HP-35


-1.234567809 35
OFF ON
x^y log ln e^x CLR
$\sqrt{x}$ arc sin cos tan
$1/x$ $x \rightleftarrows y$ R↓ STO -RCL
ENTER↑ CH S E EX CL x
− 7 8 9
+ 4 5 6
× 1 2 3
÷ 0 · π
HEWLETT • PACKARD


- 1.234567809 - 35
2
1
OFF
ON
x^y
log
ln
e^x
CLR
$\sqrt{x}$
arc
7
sin
cos
tan
3
1/x
$x \rightleftarrows y$
R↓
STO
8
RCL
5
CH S
E EX
CL x
ENTER↑
7
8
9
6
4
4
5
6
1
2
3
0
.
π
HEWLETT • PACKARD

1. POWER ON-OFF SWITCH
2. DISPLAY
3. CLEAR KEYS
4. ENTRY KEYS
5. CONTROL KEYS
6. ARITHMETIC KEYS
7. FUNCTION KEYS
8. MEMORY KEYS

HP's interest in computation evolved as a natural extension of our traditional involvement in measurement problem solving. At an early date, HP recognized the growing need for a family of computational products uniquely designed for ease of interface with scientific instrumentation.

In 1966 we introduced the first digital minicomputer specifically designed to meet this need. Soon after, we followed up with our first programmable calculator. From these modest beginnings, HP has now become an acknowledged leader in the field of computational problem solving. Over 10,000 HP programmable calculators and more than 3000 HP digital computers are now at work in a wide range of scientific, industrial, and educational applications. Their effectiveness is further enhanced by a complete line of peripherals — ranging from digital tape and disc drives to card and tape readers, printers, and plotters.

Now we've coupled our experience in scientific problem solving and computational technology to bring you a new dimension in personal computing — — the HP-35 Pocket Calculator.

HEWLETT hp PACKARD

HP-35

operating manual

HEWLETT-PACKARD
10900 WOLFE ROAD, CUPERTINO, CALIFORNIA, 95014

FOR THE CURIOUS

Most of the reasons which motivated you to purchase the Hewlett-Packard-35 Pocket Calculator also motivated us to produce it. Conceptually, the HP-35 is pure and straightforward. It is the electronic sliderule that was available only to fictional heroes like James Bond, Walter Mitty, and Dick Tracy, but is now a reality.

Historically, it is significant that the physical esthetics and keyboard functions had design priority over the electronic interior. This accounts for the handsome styling, efficient keyboard arrangement, and convenient operating characteristics of your HP-35. It also accounts for the truly innovative electronic design required to compact the complex functions residing in the HP-35 into such a small volume.

From a technical viewpoint, the operational stack and reverse Polish (Lukasiewicz) notation used within the HP-35 are solidly based upon computer theory. The two team up to become the most efficient method known for evaluating arithmetic expressions.

You will appreciate the accuracy and broad dynamic range offered by the HP-35. An accuracy of ten significant digits exceeds the precision to which most of the physical constants of the universe are known. The fact that your HP-35 will perform calculations with this accuracy and maintain the proper decimal position throughout a nearly 200-decade range is reassuring.

The speed and convenience with which you arrive at a solution to a problem is a definite asset. You will find that fewer mistakes occur because computations are easier to make and that verification is fast and positive. You will also find yourself performing calculations which you did not consider in the past. They fall into three categories: first are those calculations within your own profession which, up to now were evaluated by an educated guess. The ability to expediently resolve an estimate into a fact wherever you are and whenever the situation arises will definitely enhance your professional stature. The second category consists of those calculations indirectly related to your profession — computing the return on an investment, reconciling your bank account, pursuing your hobby with professional precision, etc. (An example appears in the Sample Problems section of this manual.) The last category contains those exploratory calculations that can only be classified as computational fun. They go by the name of "Did you know . . . ?". For example, did you know that one cubic mile of air weighs more than 10^{10} pounds?

Did you know that a man running a 4-minute mile turns 100 yards in a little more than 13.6 seconds?

Did you know that 355/113 is an incredibly good approximation to π?

When a curious person, which you are or you wouldn't be reading this, possesses an excellent computing machine, which the HP-35 is, then nice things happen. Since you have already demonstrated that you are a curious person, why not check and see just how close 355/113 does approximate π. Although the rest of this manual must be read, just between the two of us, you can't hurt the calculator by sliding the power switch to ON and pressing a few keys.

To check the approximation, key in 355, then press ENTER↑ and key in the denominator, 113. Now press ÷ to get the quotient. The approximation is now in the display. Let us now subtract the true value of π (to ten significant digits) from the approximation. Press π and −. It's closer than one would think (2.66×10^{-7}). To find the percent error, divide this difference by π and multiply by 100. (π, ÷, **100, X**). We now know that 355/113 approximates π to within 8.47 millionths of one percent. (It makes the old approximation of 22/7 look pretty sad.) Two final comments: (1) it is easy to remember the approximation because it is made by duplicating the first three odd numbers and inserting a division in the middle 113 $\overline{)355}$; (2) you have just evaluated the expression $(355/113 - \pi) \times (100/\pi)$. Congratulations . . . by the way, switch the calculator off and put it away. You are not supposed to know how it works, yet.

Table of Contents

Your HP-35 Pocket Calculator is an easy-to-use, scientific, personal-size calculator. It is capable of performing operations from the very simple to the very complex, such as are encountered in business, educational, scientific, and engineering problems.

Your HP-35 was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect working order upon receipt. Carefully inspect your HP-35 for physical damage caused in transit. If it is damaged, file a claim with the carrier and return the HP-35 to Hewlett-Packard. Refer to Service section, page 35.

ACCESSORIES
STANDARD

Your HP-35 comes complete with the following accessories:
(To reorder, see the Order Card in the back cover pocket of this manual.)

ACCESSORY	MODEL/PART NO.
• Battery Pack	03501A
• Battery Charger/AC Adapter	03502A
• Safety Travel Case	03503A
• Soft leather Carrying Case	03505A
• Operating Manual	00035-90008
• Four personalized labels	7120-2946

The personalized labels are provided for your convenience. Type your name or other identification on each label and affix to calculator, battery charger, and travel safety case.

ACCESSORIES (Cont'd)

OPTIONAL

Optional accessories for your HP-35 are specified on the Order Card in the back cover pocket of this manual. We will send you new Order Cards as additional optional accessories are added to our product line.

A Model 03504A Battery Holder and Pack is an accessory used in conjunction with your battery charger and consists of a charging attachment and a spare battery pack. Using this accessory permits the charging of a spare battery pack at one location while battery-operating the calculator at another.

SPECIFICATIONS

OPERATIONS

ARITHMETIC: $+, -, \times, \div$

LOGARITHMIC: $\log x$, $\ln x$, e^x

TRIGONOMETRIC: $\sin x$, $\cos x$, $\tan x$ [(x in degrees)]; arc $\sin x$, arc $\cos x$, arc $\tan x$

MISCELLANEOUS: x^y, $1/x$, π, $\sqrt{x}$, plus data storage and positioning operations

CALCULATING SPEED

ARITHMETIC: 150 ms, maximum

OPERATION	TYPICAL (ms)	MAXIMUM (ms)
$+, -$	60	70
$\times, \div$	100	150

LOGARITHMIC: 200 ms, typ (300 ms, max)

TRIGONOMETRIC: 500 ms, typ (900 ms, max)

MISCELLANEOUS:

OPERATION	TYPICAL (ms)	MAXIMUM (ms)
x^y	400	700
$1/x$	100	150
$\sqrt{x}$	110	180

NUMERIC NOTATION

FLOATING POINT: 10 digits and sign, of any absolute value from 10^{-2} to 10^{10} (e.g., .01 through 9999999999.)

SCIENTIFIC: An integer and sign with nine decimal digits, and a two-digit exponent and sign for any value outside the floating point range.

MIXED FLOATING POINT AND SCIENTIFIC: Mixed numeric notation may be entered as data. After performance of any operation, data reverts to floating point or scientific notation, as applicable.

DYNAMIC RANGE: 10^{-99} through 10^{99} (nearly 200 decades)

ACCURACY: see Accuracy statement

VALUE LIMITS: see Value Limits statement

AIRBORNE USE: see RFI statement

READOUT

NUMERIC: 7-segment light-emitting diode (LED)
SIGN, DECIMAL POINT: Single-segment LED for each

MAXIMUM DISPLAYABLE NUMBER:
$\pm 9.999999999 \times 10^{99}$

SPECIFICATIONS (Cont'd)

MINIMUM DISPLAYABLE NUMBER: 0.

SPECIAL INDICATIONS
Overflow: maximum displayable number
Underflow: minimum displayable number
Low Battery: All decimal points light
Improper Operation: 0.; displayed flashing
Trailing Zeros: Blanked

NUMBER OF KEYS: 35

NUMBER OF REGISTERS: 5 total
OPERATIONAL STACK: 4 registers
MEMORY: 1 register

POWER

DC
Source: Integral battery pack, consisting of three rechargeable, nickel-cadmium batteries
Operating Time: 3 to 5 hours

AC
Source Voltage: Selectable 115V or 230V (+10, -5 percent)
Source Frequency: 50 or 60 Hz, nominal

PACKAGING

CALCULATOR CASE: High-impact plastic (ABS)
ELECTRONICS: Extensive use of Large Scale Integration (LSI) circuits

WEIGHT:
CALCULATOR: 9.0 oz (0.25 Kg)
SHIPPING: 2.2 lb (1.0 Kg), approximate

DIMENSIONS

CALCULATOR: 3-1/4 x 5-7/8 x 1-1/4 inches (8.26 x 14.92 x 3.18 cm)
TRAVEL SAFETY CASE: 11 x 5-1/4 x 2-3/8 inches (27.94 x 13.34 x 6.03 cm)

TEMPERATURE RANGES

OPERATING: 0° to $+40^{\circ}$C

CHARGING: $+10^{\circ}$ to $+40^{\circ}$C

STORAGE: -40° to $+55^{\circ}$C

ACCURACY

The accuracy of the HP-35 depends on the operation being performed. Elementary operations such as add, subtract, multiply, divide, reciprocal, and square root have a maximum error of ± one count in the tenth (least significant) digit. Errors in these operations are caused by rounding answers to the tenth (least significant) digit. An example of round off error is seen when evaluating $(\sqrt{5})^2$. Rounding $\sqrt{5}$ to 10 significant digits gives 2.236067977. Manually squaring the result gives a number less than 5 (4.999999997978. . .). If the next largest approximation to $\sqrt{5}$ (2.236067978) is squared, you obtain 5.000000002237. . . . In other words, a 10-digit number does not exist which, when squared, yields 5.000000000.

The accuracy of the remaining operations (trigonometric and exponential) is dependent upon their input argument. When evaluating these operations, the answer that is displayed will be the correct value for an input argument within ± n counts in the tenth (least significant) digit of the original input argument. Trigonometric operations have an additional accuracy limitation of $\pm 1 \times 10^{-10}$ in the displayed answer. Values for n are:

OPERATION	VALUE OF N
$\log x$, $\ln x$, and e^x	2
trigonometric	3
x^y	1 for x, 2 for y

SPECIFICATIONS (Cont'd)

VALUE LIMITS

The following value limits, if exceeded, cause a flashing zero to be displayed. An improper operation is therefore indicated. Pressing **CL**x resets an improper operation condition.

OPERATION	VALUE LIMITS
arc sin x, arc cos x	$\|x\| \leqslant 1$
$1/x$, $\div$	$x \neq 0$
$\sqrt{x}$	$x \geqslant 0$
log x, ln x, x^y	$x > 0$

RFI

The HP-35 Pocket Calculator meets the Radio Frequency Interference (RFI) standards developed by the Radio Technical Commission for Aeronautics Special Committee 88, entitled Interference to Aircraft Electronic Equipment from Devices Carried Aboard, paper 39-63/DO-119, April 12, 1963.

POWER TURN-ON

Your HP-35 is a completely self-contained, portable calculator. The integral battery pack has sufficient power to provide three to five hours of continuous operation. By turning off the power when the calculator is not in immediate use, the HP-35 battery power may easily last throughout a normal working day. For your convenience, the HP-35 turns on in a cleared condition. The versatility of the HP-35 power operating modes let you

- operate from the battery pack
- operate from ac power while charging the battery pack
- operate from ac power with the battery pack removed

BATTERY OPERATION

Hewlett-Packard ships your HP-35 fully-assembled, with battery pack in place, and ready to operate. With battery charger disconnected, slide the power switch to ON. You should see a zero and a decimal point displayed. If any other indication is present, refer to Battery Pack, Low Power Indications, page 33.

AC LINE OPERATION

Operation of your HP-35 from ac power is as follows:

CAUTION

To prevent damage, check the position of the line voltage select switch on the battery charger. For 115 VAC source power, slide the switch to 115V. For 230 VAC source power, slide the switch to 230V.

1. Ensure power switch is OFF.

2. Insert battery charger plug into connector at back of HP-35.

3. Insert power plug of battery charger into power receptacle.

4. Slide power switch to ON and observe that a zero and a decimal point are displayed.

Know Your HP-35

This section contains general information about the HP-35, which will help you to operate the calculator effectively.

RANGE

Your HP-35 is an extremely powerful instrument with a wide range of capabilities. It may be efficiently used to perform calculations ranging from the simple adding-machine type of calculation to highly sophisticated scientific computations. The HP-35 accepts data, performs calculations, and displays answers throughout a nearly 200-decade dynamic range (10^{-99} through 10^{99}). All calculations are performed to ten significant digits.

NOTATION

The HP-35 uses a flexible input format that accommodates integers, floating point, and both normalized and un-normalized scientific data inputs of both positive and negative numbers.

EXAMPLE:

.001177	(floating point)
1.177×10^{-3}	(scientific)
$.1177 \times 10^{-2}$	(mixed floating point and scientific)

The HP-35 requires that negative numbers be entered with the **CH S** (change sign) key. Exponents are entered by first pressing the **E EX** (enter exponent) key, then entering the numeric power of 10.

EXAMPLE: To enter $-.0136 \times 10^{-9}$

you press: CH S . 0 1 3 6 E EX CH S 9

and see: - . 0 1 3 6 - 0 9

DISPLAY

The display is made up of light-emitting diodes (LED's). Since they are semiconductors, they, like their transistor cousins, exhibit extremely long life and high reliability.

The display also:

- displays a zero and blinks continuously for improper operations
- is blanked during computations
- lights all decimal points to show the low battery power condition
- is entirely blank with an extremely low power condition

Refer to Battery Pack, Low Power Indications, page 33 if either low power condition exists.

All answers, intermediate results, or recalls from storage are displayed in one of the following formats:

1. Numbers equal to or larger than 10^{-2} and smaller than 10^{10} are displayed in floating point; e.g., 1234. 567 is displayed as 1 2 3 4 . 5 6 7.
2. Numbers beyond this range are displayed in normalized scientific notation; e.g., an integer and as many as nine fractional decimal digits suffixed with a power of 10 exponent. (6.02×10^{23} would be displayed as:

6 . 0 2 2 3

OVERFLOW AND UNDERFLOW

Any computation or data entry resulting in a magnitude equal to or greater than 10^{100} causes 9.999999999 99 ($9.999999999 \times 10^{99}$) to be displayed. Computations or data entries having a magnitude less than 10^{-99} sets the display to zero.

IMPROPER OPERATIONS

If you attempt an improper operation, such as division by zero, the display blinks continuously and displays a zero. To reset this alarm condition, press **CL**x. The following operations are improper operations:

- Division by zero
- Square root of a negative number
- In x, log x or x^y, where $x \leq 0$
- arc sin x or arc cos x, where $|x| > 1$

DECIMAL POINTS

All decimal points light in the display when 5 to 10 minutes of operation time remain in the battery pack. Operating the calculator for more than 5 to 10 minutes after this low power condition first occurs may result in erroneous computations. The battery pack must be recharged by connecting the HP-35 to the battery charger.

NOTE

Switching from battery pack to ac line operation requires that the HP-35 be turned off during power source transfer. Therefore, all data is lost.

The calculator is operable throughout the charging cycle. The HP-35 can be operated continuously from the ac line if desired. There is no danger of overcharging the battery pack.

Even when all decimal points are turned on, the true decimal position is known because an entire digit position is allocated to the true decimal position.

EXAMPLE:

YOUR FIRST PROBLEMS

Let's do some simple problems to demonstrate the ease with which calculations are made on your HP-35.

EXAMPLE: To find the reciprocal of 4

you press	and see
4	**4.**
1/x	.25

EXAMPLE: To find the sin 30°

you press	and see
30	**30.**
sin	.5

Consider the equation

$$T = RC \ln\left(1 + \frac{V_1}{V_2}\right).$$

If we were evaluating this by hand, we would first divide V_1 by V_2, add 1, take the natural logarithm of the sum, multiply it by R, then multiply it again by C. This is precisely the process used to evaluate the equation on the HP-35. To obtain a preview of the power and convenience of the HP-35, the keys used to evaluate the equation are:

YOUR FIRST PROBLEMS (Cont'd)

you press	comment
V_1	
ENTER↑	
V_2	
÷	**divide V_1 by V_2**
1	
+	**add 1**
ln	**take natural logarithm of sum**
R	
×	**multiply it by R**
C	
×	**multiply again by C.**

The purpose of the **ENTER↑** key becomes apparent when real numbers are used in the equation. The key must be used to signify that the final digit in V_1 has been entered and that the next digit is the first digit of V_2.

With this brief introduction to the HP-35, evaluate the equation for $V_1 = 2$, $V_2 = 3$, $R = 4$, $C = 5$.

Did you obtain 10.21651248 by pressing

2 ENTER↑ **3** ÷ **1** + ln **4** × **5** × ?

Before evaluating more equations let's get into some details on data entry, displays, operational stacks, and other items that will answer any questions that you may have.

REGISTERS AND STACK

A register is a storage device that "remembers" data. Data stays in a register until it is either replaced by new data or cleared. When you clear a register, the old data is discarded and replaced with a zero.

Your HP-35 has five registers. Four of the registers are arranged into an "operational stack" while the remaining register is used for storing constants. (Registers are named with capital letters while the data contained within the register is signified with a corresponding italicized lower case letter.)

OPERATIONAL STACK

Contents	Register
t	T
z	Z
y	Y
x	X

The operational stack consists of four registers, X, Y, Z and T. The contents of the stack are x, y, z and t respectively. The operational stack stores intermediate answers as they occur and automatically brings them into position when they are required for future calculations.

To gain more insight into the power and convenience of the operational stack, let us return to the previous example and show how the stack operates when evaluating the expression:

$$T = RC \ln\left(1 + \frac{V_1}{V_2}\right).$$

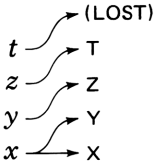
The following example shows how the stack functions in an actual computation.

Bottom row: shows successive keystrokes used to evaluate the expression.
Top four rows: show the contents of the stack following each keystroke.
The bottom of the stack (X register) is always displayed.

t											
z											
y		V_1	V_1		V_1/V_2			$\ln(1 + V_1/V_2)$		R In ( )	
DISPLAY x	V_1	V_1	V_2	V_1/V_2	1	$1 + V_1/V_2$	$\ln(1 + V_1/V_2)$	R	R In ( )	C	RC In ( )
KEY	V_1	ENTER	V_2	÷	1	+	ln	R	X	C	X

The previous example demonstrates basic characteristics of the operational stack.

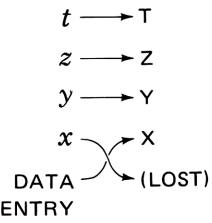
1. ENTER↑ Raises the stack.



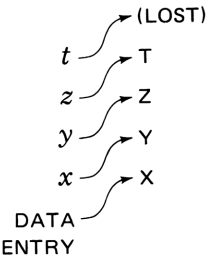
The diagram is a convenient shorthand stating that x, (the contents of the X register) remains in X and is duplicated into the Y register. Simultaneously, y is raised into Z and z into T. The contents of the T register are lost. Notice that an entry into X which follows **ENTER** ↑ (or **CL**x or **STO**) simply replaces x with the value being entered. Entries following other operations raise the stack by performing an automatic **ENTER**↑ when the first digit of a new entry is pressed.

DATA ENTRY AFTER

CL x STO ENTER↑

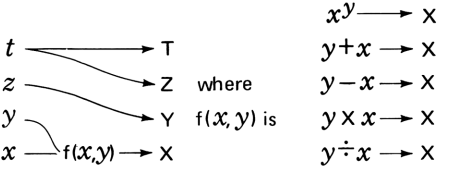


OTHER OPERATIONS



2. Two argument functions (+, −, X, ÷, and x^y) operate on data in the X and Y registers. Pressing the associated key places the result in X and drops the stack.

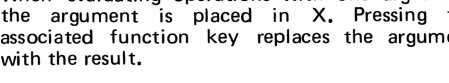
REGISTERS AND STACK (Cont'd)



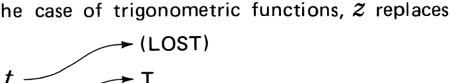
Notice that t remains in T as well as being duplicated into Z. Also remember that divisions, subtractions, and raising a number to a power all have x and y arranged just as they are in the stack; i.e.,

$$\frac{y}{x} \rightarrow X, \quad \underline{y \over -x} \rightarrow X, \text{ and } x^y \rightarrow X.$$

3. When evaluating operations with one argument, the argument is placed in X. Pressing the associated function key replaces the argument with the result.



In the case of trigonometric functions, z replaces t.



Trigonometric computations require one more internal register than any other operation. Rather than imbedding the extra register internally, it has been made available for use as the T register, with the stipulation that z is duplicated into the T register following a trigonometric operation.

Before getting into details about accuracy, range limits, etc., let's evaluate another expression.

$$\frac{(2+3)\times 4/5}{\sin 30^\circ} \times 4^{-1.5} = 1$$

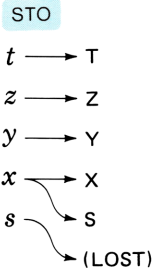
t															
z												8	8		
y		2	2		5		20		4	4		8	-1.5	-1.5	8	
DISPLAY x	2.	2.	3.	5.	4.	20.	5.	4.	30.	.5	8.	-1.5	-1.5	4.	.125	1.
KEY	2	↑	3	+	4	X	5	÷	30	sin	÷	-1.5	↑	4	x^y	X

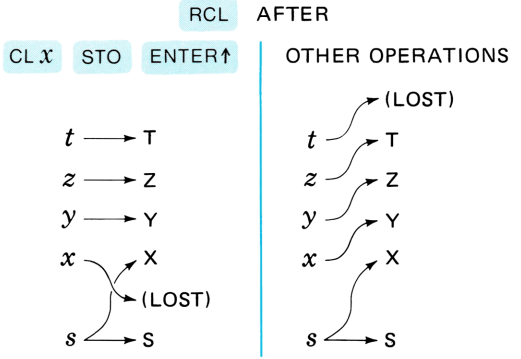
Remember that -1.5 is entered as CH S **1 . 5**

Notice that this is the sample problem shown on the instruction panel on the back of your calculator.

REGISTERS AND STACKS (Cont'd)

To complete the introduction to your HP-35, you should be aware of an additional storage register which can be used to store intermediate results or constants. Any number in the X register is stored by simply pressing **STO.** To recall a number from storage, press **RCL.**





Since **RCL** is identical to keying in the stored value, the stack is not raised when **RCL** follows **CL*x*, STO**, or **ENTER↑** .

The front cover foldout shows the six classes of keys. Each class of key is described in this section. To further expand your ability in using the HP-35, spend some time in the Sample Problems section of this manual, see page 36.

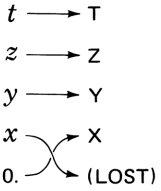
CLEAR KEYS

CLR

(CLEAR ALL REGISTERS) Replaces the contents of ALL registers with zero. Initial power-on has the same effect.

CL x

(CLEAR X) Replaces the contents of the X register with zero. This key is used most often to change an incorrectly-entered number.



ENTRY KEYS

0 Thru 9

Provides for the numeric entry of data from the keyboard into the X-register. Data enters from the left, with the most significant digit entered first.

.

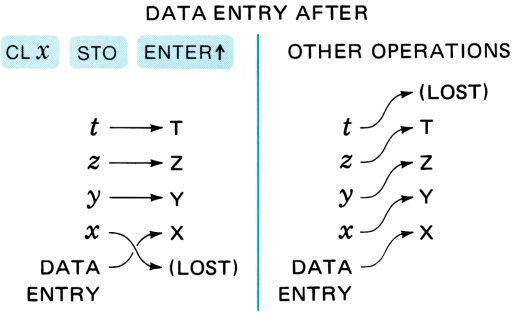
For your convenience, the 5 key has a Homing Key top.

EXAMPLE: To demonstrate the entry of 12.3

you press	and see
1	1 .
2	1 2 .
.	1 2 .
3	1 2 . 3

ENTRY KEYS (Cont'd)

Notice that the decimal point entry caused no visual change in the display, except for a slight blink when the key is pressed.



E EX (ENTER EXPONENT) Causes the next digits on **CH S** to effect the exponent portion of the digit entry. The exponent can be changed without clearing, by simply continuing with the entry of the correct two-digit exponent.

EXAMPLE: To correctly enter 55.6×10^{42}

you press	and see	
55.6	55.6	
E EX	55.6	
32 (mistake)	55.6	32
42 (correct)	55.6	42

Notice that pressing **E EX** caused no visual change in the display.

The HP-35 automatically inserts the integer 1 if only an exponent is entered.

EXAMPLE: To enter 1×10^3

you press	and see
E EX	1.
3	1. 03

A negative exponent requires that **CH S** MUST immediately follow **E EX**, otherwise **CH S** is ignored.

CH S

(CHANGE SIGN) Changes the sign of the number. After pressing **E EX**, changes the sign of the exponent. To change sign of an exponent already entered, X register must be cleared and data reentered.

CH S may be thought of in two ways:

- as a negation operator applied to the existing number in X
- as the first entry of a new, negative number (not affixed and ignored if followed by π or **RCL**)

If **CH S** precedes a keyboard entry of **0** through **9** **.** , or **E EX** , a minus sign is affixed to the new data entry. Otherwise, the **CH S** applies to the existing number in X.

EXAMPLE: To demonstrate affixing minus sign to new data entry, by using Pi.

you press	and see
π	3.141592654
CH S	-3.141592654
5	-5.

π

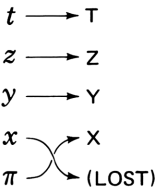
Pi is retained in Y as a positive number.

π is raised to Y as a positive number as can be demonstrated by pressing $x \rightleftarrows y$. This operation is the same as a terminated keyboard data entry. The next data entry ALWAYS raises the stack.

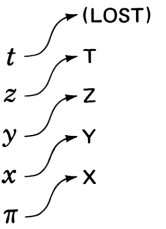
ENTRY KEYS (Cont'd)

π AFTER

CL x | STO | ENTER↑



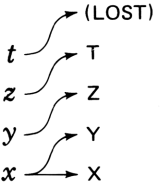
OTHER OPERATIONS



CONTROL KEYS

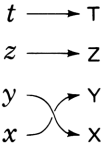
Control keys **ENTER↑**, $x \rightleftarrows y$, and **R↓** reposition the contents of the stack registers.

ENTER↑ Always raises the stack and duplicates the X register in the Y register. Its primary purpose is to enter the value of x into the stack and prepare the X register to receive a new data entry. That is, it signifies the final digit of the first data entry and that the forthcoming key depression applies to the new data entry.



$x \rightleftarrows y$ Exchanges (transposes) the contents of X and Y registers. You will find this key useful for:

- viewing contents of Y register without losing x
- rearranging operands for division, subtraction, or x^y



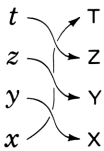
EXAMPLE: You have entered data for an x^y operation incorrectly. The problem, $2^7 = 128$ with incorrect entry and correct solution is

you press	and see
2	2.
ENTER↑	2.
7	7.
$x \rightleftarrows y$	2.
x^y	128.

R↓

(ROLL DOWN) Rolls the contents of the stack registers down without losing data. Four R↓ returns all data to their initial registers. You will find this key useful for:

- viewing contents of stack registers
- repositioning entered data for calculation

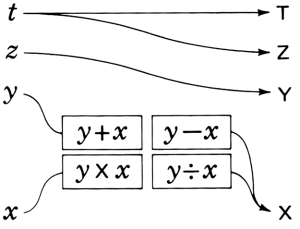


ARITHMETIC KEYS

Arithmetic keys operate on the X and Y registers according to the following rules:

KEY	FUNCTION, f(x,y)
+	$y+x \rightarrow X$
−	$y-x \rightarrow X$
×	$y \times x \rightarrow X$
÷	$y \div x \rightarrow X$

Both operands are lost during arithmetic operations and the stack drops.



VALUE LIMITS

$x \neq 0$ for ÷

EXAMPLE: To add 3 + 5

you press	and see
3	3.
ENTER↑	3.
5	5.
+	8.

Numbers may be entered in floating point, scientific, or mixed floating point and scientific notation.

EXAMPLE: To subtract 2.999 from 3

you press	and see	
3	3.	
ENTER↑	3.	
2.999	2.999	
—	1.	-03

CHAINED OPERATIONS

The advantage of the stack becomes evident when complex equations are evaluated. The HP-35 is organized so that data entries following an operation (except for **CL*x***, **STO**, and **ENTER↑**) AUTOMATICALLY perform the equivalent of an **ENTER↑** keystroke.

EXAMPLE: To find (3 x 4) + 8/4

you press	and see	comment
3	3.	
ENTER↑	3.	**Duplicates 3 in Y**
4	4.	
×	12.	
8	8.	**Saves 12 in Y with an automatic ENTER↑**
ENTER↑	8.	**Duplicates 8 in Y; saves 12 in Z**
4	4.	

(Continued Next Page)

ARITHMETIC KEYS (Cont'd)

÷	2.	**Stack drops, with 12 going to Y**
+	14.	**Prior result (2) was in proper position for new calculation WITHOUT further data manipulation**

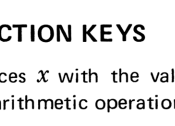
The prior example illustrates again two important features of the stack.

- The first data entry key (except after **CL**x, **STO**, and **ENTER**↑) performs an AUTOMATIC **ENTER**↑ to save the previous result or data entry in the Y register.
- Any arithmetic operation (+, —, X, and ÷) replaces x with the function of x and y and drops the stack.

FUNCTION KEYS

x^y

Replaces x with the value of x^y. The stack drops as with arithmetic operations.



VALUE LIMITS

$x > 0$

This function is calculated internally in the form $x^y = e^{(y \ln x)}$, necessitating $x > 0$ to prevent an improper operation.

EXAMPLE:

you press	and see
3	3
ENTER↑	3
5	5
x^y	124.9999998

The result is well within the stated accuracy for exponential calculations (see accuracy statement, page 5).

Each key replaces x with the designated function of x.

1/x
log
ln
$\sqrt{x}$

	FUNCTION	VALUE LIMITS
$t \longrightarrow$ T		
$z \longrightarrow$ Z	$1/x$	$x \neq 0$
$y \longrightarrow$ Y	log, ln	$x > 0$
$x \longrightarrow$ X	$\sqrt{x}$	$x \geqslant 0$
$f(x) \longrightarrow$ (LOST)		

EXAMPLE: To find the reciprocal of 2

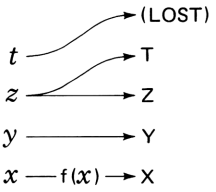
you press	and see
2	2.
1/x	.5

sin
cos
tan

Replaces x with the trigonometric function (Sine, Cosine, or Tangent) of x. (Also see **arc** key). Angles are given in degrees.

FUNCTION KEYS (Cont'd)

All trigonometric functions cause z to be duplicated in the T register.



EXAMPLE: To find the sin 30°

you press	and see
30	30.
sin	.5

arc

Used as a prefix to any trigonometric key (**sin**, **cos**, or **tan**) to calculate the inverse function.

Only the principle values of inverse functions are calculated, with the results given in degrees.

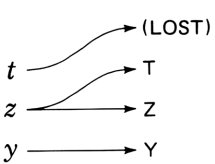
RANGE OF FUNCTION

$$-90^\circ \leqslant \arcsin x \leqslant +90^\circ$$

$$0^\circ \leqslant \arccos x \leqslant +180^\circ$$

$$-90^\circ \leqslant \arctan x \leqslant +90^\circ$$

All trigonometric functions cause z to be duplicated in the T register.



EXAMPLE: To find the arc sin −.5

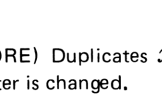
you press	and see
.5	.5
CH S	-.5
arc	-.5
sin	-30.00000001

Notice that pressing **arc** causes no visual change in the display. Pressing **CL**x resets the **arc** prefix.

MEMORY KEYS

STO

(STORE) Duplicates x into the S register. No other register is changed.



RCL

(RECALL) Enters a duplication of S into the X register and generates an automatic **ENTER**↑ (as do other data entries) UNLESS it follows **CL**x, **STO**, or **ENTER**↑.

The recall key can conveniently be used for multiplying or dividing by a constant.

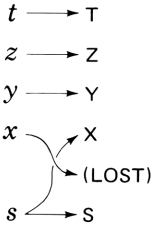
MEMORY KEYS (Cont'd)

EXAMPLE: To change entered data from inches to centimeters

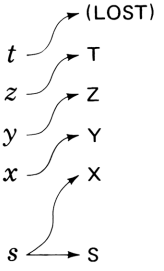
you press	and see	comments
2.54	2.54	**centimeters in 1 inch**
STO	2.54	**2.54 in S**
10	10.	**Data in inches**
RCL	2.54	**2.54 duplicated in x**
×	25.4	**Result: cm in 10 inches**
20	20.	**Data in inches**
RCL	2.54	
X	50.8	**Result: cm in 20 inches**

RCL AFTER

CL x STO ENTER↑



OTHER OPERATIONS



CHARGING

Charge the battery pack as follows:

1. Perform AC Line Operation procedure, page 7. An actual display ensures the battery charger is delivering power to the HP-35. If a display is not achieved, refer to Service section.
2. Slide power switch to OFF if only battery charging period is to follow.

NOTE

After 14 hours, a completely discharged battery pack will be fully charged. The charging period may be accomplished unattended with no danger of overcharge. For convenience, overnight charging is recommended. Shorter charge periods will allow diminished battery operating time of the HP-35 but maintain full calculation capability throughout the operating time.

3. At end of charging period, you may elect to continue using your HP-35 with ac power or proceed to next step for dc power operation.
4. With power switch at OFF, disconnect battery charger from power receptacle.
5. Disconnect battery charger from HP-35.

NOTE

If subsequent use discharges the battery pack prematurely, refer to Battery Pack, Cycling instructions, page 33. If the battery pack is unable to accept a charge, the battery pack may be defective. Refer to Service section. Continue use of your HP-35 with ac power. On receipt of new battery pack, perform Battery Pack, Replacement procedure, page 32. If trouble persists, return HP-35. Refer to Service section.

REPLACEMENT

Replace the battery pack as follows:

NOTE

Use only quality HP rechargeable Model 03501A Battery Pack which has been tested and is warranted for one year.

1. Ensure power switch is at OFF and battery charger is disconnected.
2. Slide two battery-door latches toward middle of calculator.
3. Let battery door and battery pack fall into palm of hand.
4. Ensure battery connectors have not been inadvertently flattened inward in calculator. Gently bend outward if flattening has occurred.
5. Insert battery pack with gold contacts of battery pack facing calculator so contact is made with battery connectors.
6. Insert bottom of battery door behind retaining groove, then let fall into place.
7. Gently press battery door toward calculator while sliding two battery-door latches laterally into calculator case.

NOTE

If you use your HP-35 extensively in field work or during travel, it is recommended that you order Model 03504A Battery Holder and Pack (see page 1).

CAUTION

Do not incinerate batteries.

LOW POWER INDICATIONS

The lighting of all decimal points is a low power indication. At first occurrence, you have 5 to 10 minutes operating time remaining. You must then decide to:

- operate from ac power
- charge the battery pack
- insert a fully charged battery pack

BLANK DISPLAY

A blank display while using battery power means the:

- battery pack is discharged
- battery pack is not making contact
- calculator is defective

You should isolate the difficulty by performing each of the following:

1. Battery Pack, Replacement procedure, page 32.
2. Slide power switch to ON. If the display is obtained, battery pack was not making contact. Proceed with normal use. If display is still blank, proceed to next step.
3. Perform Battery Pack, Charging procedure, page 31. If display remains blank, HP-35 is defective. Refer to Service section. If display is obtained, battery pack was discharged. Continue a full charge period.

CYCLING

Temporary degradation, peculiar to nickel-cadmium batteries, may cause a noticeable decrease in the operating period of the battery pack. Should this situation arise, battery-operate the HP-35 for at least five hours to completely discharge the batteries. Then initiate a full charging period of at least 14 hours. Correction of the temporary degradation should result.

Service

WARRANTY

Hewlett-Packard pocket calculator products are warranted against defects in materials and workmanship. This warranty applies for one year from date of delivery. We will repair or replace components which prove to be defective during the warranty period, provided the defective units are returned to Hewlett-Packard (see Shipping Instructions). No other warranty is expressed or implied. We are not liable for consequential damage.

OUT OF WARRANTY

Beyond the one year warranty period, your calculator will be repaired for a moderate charge. Return the HP-35 along with all standard accessories (see Shipping Instructions). If only the battery pack is defective, simply order a replacement (see Order Card in the back cover pocket of this manual).

SHIPPING INSTRUCTIONS

Malfunctions traced to the calculator or battery charger require that you return to us:

1. your HP-35 with all standard accessories in your travel safety case
2. a completed Service Card (from back cover pocket of this manual).

If a battery pack is defective and in-warranty, return to us:

1. only the defective battery pack
2. a completed Service Card (from back cover pocket of this manual)

Send returned items safely packaged to this central address:

Hewlett-Packard
Advanced Products
10900 Wolfe Road
Cupertino, California 95014

Under normal conditions, your calculator will be repaired and reshipped within two days of receipt at this address. Should other problems or questions arise regarding service, please call this telephone number collect: (408) 257-7000, and ask for Pocket Calculator Customer Service.

Sample Problems

PROBLEMS

The sample problems which follow serve as a self-analysis of individual adeptness in using the HP-35. Refer to Solutions, page 38, for correct answers and preferred methods of calculations.

1. $(3 \times 4) + (5 \times 6) + (7 \times 8)$

2. $(3 + 4)(5 + 6)(7 + 8)$

3. $\left(\frac{4 \times 5}{2} + \frac{24}{3 \times 4}\right)\left(\frac{18}{2 + 4} + \frac{2 + 6}{4}\right)$

4. $\cfrac{1}{1/3 + 1/6}$

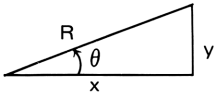
5. $3 + \cfrac{1}{7 + \cfrac{1}{15 + \cfrac{1}{1 + \cfrac{1}{292}}}}$

6. $60 \arccos(\cos 45^\circ \cos 150^\circ + \sin 45^\circ \sin 150^\circ \cos 60^\circ)$

NOTE

The solutions to the following problems do not require multiple entries of the same data:

7.



a. $R = 5$, $\theta = 30^\circ$. Find x, y

($x = R \cos \theta$; $y = x \tan \theta$)

b. $x = 4$, $y = 3$. Find R, θ

($\theta = \arctan (y/x)$; $R = y/\sin \theta$)

8. Convert the following to centimeters:

a. 5'3"
b. 37"
c. 24"
d. 36"

9. Compute the annual rate of return (after taxes) of an investment held for 6-1/2 months when

Tax Rate = 35%
Buy Price = $2341
Sell Price = $2672

RETURN =

$$\frac{(\text{SELL} - \text{BUY})(1 - \text{TAX})}{\text{BUY}} \frac{12}{\text{HOLD DURATION}} \times 100$$

SOLUTIONS

Each solution to a sample problem includes the keystrokes required in the preferred method of calculation.

1. 98.

3 ↑ 4 × 5 ↑ 6

× + 7 ↑ 8 × +

2. 1155.

3 ↑ 4 + 5 ↑ 6

+ × 7 ↑ 8 + ×

3. 60.

4 ↑ 5 × 2 ÷ 24 ↑ 3 ÷

4 ÷ + 18 ↑ 2 ↑ 4 +

÷ 2 ↑ 6 + 4 ÷ + ×

4. 2.

3 1/x 6 1/x + 1/x

5. 3.141592653

292 1/x 1 + 1/x 15 +

1/x 7 + 1/x 3 +

6. 6949.392474

45 cos 150 cos × 45

sin 150 sin × 60 cos

× + arc cos 60 ×

7. a. x = 4.33012702
y = 2.5

30 ↑ tan $x \rightleftarrows y$ cos

5 × (value of x) × (value of y)

b. θ = 36.86989764
R = 5.0000000003

3 ↑ ↑ 4 ÷ arc

tan sin ÷ (value of θ) (value of R)

8. a. 160.02

2.54 STO 5 ↑ 12

× 3 + RCL ×

b. 93.98
c. 60.96
d. 91.44

9. 16.96710808

2672 ↑ 2341 STO − 1

↑ .35 − × RCL ÷

12 × 6.5 ÷ 100 ×

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