When you press the addition key the contents of X and Y are added together. The stack then drops, with t reproduced in T and Z, z transferred to Y, y + x transferred to X, and x transferred to **LAST X** (location 0).

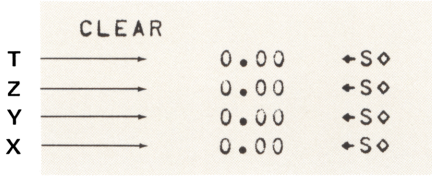


The same dropping action takes place with any operator (+, –, x, or ÷); the result is placed in x.

EXAMPLE

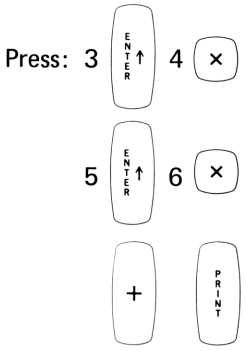
Problem: (3 x 4) + (5 x 6) = ?

First erase the stack by pressing CLEAR. Now list the stack by pressing [ ] [LIST] (STK). The printout shows that there is nothing in the stack:



All problems can be solved by keying in the numbers in the same order as they appear in the original expression, that is, from left-to-right.

To work a problem, key in the first number. If there is an operation you can perform at this point ($\sqrt{x}$, 1/x), do it. If there is not, press **ENTER↑**. Now key in the next number. Perform any operation that can be done (+, –, x, ÷, x^2, $\sqrt{x}$, 1/x, etc.). If there is no operation you can perform, **ENTER↑** this number and repeat the procedure.




```
3.00      ↑
4.00      ×
5.00      ↑
6.00      ×
          +
42.00     ◇
```

Notice that the numbers are entered in the same order as they appear in the problem.

Now look at the stack listings below as we do the same example. (First press **CLEAR**.)

T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Z	0.00	0.00	0.00	0.00	0.00	12.00	12.00	0.00	0.00
Y	0.00	3.00	3.00	0.00	12.00	5.00	5.00	12.00	0.00
X	3.00	3.00	4.00	12.00	5.00	5.00	6.00	30.00	42.00

STACK LISTINGS

PRINT finally prints the contents of X without changing the stack.

Manipulating the Stack

The R↓ (roll down) key lets you review the stack contents without losing data. It is also used to reposition data within the stack. Watch the stack listings below as we use this key.

Load the data t = l, z = 2, y = 3, and x = 4:

1 ENTER↑ 2 ENTER↑ 3 ENTER↑ 4

T	0.00	0.00	0.00	0.00	0.00	1.00	1.00
Z	0.00	0.00	0.00	1.00	1.00	2.00	2.00
Y	0.00	1.00	1.00	2.00	2.00	3.00	3.00
X	1.00	1.00	2.00	2.00	3.00	3.00	4.00

STACK LISTINGS

Now you can reposition the data any way you choose:

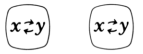
R↓ R↓ R↓ R↓

T	4.00	3.00	2.00	1.00
Z	1.00	4.00	3.00	2.00
Y	2.00	1.00	4.00	3.00
X	3.00	2.00	1.00	4.00

STACK LISTINGS

The x⇄y (x,y exchange) key exchanges the contents of X and Y. When you want to see what the contents of Y are without listing the entire stack, press: x⇄y **PRINT** and then x⇄y again.

Look at the stack listings below when this key is used.



T	1.00	1.00
Z	2.00	2.00
Y	4.00	3.00
X	3.00	4.00

STACK LISTINGS

Combined Arithmetic Operations

Any time a new number is entered after an operation, the HP-46 performs an automatic **ENTER↑** on the result of that operation. This feature allows you to work serial calculations as well as chain and mixed chain calculations.

EXAMPLES

A. Serial Calculation — find the sum of 4, 6, 8, and 10.

Press: 4 [ENTER↑] 6 [+] 8 [+]

10 [+] [PRINT]

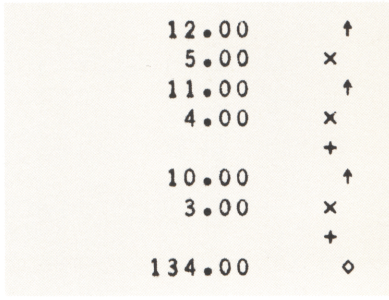
4.00	↑
6.00	+
8.00	+
10.00	+
28.00	◇

B. Chain Calculation : (12 x 5) + (11 x 4) + (10 x 3) = ?

Press: 12 [ENTER ↑] 5 [×]

11 [ENTER ↑] 4 [×] [+]

10 [ENTER ↑] 3 [×] [+] [PRINT]



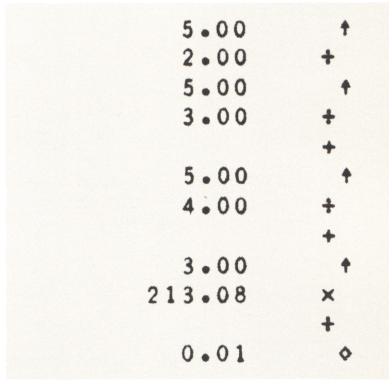
C. Mixed Chain Calculation : (5/2 + 5/3 + 5/4) ÷ (3 x 213.08) = ?

Press: 5 [ENTER ↑] 2 [÷]

5 [ENTER ↑] 3 [÷] [+]

5 [ENTER ↑] 4 [÷] [+]

3 [ENTER ↑] 213.08 [×] [÷] [PRINT]



Once again you can see that the numbers were entered in the same order as they appeared in the equations.

3 General Purpose Functions

The functions described in this chapter are useful in many of the applications presented later in this guide.

Pi

π is one of the fixed constants provided in the HP-46. Merely press [ ] [·] (π) whenever you need it in a calculation.

Problem: Find the circumference of a circle with a 3 foot radius.

Solution: $C = 2\pi r = 2\pi 3$

Press: 2 [ ] [·] (π) 3 [×] [×] [PRINT]

These numbers are automatically entered.

```
2.00
3.14
3.00
18.85
```

Reciprocals

The [1/x] key calculates the reciprocal of **x**.

Problem: Find the reciprocal of .0625.

Solution: (Change the format first to **FIX 4** to prevent rounding on the printout.)

Press: .0625 [1/x] [PRINT]

```
0.0625
16.0000
```

Square Roots

The keys, [−] [x^2 / $\sqrt{x}$], calculate the positive square root of **x**.

Problem: Find the square root of the previous example.

Solution: If you haven't worked the previous example, key in 16 first. (Change back to **FIX 2** for easier reading.)

Press: [−] [x^2 / $\sqrt{x}$] [PRINT]

```
                √
          4.00    ◇
```

Squaring Numbers

The [x^2] key calculates the square of **x**.

Problem: Square the answer to the previous example.

Solution: If you haven't worked the previous example, key in 4 first.

Press: [x^2] [PRINT]

```
                x²
         16.00    ◇
```

Note that this example can also be worked like this:

Press: 4 [ENTER↑] [×] [PRINT]

```
          4.00    ↑
                  ×
         16.00    ◇
```

Raising a Number to a Power

[ ] [1/x] (y^x) permits you to find any power of a positive number, within the range of the calculator.† The power can be either an integer or decimal fraction; it makes no difference.

EXAMPLES

A. Find 2^9 (2x2x2x2x2x2x2x2x2)

Press: 2 [ENTER↑] 9 [ ] [1/x] (y^x) [PRINT]

```
2.00      ↑
9.00      yˣ
512.00    ◇
```

B. Find $8^{2/3}$

Press: 8 [ENTER↑] 2 [ENTER↑] 3 [÷]

[ ] [1/x] (y^x) [PRINT]

```
8.00      ↑
2.00      ↑
3.00      ÷
          yˣ
4.00      ◇
```

Using the result of this example, check different formats:

Press: [FIX] 8 [PRINT]

[FIX] 9 [PRINT]

```
4.00000000    ◇
3.999999999   ◇
```

This shows an example of 'calculating error' which occurs because logarithms are used for internal programming of y^x and the results are not always accurate to the last decimal place. In this case the error magnitude is only .000000001 (1 billionth)!

†See 'Calculator Range' in Appendix C.

C. Find the increase in the volume of a spherical balloon when its radius is increased from 2 to 3 inches. (Reset the calculator to **FIX 2** format.)

Solution: Volume = $4/3\,\pi\,r^3$

$$\text{Difference in volumes} = 4/3\pi r_2{}^3 - 4/3\pi r_1{}^3$$
$$= 4/3\pi(r_2{}^3 - r_1{}^3)$$
$$= 4/3\pi(3^3 - 2^3)$$

Press: 4 ENTER↑ 3 ÷ [ ] · (π) ×

3 ENTER↑ [ ] 1/x (y^x)

2 ENTER↑ 3 [ ] 1/x (y^x)

− × PRINT

4.00	↑
3.00	÷
3.14	
	×
3.00	↑
	y^x
2.00	↑
3.00	y^x
	−
	×
79.59	◇

Using Factorials

The n! (n factorial) key permits you to handle permutations and combinations with ease. To calculate the factorial, merely press [ ] x⇄y (n!) after the associated value.

EXAMPLE

A. A conference is being held between representatives of the following Central American countries: Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. The flags of the 6 countries are all flown on one pole, and each day they are arranged in a different order. How many days would the conference have to last if the flags were flown in all possible arrangements?

Solution: The permutations of 6 things (n) taken 6 at a time (k) is solved using the formula:

$$P^n_k = \frac{n!}{(n-k)!} = \frac{6!}{(6-6)!}$$

Press: 6 [shift] [x⇄y] (n!) 6 [ENTER↑] [−]

[shift] [x⇄y] (n!) [÷] [PRINT]

```
          6.00    !
          6.00     ↑
                   −
                   !
                   ÷
        720.00     ◇
```

Almost two years!

Percentage Problems

To find the percentage of a number, enter the base number and press **ENTER↑**. Then key in the percent rate and press [%].

A. Find 25% of 78

Press: [CLEAR]

78 [ENTER↑] 25 [%] [PRINT]

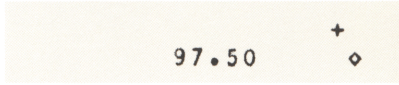
```
CLEAR
         78.00     ↑
         25.00     %
         19.50     ◇
```

A listing of the stack shows that the base number and the percentage are in Y and X.

Press: [shift] [LIST] (STK)

```
          0.00    ←S◇
          0.00    ←S◇
         78.00    ←S◇
         19.50    ←S◇
```

You can then add a percentage of a number to itself by pressing:

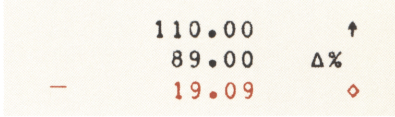


The percent increase or decrease from Y to X uses the [−] [%] (Δ%) keys. Key in the base number and **ENTER↑** it. Then key in the second number and press [−] [%] (Δ%).

EXAMPLES

A. Find the percent decrease from 110 to 89.

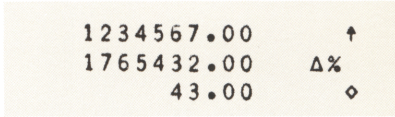
Press: 110 [ENTER↑] 89 [−] [%] (Δ%) [PRINT]



B. A company grosses $1,234,567 in fiscal 1971 and $1,765,432 in fiscal 1972. The manager would like to calculate the percentage increase in gross sales.

Press: 1234567 [ENTER↑]

1765432 [−] [%] (Δ%) [PRINT]



Data Storage Locations

4

In addition to the stack, the HP-46 has nine storage locations, numbered 1 through 9†, for constant storage. Although the calculator itself requires some of this storage when calculating particular functions (see Calculator Storage Requirements on page 24), in general, all nine locations are available to the user.

Storing and Recalling Data

To store a value that is in X, press STO followed by the number key (1-9) specifying the location. That value is reproduced in the storage location leaving the original in X. To retrieve a value, press RCL followed by the applicable number key. A duplicate of the recalled value is placed in X, pushing the stack up; the original value remains in the constant storage location.

Problem: Store the numbers one through nine in the storage locations 9 through 1:

Press: 1 STO 9 2 STO 8 3 STO 7

4 STO 6 5 STO 5 6 STO 4

7 STO 3 8 STO 2 9 STO 1

1.00	→ 9
2.00	→ 8
3.00	→ 7
4.00	→ 6
5.00	→ 5
6.00	→ 4
7.00	→ 3
8.00	→ 2
9.00	→ 1

†A tenth location, 0, is used for **LAST X** and is discussed on page 5.

List the contents of the storage locations by pressing [LIST]. Your printout should match the one below:

```
LIST
9.00    ← 1
8.00    ← 2
7.00    ← 3
6.00    ← 4
5.00    ← 5
4.00    ← 6
3.00    ← 7
2.00    ← 8
1.00    ← 9
```

Erase the contents of all nine storage locations and the stack by pressing [CLEAR ALL] (Note that individual storage locations can be erased by storing 0 in them).

EXAMPLE

A. Suppose you want to calculate the cost of buying an item in various quantities. The unit price of the item is $132.57 and the quantities you need to calculate cost for are 47, 36 and 29.

Solution: Store the unit price in location 1. Then recall it to multiply each quantity.

Press: 132.57 [STO] 1

47 [×] [PRINT]

[RCL] 1 36 [×] [PRINT]

[RCL] 1 29 [×] [PRINT]

```
132.57    ← 1
 47.00    ×
6230.79    ◇

           ← 1
132.57
 36.00    ×
4772.52    ◇

           ← 1
132.57
 29.00    ×
3844.53    ◇
```

In this case you can easily calculate the total cost because the individual totals are still in the stack.

Press: [LIST / STK] [+] [+] [PRINT]

```
6230.79   ←S◇
6230.79   ←S◇
4772.52   ←S◇
3844.53   ←S◇

                +
                +
14847.84        ◇
```

Storage Location Arithmetic

Arithmetic operations can also be performed on x using the contents of a storage location. The result of the operation can be placed in the storage location or in X.

To operate on x using a stored value and placing the result in the storage location, press **STO**, then the applicable operator, and finally the number key specifying the storage location.

Problem: Store 6 in storage location number 1, and then increment it by 2. Recall storage location 1 to check the answer.

Press: 6 [STO] 1

2 [STO] [+] 1 [RCL] 1

```
6.00    → 1
2.00    →+1
        ← 1
8.00
```

Now subtract the register contents from a displayed value (make it 13) and store the result back in register one.

Press: 13 [STO] [−] 1

[RCL] 1

```
13.00   →−1
        ← 1
5.00
```

Conversely, to operate on x using a stored value and placing the result in X, press **RCL** followed by the applicable operator and the number key specifying the storage location.

Problem: Add the current value in location 1 to a new entry of 2.

Press: 2 RCL + 1 PRINT

```
2.00      ←+1
7.00      ◇
```

Recall storage location 1 to verify that it still contains 5.

Press: RCL 1

```
          ← 1
5.00
```

Calculator Storage Requirements

The HP-46 requires the use of some storage locations when calculating certain functions:

- The temporary storage locations of the stack are never required by the calculator, so you can use them at all times.
- Storage locations 1 through 4 also are never required by the calculator.
- Storage locations 5 through 8 are used by the calculator when calculating with the $\Sigma+$, $\Sigma-$ and $\bar{x},s$ keys (see Statistical Functions, page 27).
- Storage location 9 is used by the calculator to compute trig functions and polar/rectangular coordinate conversions (see Trigonometric Operations, page 33 and Coordinate Conversion, page 37).

You should not store numbers in storage locations which the calculator requires for particular operations if you are going to use those operations. If you know that you are not going to use the functions described above, you can store numbers freely in all 9 storage locations.

Metric/English Conversions † 5

The HP-46 provides built in conversion constants for:

- [7 C/I] Centimeters-to-inches-to-centimeters (1 inch = 2.540000000 centimeters)
- [8 K/L] Kilograms-to-pounds-to-kilograms (1 pound* = 0.453592370 kilograms)
- [9 L/G] Liters-to-gallons-to-liters (1 gallon** = 3.785411784 liters)

To use these constants, enter the measure to be converted, press [ ] and the desired conversion key, followed by the applicable operator: '**x**' if converting *to* metric equivalents; '÷' if converting *from* metric equivalents.

Note that it isn't necessary to press ENTER↑ after keying in the initial value; the HP-46 performs an automatic ENTER↑ when a preprogrammed constant is pressed.

EXAMPLES

A. If an 8" x 10" drawing is to be reduced to 85% of its original size, what are the reduced dimensions in centimeters?

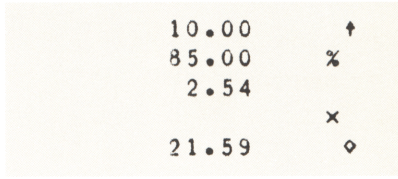
Press: 8 [ENTER↑] 85 [%] [ ] [7 C/I] [×] [PRINT]

8.00	↑
85.00	%
2.54	
	×
17.27	◇

†Ref: National Bureau of Standards, 1967.
*Avoirdupois system.
**U.S. liquid measure.

The width is 17.27 centimeters.

Press: 10 [ENTER ↑] 85 [%] [−] [7 C/I] [×] [PRINT]

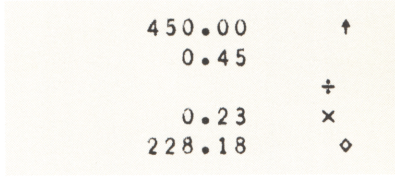


And the length is 21.59 centimeters.

B. A zoo is importing from India a baby elephant which weighs 450 kilograms. If the shipping cost per pound is 23 cents, how much money must the zoo pay?

Press: 450 [−] [8 K/L] [÷]

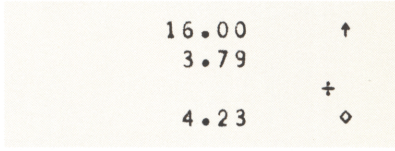
.23 [×] [PRINT]



The zoo pays $228.18 shipping costs.

C. An American in Germany purchases 16 liters of wine. The duty, however, is figured in gallons; so how many gallons does he have?

Press: 16 [−] [9 L/G] [÷] [PRINT]



6 Statistical Functions

Summations

Summation calculations use the Σ+ key to total numbers for use in other calculations (the letter "Σ" — sigma — is the Greek equivalent of our "S").

The HP-46 uses storage locations 5 through 8 to store accumulated results. Before doing a statistics problem, erase the data in these locations and the stack by pressing [orange] [CL x] (CLR). Otherwise the totals stored will include the current data in those locations. (This operation does not erase the data in storage locations 1 through 4 or 9.)

Key in each value to be included in the total and press [Σ+]. The number of entries is totaled in X and in storage location number 5. If you key in an incorrect value and you have not pressed Σ+, press [CL x] and enter the correct value. If you have already pressed Σ+, key in the mistaken value again and press [orange] [Σ+] (Σ−).

Σ+ also totals the contents of Y.† To total x and y values, first key in the y value and press **ENTER**↑. Next key in the x value. Now press Σ+. To delete an x,y pair, enter both values and press [orange] Σ−.

The types of data stored in locations 5 through 8 are shown below:

Storage Location	Data
5	# of entries
6	Σx^2
7	Σx
8	Σy

By pressing **RCL** Σ+ the data in storage locations 7 and 8 is recalled to X and Y and printed (the stack is pushed up by these two values). To recall any of the data, press RCL and the appropriate location number.

†See 'Vector Arithmetic' for a further explanation of this feature.

Mean and Standard Deviation

To calculate the mean and standard deviation† of a group of numbers, first total the numbers as described earlier by keying in each value and pressing $\Sigma+$. When all values are totaled, press [f] $\bar{x}, \Delta$. The following information is printed:

- number of entries (#)
- standard deviation (Δ)
- mean ($\bar{x}$)

The standard deviation is placed in Y. The mean is placed in X. The previous x and y values are erased.

EXAMPLE

A. In a recent survey to determine the average age of the 10 wealthiest people in the U.S., the following data was obtained:

62 84 47 58 68 60 62 59 71 73

Of the ages given, what is the mean? The standard deviation?

Press: [f] [CL x] (CLR)

62 [Σ+] 84 [Σ+] 47 [Σ+]

58 [Σ+] 68 [Σ+] 60 [Σ+]

62 [Σ+] 59 [Σ+] 71 [Σ+]

73 [Σ+] [f] [R↓] ($\bar{x}, \Delta$)

CLEAR		
	62.00	Σ+
	84.00	Σ+
	47.00	Σ+
	58.00	Σ+
	68.00	Σ+
	60.00	Σ+
	62.00	Σ+
	59.00	Σ+
	71.00	Σ+
	73.00	Σ+
#	10.00	◇
	10.10	Δ ◇
	64.40	$\bar{x}$ ◇

†The formula used for standard deviation is: $\Delta = \sqrt{\frac{\Sigma x^2 - 1/n\,(\Sigma x)^2}{n-1}}$

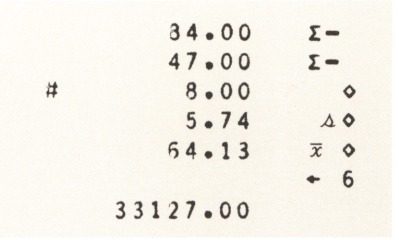
Delete the highest and lowest age. (The same procedure is used for deleting unwanted or incorrect entries.) What is the new mean and standard deviation? What is the sum of the squares of X?

Press: 84 [Σ+] (Σ−)

47 [Σ+] (Σ−)

[ ] [R↓] (x̄, Δ)

[RCL] 6



Notes

7 Logarithms

The HP-46 calculates natural logs, common logs, and antilogs.

LN This key calculates the natural log (to the base e) of x.

e^x This key raises e (2.718. . .) to the power in X. This is called the natural antilog and it is used in conjunction with the LN key.

LN (LOG) Pressing this key sequence takes the log to the base 10 of x.

e^x (10^x) Pressing this key sequence raises 10 to the power in X. This is called the common antilog and it is used in conjunction with the LN (LOG) keys.

EXAMPLES

A. Suppose you wish to use an ordinary barometer as an altimeter. After measuring the sea level pressure (30 inches of mercury) you climb until the barometer indicates 9.4 inches of mercury. How high are you?

Solution: Although the exact relationship of pressure and altitude is a function of many factors, a reasonable approximation is given by:

$$\text{Altitude (feet)} = 25{,}000 \ln \frac{30}{\text{Pressure}} = 25{,}000 \ln \frac{30}{9.4}$$

Press: 25000 ENTER↑ 30 ENTER↑

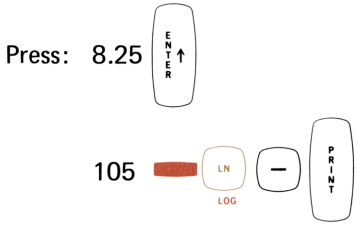
9.4 ÷ LN × PRINT

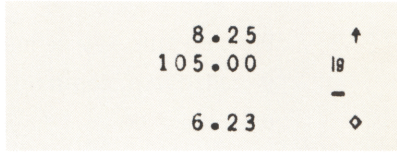
25000.00	↑
30.00	↑
9.40	÷
	ln
	×
29012.19	◇

(We suspect you are on Mt. Everest.)

Logarithms can be particularly helpful to the scientist and the engineer. For instance, the Richter scale, used by seismologists to measure the magnitude of earthquakes, operates on a logarithmic basis so there is a 10-fold increase from one unit to the next.

B. The 1906 San Francisco earthquake, with a magnitude of 8.25 on the Richter scale is estimated to be about 105 times greater than the Nicaragua quake of 1972. What would be the magnitude of the latter on the Richter scale?

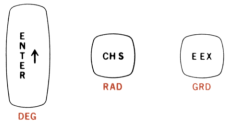




8 Trigonometric Operations

Angular Units

Three decimal-angle units are provided in the HP-46: degrees, radians and grads. When the calculator is switched on, it automatically calculates in degrees. To select a different unit, press [f] and the applicable key:



Trig Functions

The following trig functions are available on the HP-46:

SIN	ASN ($\sin^{-1}$)
COS	ACS ($\cos^{-1}$)
TAN	ATN ($\tan^{-1}$)

These functions, as the simple functions, operate on x, whether it is a newly keyed in number or the result of a previous calculation. To use the standard trig functions, press the function key. To use the inverse functions, press first [f], and then the appropriate function key.

The calculator uses storage location number 9 to store intermediate results while calculating trig functions. Any data stored in this location is erased when using these functions.

EXAMPLES

A. Find the cosine of 33° (If the calculator is not already in degree units, press [f] DEG).

Press: 33 [COS] [PRINT]

```
33.00      C
 0.84      ◇
```

B. Find the tangent of 26 radians.

Press: [shift] [CHS] (RAD)

26 [TAN] [PRINT]

```
          RAD
26.00      T
 1.18      ◇
```

C. Find the arc sine, in grads, of .5.

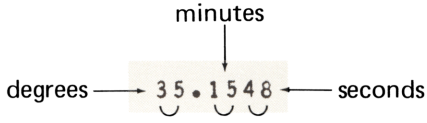
Press: [shift] [EEX] (GRD)

.5 [shift] [SIN] (ASN) [PRINT]

```
          GRD
 0.50     AS
33.33     ◇
```

Angular Conversion

Decimal angles can be converted from any angular units to degrees-minutes-seconds by pressing [shift] [STO] (DM←) . The converted angle is in the following form: dd.mmss. For instance 35° 15′ 48″ is printed to look like this:



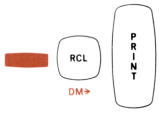
The calculator goes to a temporary FIX 4 format for easier printout reading. For example, to convert the angle 10.55°:

Press: [shift] [ENTER↑] (DEG) 10.55 [shift] [STO] (DM←)

```
          D
10.55
          DMS←
10.3300   ◇
```

Similarly, angles in degrees-minutes-seconds can be converted to their decimal equivalents in the current angular unit by pressing [shift] [RCL] (DM→). For example:

Press: [FIX] 4 10.3006




```
10.3006
        DMS→
10.5017      ◇
```

EXAMPLE

A. A surveyor wants to add the two angles 38°8′56″ and 89°17′42″. He can do this by first converting them to decimal angles and then adding them.

Press: [FIX] 2

38.0856 [shift] [RCL] (DM→)

89.1742 [shift] [RCL] (DM→)

[+] [shift] [STO] (DM←) [PRINT]

```
38.09
      DMS→
89.17
      DMS→
         +
      DMS←
127.2638     ◇
```

which is 127° 26′ 38″.

NOTE

Angles in degrees, minutes and seconds must be converted to decimal angles before the SIN, COS or TAN keys can be used.

Notes

Coordinate Conversion

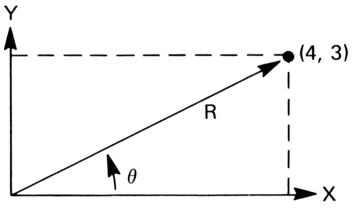
Polar coordinates can be converted to rectangular coordinates and vice versa using the following two functions:

TO POL This function converts the x coordinate and y coordinate, in x and y respectively, to the corresponding magnitude and angle (in the designated units).

[2nd] TO POL REC These keys convert the polar coordinates of magnitude and angle, in x and y respectively, to the corresponding x and y coordinates.

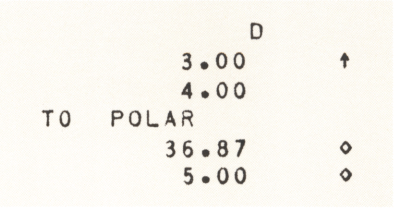
EXAMPLES

A. Convert the coordinates 4,3 (x,y) to polar form with the angle expressed in degrees.



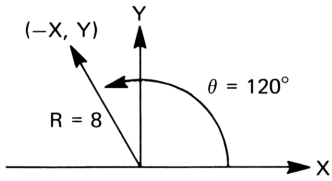
Press: [2nd] ENTER↑ DEG

3 ENTER↑ 4 TO POL



The resulting vector has a magnitude of 5 at 36.87°.

B. What are the coordinates of a vector of magnitude 8 and angle 120°?



Press: 120 ENTER↑ 8 [TO POL / REC]

```
          120.00      ↑
            8.00
TO   RECT
            6.93      ◇
−           4.00      ◇
```

The X coordinate is -4.00 and the Y coordinate is 6.93.

The calculator uses storage location number 9 to store intermediate results while performing coordinate conversions. Any data in this location, stored previous to using these functions, is erased.

Vector Arithmetic 10

After a vector has been converted to rectangular coordinates, it can be added to or subtracted from another converted vector by using the $\Sigma+$ and [ ] $\Sigma-$ keys. The procedure for adding or subtracting vectors follows:

1. Erase the summation storage locations (5-8) by pressing [ ] **CLR.**
2. Convert the first vector to rectangular coordinates by pressing [ ] REC.
3. Store the x and y values in locations 7 and 8 by pressing $\Sigma+$.
4. Convert the second vector to rectangular coordinates.
5. Add the second vector's coordinates to those in locations 7 and 8 by pressing $\Sigma+$. Or alternatively, subtract the second vector's coordinates from those in 7 and 8 by pressing [ ] $\Sigma-$. The resultant vector, in rectangular coordinates, is stored in locations 7 and 8.
6. Recall locations 7 and 8 to X and Y respectively by pressing **RCL** $\Sigma+$.
7. Finally convert these values to polar coordinates by pressing TO POL

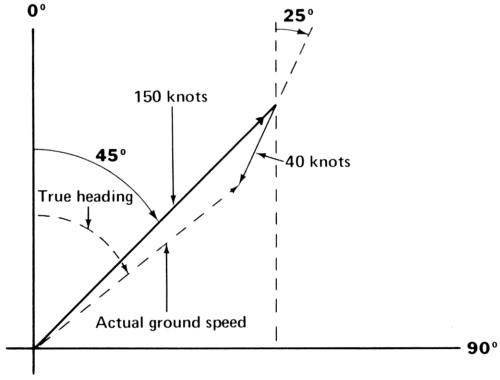
EXAMPLE

A. An aircraft has a true air speed of 150 knots and an estimated heading of 45°. There is a head wind of 40 knots and 25°. What is the actual ground speed and true heading?

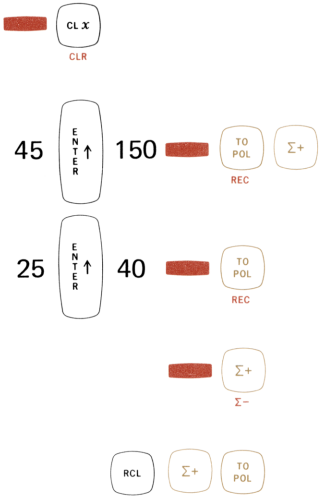
Solution: The true heading and actual ground speed are equal to the difference of the vectors:

45°, 150 knots

25°, 40 knots



Press:




```
CLEAR
          45.00        ↑
         150.00
TO   RECT
         106.07        ◇
         106.07        ◇
                       Σ+
          25.00        ↑
          40.00
TO   RECT
          16.90        ◇
          36.25        ◇
                       Σ−
          39.16        AC◇
          69.81        AC◇
TO   POLAR
          51.94        ◇
         113.24        ◇
```

The true heading is 51.94°. The actual ground speed is 113.24 knots.

The calculator uses storage location number 9 to store intermediate results while performing coordinate conversions. Any data in this location stored previous to using these functions is erased.

Appendix A
Inspection and Turn-on Procedures

Please check to see that all the accessories listed below are present when unpacking your HP-46. Also, inspect the calculator for damage which may have occurred during shipment. If you find any damage or if any accessories listed are missing, you should file a claim with the carrier and contact the nearest -hp- Sales and Service Office listed at the back of this guide.

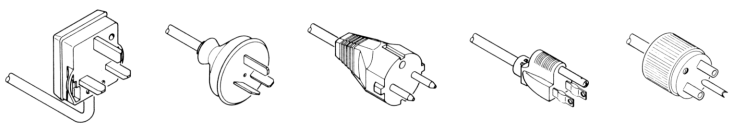
Accessories

Each HP-46 is furnished with these basic accessories:

DESCRIPTION	-hp- PART NUMBER
Operating Guide	00046-90005
Printer Paper (2 rolls)	9281-0415
Printer ribbon	9282-0511
Power Cord	(See below)
Dust Cover	4040-0528
Spare Fuses:	
½ A, 250 V slo-blo	2110-0202
¼ A, 250 V slo-blo	2110-0201
Travel case	5061-0707

Power cords with different plugs are available for the calculator. Each plug, together with the part number of the power cord which has that plug, is shown below. The cord packaged with each calculator depends upon where that calculator is to be delivered. If your calculator has the wrong power cord for your area, please contact the nearest -hp- Sales and Service Office.

Standard



8120-1351 8120-1369 8120-1689 8120-1378 8120-0698 *

* UL approved for use in the United States with calculators set for either 220V or 240V operation.

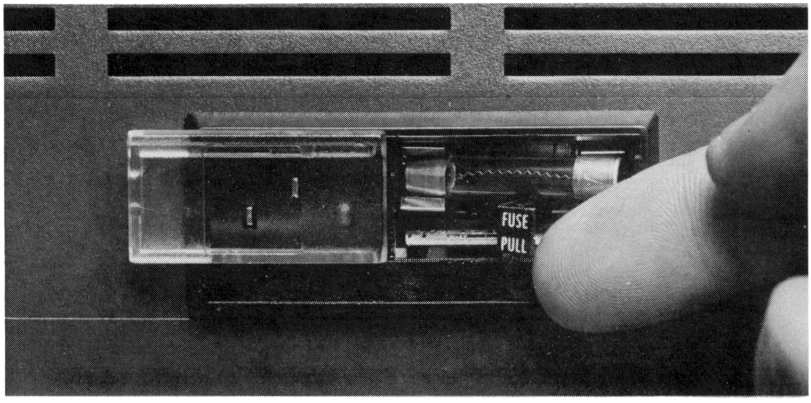
Turn-On Procedure

1. Before connecting the power cord to the back of your calculator, check the setting of the voltage selector card in the power module (see the following photos). The number visible indicates which voltage is set. The HP-46 operates on power line voltages of 100, 120, 220 and 240 volts ac, with a power line frequency of between 48 and 66 Hz. If the card is set to the available power line voltage, you may skip the next step and go to step three.

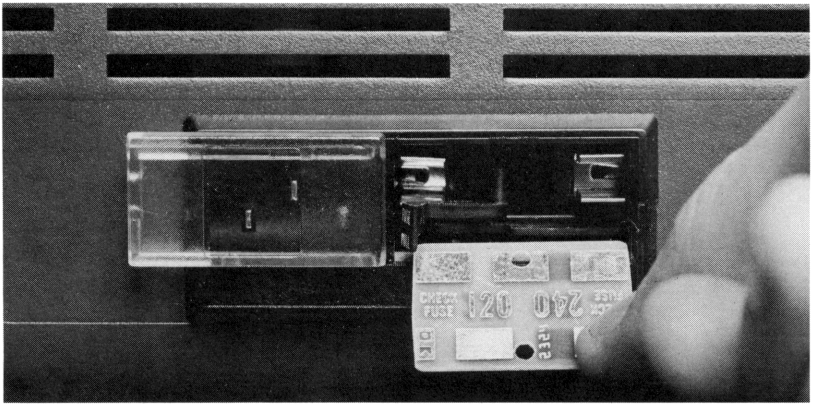
CAUTION

THE HP-46 CAN BE DAMAGED IF IT IS SWITCHED ON WHEN NOT SET TO THE CORRECT LINE VOLTAGE.

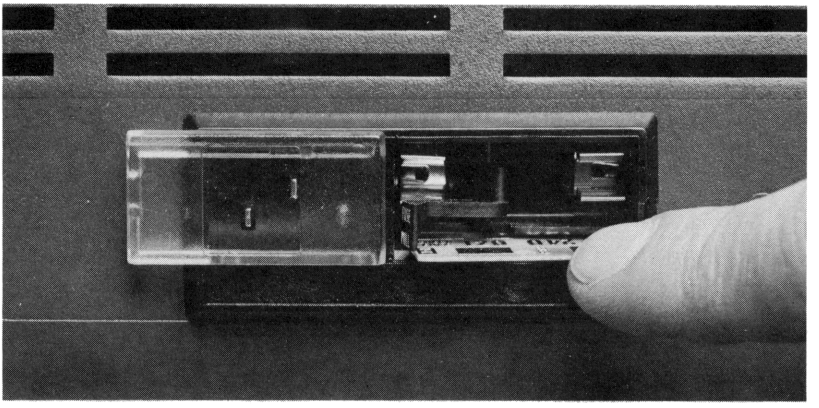
2. To reset the voltage selector card:



a. Slide the plastic window on the power module completely to the left; then remove the fuse by moving the FUSE PULL lever to the left.



b. Pry the voltage selector card out (use a pointed tool such as a ball-point pen) and re-insert it so that the number representing the available line voltage is readable.



c. Move the FUSE PULL lever to the right and insert the correct fuse for the new line voltage setting. Then slide the plastic window back to the right.

NOTE

For 100 and 120 volts ac operation, use a ½ A. fuse.
For 220 and 240 volts ac operation, use a ¼ A. fuse.

3. Plug the power cord into the back of the calculator and into a suitable power outlet. The calculator requires a maximum of 40 voltamps.

4. Turn your calculator ON by pressing the LINE switch. Each time the HP-46 is switched-on, the word CLEAR is printed (provided PRT OFF is released). To switch-off the calculator, merely press LINE again so that OFF is visible.

Your calculator meets current NEMA (National Electrical Manufacturers' Association) grounding standards provided that a 3-conductor power cord is used to supply power to the calculator from a suitably grounded outlet.

If your calculator does not operate as described above when switched on, see Service (Appendix D).

Appendix B

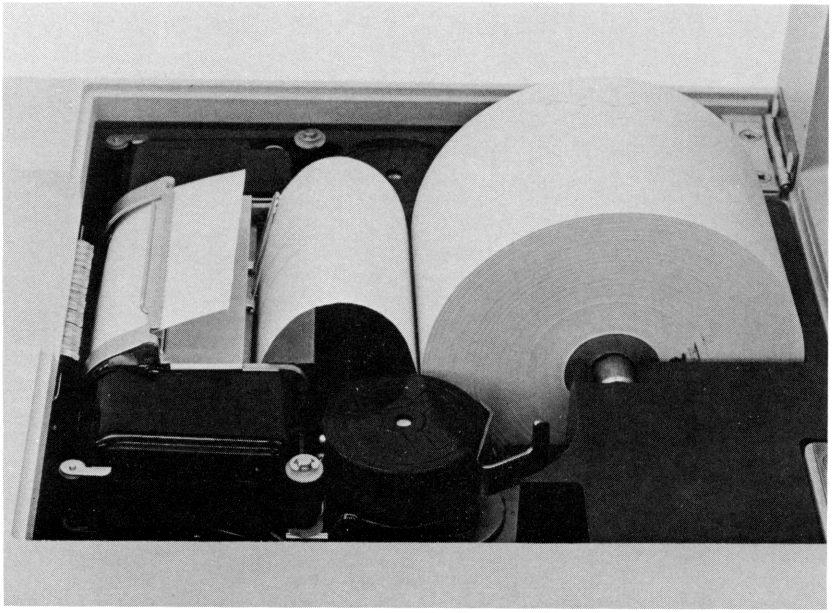
Maintenance

Installing Printer Paper

The calculator is furnished with two rolls of printer paper. If you wish to purchase paper other than that supplied by -hp-, many replacement products are available — just be sure to specify 2¼" wide, adding machine paper.

When replacing the printer paper:

1. Be sure to remove any remaining old paper before loading a new roll.
2. Insert the free end of the new paper as shown below, press the **PAPER↑** key and guide the advancing paper under the paper tear-off bracket.



Replacing the Printer Ribbon

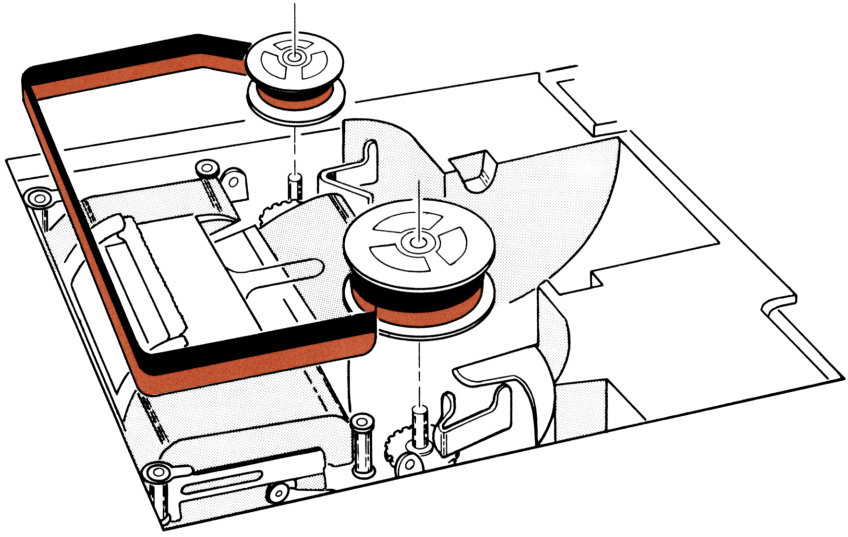
The printer ribbon supplied should give many months of reliable service, but when the printout becomes light or intermittent, the ribbon needs replacing. Any adding machine ribbon equivalent to the ribbon supplied with the calculator or either of the products listed below can be used as a replacement.

General Ribbon Co., type E200, black and red intense ribbon.

Columbia Ribbon Co., type 43, black-red record, double-spool ribbon.

When replacing the printer ribbon:

1. Notice the path of the old ribbon before removing it. (See drawing below.)
2. Be sure the black portion of the new ribbon is up when installed.
3. Press **PAPER↑** to draw the ribbon taut before closing the calculator top cover.

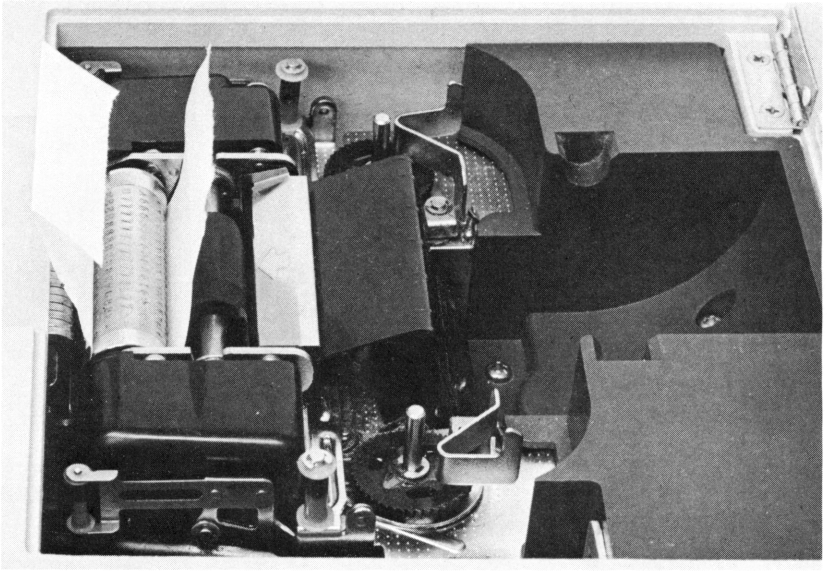


Cleaning the Printer

To ensure clear printouts, we recommend that the printer be cleaned at least every 3 months. The only equipment needed to clean the printer is a cleaning brush (any small, stiff-bristled brush will do) and a small amount of denatured (isopropyl) alcohol.

To clean the printer:

1. Remove the printer paper; then lift up the paper tear-off bracket and lift off the small, metal cover plate (see photo below).
2. Remove the ribbon and inspect it for wear; if it looks frayed or perforated — install a new one later.



3. Slide a strip of printer paper about 6" long, under and around the metal print drum as shown in the first photograph. This paper will catch any particles brushed from the print drum.
4. Use the stiff-bristled brush and a small amount of alcohol to clean each character on the print drum.

CAUTION

BE SURE NOT TO SPILL ALCOHOL ON ANY OF THE OTHER COMPONENTS.

5. After you've cleaned the drum, fold the paper as shown and slowly pull the paper back out from under the drum. Now blow any dust or remaining ribbon particles out of the printer.

6. Replace the small cover plate; snap the paper tear-off bracket back into place, replace the ribbon and the printer paper.

Cleaning the Calculator

The calculator can be cleaned with a soft cloth dampened either in clean water or in water containing a mild detergent. Do not use an excessively wet cloth nor allow water to penetrate inside the calculator. Also, do not use any abrasive cleaners, especially on the display window.

Appendix C

Operating Limits

Calculator Range

The HP-46 handles numbers up to 10^{100}. Calculations or data entries exceeding this range are printed (and displayed) as 9.999999999 99. The calculator also handles numbers as small as 10^{-99}. Calculations or data entries exceeding this range are printed (and displayed) as zero.

Accuracy

The accuracy of the HP-46 varies according to the operation being performed. Arithmetic operations and simple functions (+, −, x, ÷, 1/x, $\sqrt{x}$, n!, %, Δ%, x^2,) are accurate to within ±1 count in the tenth (least significant) digit.

The accuracy of the remaining operations can be expressed in terms of the original number. For example, if you calculate the natural log of 5, your answer would be 1.609437912. This answer is actually the natural log of some number between 4.999999998 and 5.000000002. It is accurate then, for the original number ±2 counts (N=2 for LN; see table below) in the tenth digit.

All operations are accurate for the original number ±N counts in the tenth digit. The values for N for each operation are listed below:

Operation	Value of N
Ln, Log, e^x	2
Trig Functions	3
To Pol, To Rec	3
10^x	7 for x
$\sqrt{x}$	3 for Σx^2, and 2 for Σx
y^x	4 for y, and 7 for x

Clear Functions

CL x — erases the current contents of X

CLEAR — erases the contents of X, Y, Z and T (the stack)

f CLEAR (ALL) — erases the stack and the 9 storage locations

f CL x (CLR) — erases the statistics storage locations 5-8 and the stack.

Appendix D

Service

If the calculator fails to turn on properly, check these possible causes:

1. Is the calculator set to operate on the correct line voltage?
2. Is the fuse burned out (look for a broken filament inside the fuse)? Follow steps 2a and 2c of the 'Turn-on Procedure' when checking or replacing the fuse.

Should the calculator print anything but 'CLEAR' when it is switched on, carefully press the following sequence of keys and compare the printout (and display, if installed) with those shown.

NOTE
Be sure PRT OFF is released (up).

1. Press: CLEAR

   Display: 0.00

2. Press: 1234567890

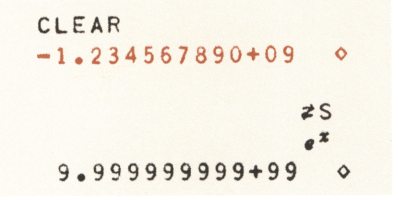
   Display: 1234567890.

3. Press: CHS PRINT

   Display: -1.234567890 09

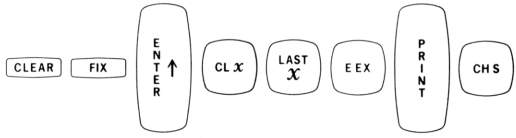
4. Press: CHS e^x PRINT

   Display: 9.999999999 99



If you suspect the operation of a particular function, find that function in one of the 5 test sequences which follow. Press [CLEAR ALL] and run through the key sequence comparing printouts (and display, if you have one).

A. To test these keys:



1. Press: CLEAR

2. Press: FIX 8 1 0 ENTER↑

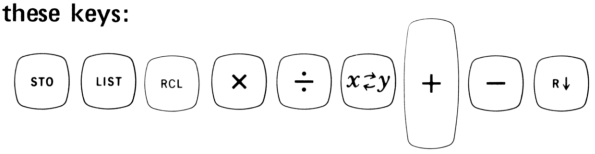
3. Press: CL x PRINT LAST x

4. Press: EEX 2 PRINT

5. Press: CHS PRINT

```
CLEAR
 10.00000000        ↑
  0.00000000        ◇

                  ← 0
 10.00000000
 1.000000000+02     ◇

                  ⇄S
-1.000000000+02     ◇
```

B. To test these keys:



1. Press: [ON] [CLEAR ALL] [FIX] [2]

2. Press: [3] [STO] [1]

3. Press: [5] [STO] [2]

4. Press: [8] [STO] [4]

5. Press: [9] [STO] [8] [LIST]

6. Press: [RCL] [8] [RCL] [4] [×] [PRINT]

7. Press: [RCL] [1] [÷] [PRINT]

8. Press: [RCL] [2] [−] [PRINT]

9. Press: [x⇄y] [PRINT] [+] [PRINT] [R↓] [PRINT]

```
CLEAR
          3.00    → 1
          5.00    → 2
          8.00    → 4
          9.00    → 8
LIST
          3.00    ← 1
          5.00    ← 2
          0.00    ← 3
          8.00    ← 4
          0.00    ← 5
          0.00    ← 6
          0.00    ← 7
          9.00    ← 8
          0.00    ← 9

                  ← 8
          9.00
                  ← 4
          8.00
                    ×
         72.00      ◇

                  ← 1
          3.00
                    ÷
         24.00      ◇

                  ← 2
          5.00
                    −
         19.00      ◇

                    ⇄
          9.00      ◇

                    +
         28.00      ◇

                    ↓
          8.00      ◇
```

C. To test these keys:

1. Press: [f] CLEAR (ALL) FIX 2

2. Press: 8 ENTER↑

3. Press: SIN PRINT [f] SIN (ASN) PRINT

4. Press: COS PRINT [f] COS (ACS) PRINT

5. Press: TAN PRINT [f] TAN (ATN) PRINT

6. Press: TO POL [f] TO POL (REC)

7. Press: 7 Σ+ 6 Σ+ [f] R↓ (x̄,Δ)

8. Press: [f] CL x (CLR)

```
CLEAR
                8.00      ↑
                          S
                0.14      ◇

                          AS
                8.00      ◇

                          C
                0.99      ◇

                          AC
                8.00      ◇

                          T
                0.14      ◇

                          AT
                8.00      ◇

TO   POLAR
               45.00      ◇
               11.31      ◇
TO   RECT
                8.00      ◇
                8.00      ◇
                7.00      Σ+
                6.00      Σ+
#               2.00      ◇
                0.71      Δ◇
                6.50      x̄ ◇

CLEAR
```

D. To test these keys:

1. Press: FIX 2 [shift] CLEAR ALL

2. Press: 1 2 1/x

3. Press: x⇄y [shift] 1/x (y^x) PRINT

4. Press: [shift] e^x (10^x) x² [shift] x² (√x) PRINT

5. Press: [shift] LN (LOG) LN PRINT

6. Press: e^x % [shift] % (Δ%)

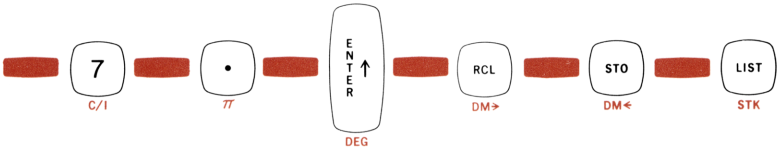
7. Press: [shift] x⇄y (n!) PRINT

8. Press: [shift] CHS (RAD) PRINT

9. Press: [shift] EEX (GRD) PRINT

```
CLEAR
          12.00      ½
                     ⇄
                     y^x
           1.00       ◇

                     10^x
                     x²
                     √
          10.00       ◇

                     lg
                     ln
           0.00       ◇

                     e^x
                     %
                     Δ%
NOTE          1
                     !
           1.00       ◇

                RAD
           1.00       ◇

                GRD
           1.00       ◇
```

E. To test these keys:



1. Press: FIX 2 [ ] CLEAR ALL

2. Press: [ ] 7 C/I

3. Press: [ ] • π

4. Press: [ ] ENTER ↑ DEG, PRINT

5. Press: [ ] RCL DM→, PRINT

6. Press: [ ] STO DM←, PRINT

7. Press: [ ] LIST STK

```
CLEAR
          2.54
          3.14
             D
          3.14          ◇

           DMS→
          3.24          ◇

           DMS←
        3.1416          ◇

          0.00      ←S◇
          0.00      ←S◇
          2.54      ←S◇
          3.14      ←S◇
```

If your printout results do not duplicate the sample, or if the calculator has a problem not checked by the above procedure (for example, if the **LINE** switch does not lock in place), return the calculator according to the instructions below.

Shipping Instructions

Please be sure that all items are protectively packed to avoid damage while in transit. Such damage would not be covered by warranty. Also, you should insure your shipment.

When returning your calculator for service:

1. Remove the roll of printer paper and the spindle,
2. Fill out the Service Card and place it back in its pocket under the calculator top-cover.
3. Pack the calculator in its travel case.
4. Carefully pack the travel case in a large cardboard box.
5. Return your calculator to the nearest service location listed on the next page and mark it, Attention: Calculator Service. If it is more convenient, you can send the calculator back to the factory. Follow the shipping instructions but send the calculator to the following address.

Hewlett-Packard
815 14th Street S.W.
Loveland, Colorado 80537

Attn: Calculator Service

If you have any questions or problems regarding calculator service, please call the nearest -hp- Sales and Service Office listed on pages 58 and 59.

SALES & SERVICE OFFICES

UNITED STATES

CALIFORNIA
1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000
TWX: 910-592-1288

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

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

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

CUSTOMER SERVICE CENTER
333 Logue Avenue
Mountain View, California 94040

CANADA

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire H9R 1G7
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20607

AFRICA, ASIA, AUSTRALIA

ANGOLA
Telectra-Empresa Tecnica de Equipamentos Electricos SARL
Rua de Barbosa, Rodrigues, 42-1°, D1°
P.O. 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: 31 024

Hewlett-Packard Australia Pty. Ltd.
31 Bridge Street
Pymble,
New South Wales, 2073
Tel: 449 6566
Telex: 21561
Cable: HEWPARD Sydney

Hewlett-Packard Australia Pty. Ltd.
97 Churchill Road
Prospect 5082
South Australia
Tel: 44 8151
Cable: HEWPARD Adelaide

Hewlett-Packard Australia Pty. Ltd.
Casablanca Buildings
196 Adelaide Terrace
Perth, W.A. 6000
Tel: 25-6800
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.
2nd Floor, 49 Gregory Terrace
Brisbane, Queensland, 4000
Tel: 29 1544

CEYLON
United Electricals Ltd.
P.O. Box 681
60, Park St.
Colombo 2
Tel: 26696
Cable: HOTPOINT Colombo

CYPRUS
Kypronics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
CY-**Nicosia**
Tel: 45628/29
Cable: KYPRONICS PANDEHIS

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
Connalight Centre
39th Floor
Connaught Road, Central
Hong Kong
Tel: 240168, 232735
Telex: HX4766
Cable: SCHMIDTCO Hong Kong

INDIA
Blue Star Ltd.
Kasturi Buildings
Jamshedji Tata Rd.
Bombay 400 020
Tel: 29 50 21
Telex: 3751
Cable: BLUEFROST

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 4093
Cable: FROSTBLUE

Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 3751
Cable: BLUESTAR

Blue Star Ltd.
14/40 Civil Lines
Kampur 208 001
Tel: 6 88 82
Cable: BLUESTAR

Blue Star, Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Telex: 655
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House,
34 Ring Road
Lajpat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 2463
Cable: BLUESTAR

Blue Star, Ltd.
Blue Star House
11-11A Magarath Road
Bangalore 560 025
Tel: 55668
Telex: 430
Cable: BLUESTAR

Blue Star, Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 7 63 91, 7 73 93
Cable: BLUEFROST
Telex: 459

Blue Star, Ltd.
23/24 Second Line Beach
Madras 600 001
Tel: 23954
Telex: 379
Cable: BLUESTAR

Blue Star, Ltd.
Nathraj Mansions
2nd Floor Bistupur
Jamshedpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240

INDONESIA
Bah Bolon Trading Coy. N.V.
Dialah Merdeka 29
Bandung
Tel: 4915; 51560
Cable: ILMU
Telex: 08-809

IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-**Teheran**
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2893 MCI TN

ISRAEL
Electronics & Engineering Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724

Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA

Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisasazima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171

Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-4-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.
Rm. 603 3,
2-Chome
IZUMI-CHO,
Mito, 310
Tel: 0292-25-7470

KENYA
Kenya Kinetics
P.O. Box 18311
Nairobi, Kenya
Tel: 57726
Cable: PROTON

KOREA
American Trading Company Korea,
I.P.O. Box 1103
Dae Kyung Bldg., 8th Floor
107 Sejong-Ro,
Chongro-Ku, **Seoul**
Tel: (4 lines) 73-8924-7
Cable: AMTRACO Seoul

LEBANON
Constantin E. Macridis
P.O. Box 7213
RL-**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, Lta.
162, Av. D. Luis
P.O. Box 107
Lourenco Marques
Tel: 27091, 27114
Telex: 6-203 Negon Mo
Cable: NEGON

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
94-96 Dixon Street
P.O. Box 9443
Courtenay Place,
Wellington
Tel: 59-559
Telex: 3898
Cable: HEWPACK Wellington

Hewlett-Packard (N.Z.) Ltd.
Pakuranga Professional Centre
267 Pakuranga Highway
Box 51092
Pakuranga
Tel: 569-651
Cable: HEWPACK, Auckland

NIGERIA
The Electronics Instrumentations Ltd. (TEIL)
144 Agege Motor Rd., Mushin
P.O. Box 6645
Lagos
Cable: THETEIL Lagos

The Electronics Instrumentations Ltd. (TEIL)
16th Floor Cocoa House
P.M.B. 5402
Ibadan
Tel: 22325
Cable: THETEIL Ibadan

PAKISTAN
Mushko & Company, Ltd.
Oosman Chambers
Abdullah Haroon Road
Karachi 3
Tel: 511027, 512927
Cable: COOPERATOR Karachi

Mushko & Company, Ltd.
38B, Satellite Town
Rawalpindi
Tel: 41924
Cable: FEMUS Rawalpindi

PHILIPPINES
Electromex, Inc.
6th Floor, Amalgamated Development Corp. Bldg.
Ayala Avenue, Makati, Rizal
C.C.P.O. Box 1028
Makati, Rizal
Tel: 86-18-87, 87-76-77, 87-86-88, 87-18-45, 88-91-71, 83-81-12, 83-82-12
Cable: ELEMEX Manila

SINGAPORE
Mechanical & Combustion Engineering Company Pte., Ltd.
10-12, Jalan Kilang
Red Hill Industrial Estate
Singapore, 3
Tel: 647151 (7 lines)
Cable: MECOMB Singapore

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

SOUTH AFRICA
Hewlett Packard South Africa (Pty.), Ltd.
Hewlett-Packard House
Daphne Street, Wendywood,
Sandton, Transvaal 2001
Tel: 407641 (five lines)

Hewlett Packard South Africa (Pty.), Ltd.
Breecastle House
Bree Street
Cape Town
Tel: 2-6941/2/3
Cable: HEWPACK Cape Town
Telex: 0006 CT

Hewlett Packard South Africa (Pty.), Ltd.
641 Ridge Road, Durban
P.O. Box 99
Overport, Natal
Tel: 88-6102
Telex: 567954
Cable: HEWPACK

TAIWAN
Hewlett Packard Taiwan
39 Chung Shiao West Road
Sec. 1
Overseas Insurance Corp. Bldg. 7th Floor
Taipei
Tel: 389160,1,2, 375121, Ext. 240-249
Telex: TP824 HEWPACK
Cable: HEWPACK Taipei

THAILAND
UNIMESA Co., Ltd.
Chongkoinee Building
56 Suriwongse Road
Bangkok
Tel: 37956, 31300, 31307, 37540
Cable: UNIMESA Bangkok

UGANDA
Uganda Tele-Electric Co., Ltd.
P.O. Box 4449
Kampala
Tel: 57279
Cable: COMCO Kampala

VIETNAM
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Operating Notes

If you attempt a calculation beyond the range of the machine or one with a logic error – say division by zero – an operating note is printed. These notes are listed below together with a brief explanation of each.

NOTE 1 Division by zero
Standard deviation of less than two entries

NOTE 2 LN or LOG of a negative number or zero
Negative y to a power

NOTE 3 Arc sine or arc cosine of a number whose magnitude is greater than 1
Conversion to or from degrees-minutes-seconds of an angle greater than 10^5 degrees

NOTE 4 Square root of a negative number
Factorial of a negative number or non-integer
Overflow or underflow of Σx^2
Deletion of data which was never entered using the $\Sigma+$ key.

These notes are also printed under the lid of your calculator.

If you have the display option, errors will be indicated by a display, like the one shown, in addition to the printed notes.

Part No. 00046-90005
Microfiche No. 00046-99005

Printed in U.S.A.
Dec. 1973