HP-65

KEY NOTE

for HP-65 owners
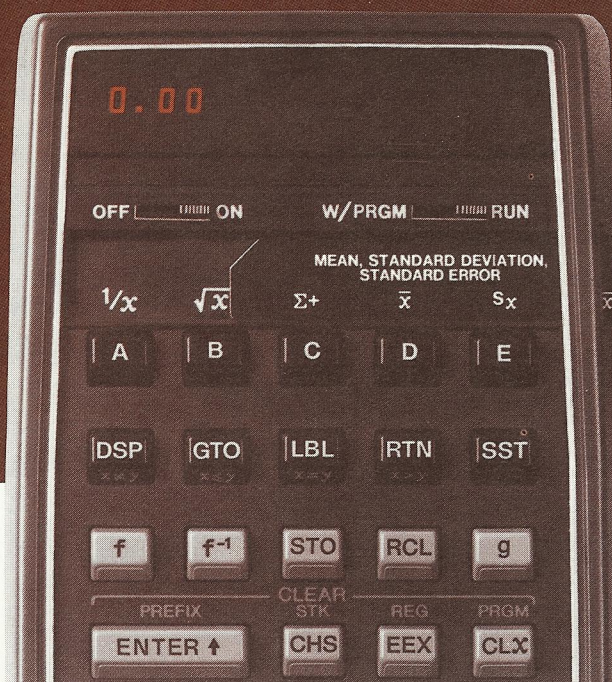
HP-65 + 4,757 = SX-70

The above photo was taken with a new Polaroid SX-70 camera won at Las Vegas—and therein lies a really fantastic "believe-it-or-not" story for all you HP-65 fans.

The man in the photo is Emmett Ingram, Jr., Chief Engineer at Jetronix Radio Engineering Labs in Palos Verdes, California. And if you find it difficult to believe his story, then you just don't know Emmett. *(I do; I've met him. An incredible man. And the story is true. Ed.)*

If you happened to attend the NEWCOM show in Las Vegas in May, 1974, you probably remember that the United Technical Publications booth had a large plastic tank containing many marbles and the three-volume set of the *Electronic Engineers Master (EEM)*. There was a prize for guessing the correct (or nearest to correct) number of marbles in the rectangular tank, and the prize was (you've guessed it!) a brand new Polaroid SX-70 camera. Well, Emmett decided he wanted to win that camera and, besides, the problem was a real challenge for his trusty HP-65, which he is NEVER without.

First, Emmett measured the container, two-thirds full of marbles, subtracting the volume occupied by the three-volume set of the *Electronic Engineers Master.* Then he counted and recounted those exposed marbles per row on each of the four sides of the tank. He also counted each marble tangent to the plastic face of the container. Of those marbles that appeared to touch the face of the plastic tank, a count determined that 42.7% actually did. Armed with those numbers, he went to the local Las Vegas ten-cent store and purchased all the marbles they had in stock ($5.80 worth). Then off to the photo store next door, where he picked up a 1,000 cc graduated beaker. Then he cut off the top of a 6-quart bottle that he had found in the alley, added water, measured, counted, and computed.

Following all of this, Emmett placed a long-distance telephone call to a U.S.C. mathematician. (You can imagine the conversation!) He advised Emmett that the data gathered would best fit the Chi Squared Probability equation. All of this was then pumped into Emmett's trusty HP-65, and out popped 4,757.

The correct number of marbles in the container was 4,754, which represented the total number of pages in the '74 edition of *Off-The-Shelf* (O-T-S) and the '73–'74 edition of EEM. Naturally, the people at United Technical Publications were astonished by Emmett's wild but accurate guess, and even more astonished when he told them it was not a *guess,* it was a carefully calculated *answer!*

As a matter of record, if the quality control on the marbles that Emmett bought had been better, it's probable that he would have hit 4,754 right on the nose! According to Emmett: "Some marbles measured to be nonspherical by 0.05% (4754/4757, an error of 0.063%). It appears a few of the marbles escaped the manufacturer's quality control and fouled me up by a count of three!"

So, that's the story. We're grateful to Emmett for allowing us to share it with all you other HP-65 owners. We're also grateful to Emmett for his staunch support of HP calculators. He's owned an HP-35, HP-45, HP-80, and now the HP-65!

All prices quoted in KEY NOTE are domestic U.S.A. prices only.

USERS' LIBRARY CORNER

Thanks to the many, many contributors, the HP-65 Users' Library is growing and growing. We continue to get new and varied programs, and many of you are taking advantage of this virtual cornucopia of timesaving programs.

After all, think of the advantages of not having to develop all of your own programs. First, you save time—and therefore money. You don't have to research the application. You don't have to program the problem. You don't have the onerous task of checking the program. And, last but not least, you save the time and trouble of completely documenting everything. What could be better?

Of course we don't advocate that you give up the pleasure of formulating your own programs. However, why spend time doing what someone has already done? Or why struggle through a problem that might be just a bit beyond your capabilities? All you have to do now is look in your Catalog, find the program that will solve your problem, and send in your order. Each program you order comes completely documented. It takes only a few minutes to key in the program and record it on a magnetic card...and you have a program ready to run.

Incredible as it may seem to be, some people who buy HP-65's do not send in the *Free Subscription Card,* and therefore are not members of the Users' Library. That also means they do not receive **KEY NOTE.** Since it is a free service, we wonder why they turn it down. If you know any HP-65 owners who have not mailed their subscription cards, tell them what they are missing. And remember, this offer is valid only in the domestic U.S.A.

What You Get When You Order A Program

A lot of you have asked that question, so here is the answer.

Primarily, you get a photo copy of the original documentation from the submitter (see also, *When Contributing Programs)* which includes:

1. **The Program Description—with equations, variables used, operating limits and warnings, sketches (when applicable), sample problem(s), sample solutions(s), and references used.**
2. **Operating Instructions—that show, step-by-step, how the data is keyed in and how answers are generated.**

3. **A Program Form—that shows each step required to key in the program, including the associated program code and program comments. Register, label, and flag usage also are documented here.**

With the information you get, it then takes only a few minutes to key in the program and permanently record it on a magnetic card. Then, don't forget to cut off the upper left corner of the card so that it cannot be accidently erased.

What's In The Library Now??

By now you should have your new HP-65 Users' Library *Catalog of Contributed Programs.* The new Catalog is easy to identify: it's bright blue; the previous one is orange. In the new Catalog you'll find 593 programs, twice the number listed in the first edition. Among these programs are all the new ones from the three new application pacs (Finance, Aviation, Navigation) that were recently released. You'll find an article about the new pacs on another page in **KEY NOTE.**

Notice the increase in the number of the ever-popular "games." There is a strong order rate for these—especially new ones. In fact, you'll find three more new programs for "games" in the next paragraph. And believe it or not, there's even a program for computing bowling scores!

New Programs

Although there are lots of new programs in the new *Catalog* to keep you busy for a while, we thought you'd like to read about some exciting new programs that were submitted after the *Catalog* was printed. More and more programs are now coming in from all over the U.S.

You can order any of the following programs. Unless it is not possible, always use an order form to order programs from the HP-65 Users' Library. The forms come with the *Catalog.* Also, there are additional forms in the back of the *Catalog.* Always use the program number shown in the *Catalog.* DO NOT use any other number, regardless of the source, to order programs.

Each program has a nominal charge of $3.00. Send *only* checks or money orders, payable to Hewlett-Packard Company. Be sure to include any state or local taxes.

FISHER'S EXACT PROBABILITY (Order #00719A)

This program computes the exact test statistics for a 2 x 2 contingency table. The probability for each separate table, the sum for first n tables, and Tocher's modification are also found.
Author: A. Oscar H. Roberts,
Palo Alto, California

WAITING TIMES—MULTISERVER QUEUES (Order #00849A)

Computes (1) the probability that all servers are busy, (2) the probability of waiting longer than a given time if all servers are busy, (3) the mean waiting time for all transactions including those served immediately, and (4) the mean waiting time for transactions that wait.
Author: William M. Kolb,
Upper Marlboro, Maryland

CRAPS GAME (Order #00788A)

Craps is a game played with two dice. On the first roll (simulated by pressing the R/S key) a 2, a 3, or a 12 loses, and a 7 or an 11 wins. Any other roll is recorded, and the dice must be rolled again. Matching the original roll wins, and a 7 loses. Continue to roll until a match or a 7 occurs.
Author: Roy Martin,
Cupertino, California

WYTHOFF'S NUMBER GAME (Order #00856A)

To play this game of skill, the user first chooses two positive integers P and Q up to 99,999. Then the HP-65 and the user alternately choose a number and subtract it from P, Q, or both. The object is to reduce both P and Q to zero. There are more than 38,000 starting values from which the user can win, from (P, Q) = (1, 2) for a short and simple game, to (61802,99998) for a much more challenging one.
Author: William C. Davidon,
Haverford, Pennsylvania

REVERSE SOLITAIRE GAME (Order #00859A)

You are given the nine digits, 1 through 9, in a random order. The object of the game is to order the digits consecutively. You do so by specifying a number from 2 to 9; call this number n. The leftmost n digits are then reversed, the remaining digits are unchanged. Can you

order the digits in the fewest possible moves?

Author: Jacob R. Jacobs,
Mountain View, California

WEDDLE'S RULE FOR NUMERICAL INTERGRATION (Order #00748A)

This program approximates definite integrals by Weddle's rule, offering a higher degree of accuracy than Simpson's rule. Any number of increments may be used—as long as they are evenly divisible by 6. The user writes the function f(x) to be integrated (30 working steps).

Author: Harry J. Gangloff,
Plum Boro, Pennsylvania

SYSTEM OF FIRST-ORDER DIFFERENTIAL EQUATIONS (Order #00861A)

A program that finds the numerical solution, step-wise for a system of two first-order differential equations. The program uses the fourth-order Runge-Kutta method. The user must write boundary conditions and step-size into memory and insert program steps for computing the first derivatives.

Author: Albert Furman,
Los Altos Hills, California

REVERSE CURVE–GIVEN PARALLEL TANGENTS, OFFSET, RADIUS 1 & 2 (Order #00664A)

Computes both arc lengths and the total arc length, the horizontal length, and the delta angle when given the offset, radius 1, radius 2, and parallel tangents.

Author: Richard C. Moran,
Toledo, Ohio

BOWLING SCORES FOR TWO PLAYERS (Order #00907A)

This handy program computes bowling scores for either one player or two players.

Author: Lee H. Skinner,
Albuquerque, New Mexico

MIXER INTERMODULATION PERFORMANCE (Order #00767A)

A program used to compute the order of mixer products (up to 10 x 10) that produces outputs within a specified range.

Author: Kenneth C. Bower,
Livermore, California

INFINITE BEAM ON ELASTIC FOUNDATION WITH A CONCENTRATED LOAD (Order #00994A)

This program is useful in design of foundations for buildings. It computes deflection, rotation, shear, moment, and bending stress at a point specified by the user. It is also of use in design of machine elements such as ways for a lathe.

Author: John E. Key,
Huntsville, Alabama

When Contributing Programs

We still have a fairly high rejection rate for new program submittals. By far, the main reason for rejection is *unacceptable documentation.* Unacceptable usually means: (a) illegible, (b) incomplete, (c) will not copy on a reproducing machine (i.e., Xerox), (d) not on original HP-65 Users' Library forms, or (e) unsigned *Program Submittal* sheet.

The reason we enforce these high standards is to ensure that those who pay $3.00 for a copy of these programs will receive readable and understandable documentation. Therefore, before you submit a program to the Library, read the HP-65 Users' Library *Contributor's Guide* for details, and use the forms supplied.

Another reminder: Only an author may revise a program. Therefore, if you run across a bug in a program, tell us about it (on a *Program Comment* form), and we will notify the author, who will make the necessary changes or corrections.

While we're on the subject of contributed programs, here's a plea for some brevity. Please try to keep your program titles as short as possible. It might not always be possible, but most can be easily shortened without losing anything in clarity. Use abbreviations if necessary. Actually, the title must not exceed the number of spaces provided on the *Program Submittal* form. That is the maximum length the computer will handle.
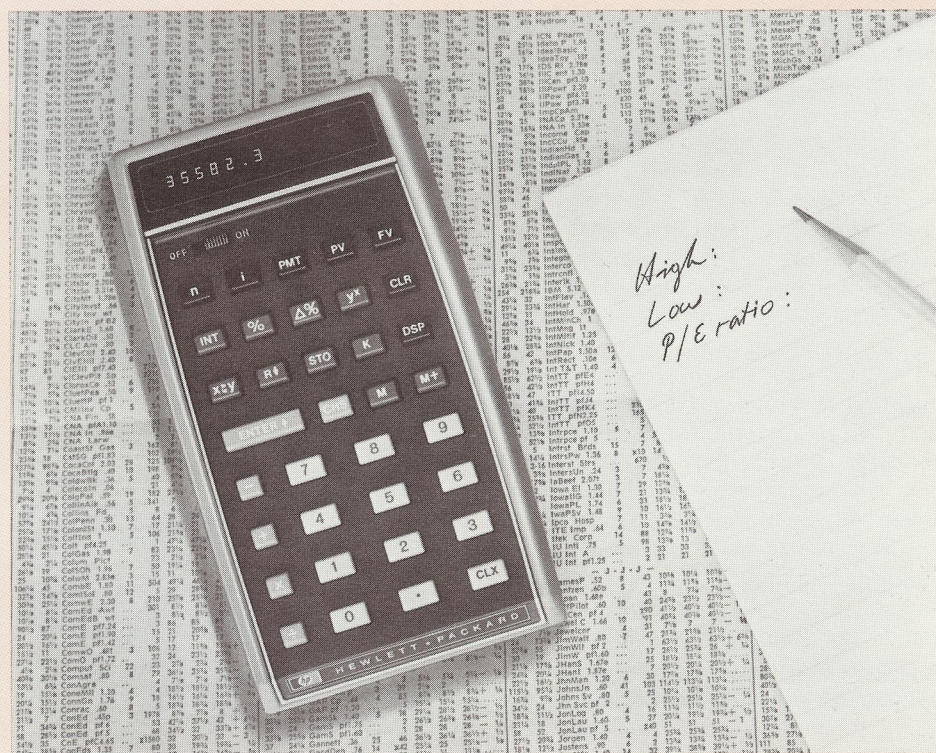

HP-70 Business Calculator

HAVE YOU MET THE HP-70?

On August 1, Hewlett-Packard announced a new pocket-sized business calculator—the HP-70. The 9-ounce calculator, which sells for $275.00, solves common financial calculations encountered by the personal user and the professional banker and accountant, and by insurance and business persons. In addition to the four basic arithmetic functions of ordinary electronic calculators, 21 of the most common equations used in business and personal finance have been programmed into the HP-70.

Preprogrammed financial routines include accrued interest, future value of a compounded amount, effective rate of a mortgage, effective rate of return for compounded amounts, percentage differ-

ence, percentage calculations, and many more.

The HP-70 is the only pocket-sized business calculator to feature a four-memory operational stack as well as two independent memories for intermediate storage of numbers.

If you want more details about the HP-70, contact your nearest HP Sales Office, or request a brochure from Hewlett-Packard Co., 19310 Pruneridge Avenue, Cupertino, CA 95014.
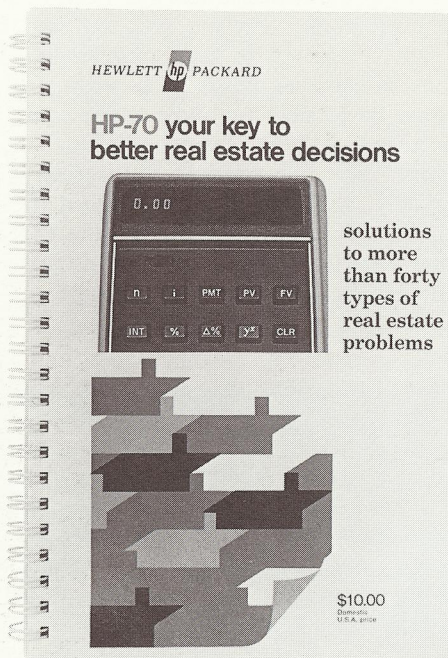
EASY CHRISTMAS SHOPPING

With Christmas rapidly approaching, what better gift could you give to HP calculator owners than an application book that can enormously increase the power of their calculators? At only $10.00 a copy, these books are a bargain in today's inflation.

Last issue, we introduced the *HP-80 Real Estate Applications* handbook and the *HP-35 Math Pac* handbook. Two new handbooks have been released since then: *HP-70: Your Key to Better Real Estate Decisions,* and *HP-45 Applications Book.* Both are excellent aids to their respective calculators—and nearly indispensable time-savers. If *your* time is worth $10.00 an hour (and it's hard to believe it isn't), is it worthwhile to do a lot of compilations that have already been done for you? And at only $10.00 for the entire book? You have to admit these books are a good buy. Especially for Christmas. We've even included a handy order form for your convenience.

PROGRAMMING TIPS

More and more HP-65 owners are finding new and clever ways to write and edit programs. Quite a few of you send your ideas and hints to us. We, in turn, will continue to publish them in **KEY NOTE** so that everyone can profit by the information. Here are three more tips.

Rearranging Saves Steps

Most equations can be "juggled" or rearranged to save steps in memory. Consider the following (assuming χ is in the x-register):

$$\chi^3 + 2\chi^2 + \chi + 1 =$$

STO 1 3 g y^x RCL 1 ENTER↑ × 2 × + RCL 1 + 1 +

This results in 14 steps. Now, see how rearranging the equation results in only 11 steps (and saves one register).

$$((\chi + 2) \chi + 1) \chi + 1 =$$

ENTER↑ ENTER↑ ENTER↑ 2 + × 1 + × 1 +

Store More Than Nine Constants!

Thanks to Mr. Henry L. Cox, Jr., of Annapolis, Maryland, for the following terrific tip.

Two (or more*) constants (up to a total of 10 digits) can be stored in one register by multiplying or dividing them as necessary to make one a pure integer and the other a pure decimal fraction and by combining them as one decimal number. To get either number back, recall the composite number stored. Then f INT or f⁻¹ INT , followed by multiplication or division by the appropriate power of 10, restores the original constant to the display. Look at the following example.

Let's use 12.34 and 567.89 as two constants to be stored in register R_1: Multiplying the first by 100 and dividing the second by 1000 gives 1234 and 0.56789, which are added and stored as 1234.56789. Then, pressing RCL 1 f INT yields 1234, which is then divided by 100 to obtain the original 12.34. Similarly, pressing RCL 1 f⁻¹ INT 1000 × yields the original 567.89.

Using combinations of f INT and f⁻¹ INT , and multiplying and dividing as shown above, you can get more than two constants in one register. You will, of course, have to use smaller numbers, and use the integer keys more than once. Ed.

Using DSZ as a Flag

Although very handy, and sometimes necessary, flags do use a lot of steps in memory. Therefore, it often pays to use DSZ as a flag, because you then save several steps. By storing 1 in register R_8, you create your own self-clearing flag using DSZ . When the program executes DSZ , it decrements the contents of R_8, which sets it to zero. Then it tests R_8 and, because it *is* zero, skips before continuing execution (just as when testing a flag that is set). The second time the program executes DSZ , R_8 is decremented again and the program pointer continues sequentially (just as when testing a flag that is clear) because the number in R_8 is no longer zero. The following examples should clarify this function. Also, look at the program listing for compound interest on page 70 of your *HP-65 Standard Pac.*

Example 1	Example 2
LBL	LBL
A	A
g	f⁻¹
DSZ	TF 1
GTO	GTO
0	0
3	3
6	6
0	0
RTN	f⁻¹ }*
LBL	SF 1 }
0	RTN
4	LBL
0	0
0	4
RTN	0
	0
	RTN

Notice that in Example 2 there are two extra steps (f⁻¹ and SF 1) to clear the flag. This is unnecessary in Example 1 because DSZ decrements to zero and is self-clearing.

ELECTION RESULTS TOUT de SUITE

On the evening of the French presidential elections, for the first and the second ballot, *EUROPE NO. 1** reporters used an HP-65 to make the calculations to count the votes. By using specialized prerecorded programs on magnetic cards, the calculations could be made immediately, with no risk of errors, merely by entering the data as soon as it came in.

For instance, for the second ballot, the reporters, after inserting the prepro-

grammed card, needed only to enter the number of votes for *Mr. Giscard d'Estaing* and *Mr. Mitterrand* and the number of voters. Then, with just a keystroke, the HP-65 could immediately give the total voiced votes, the respective percentages for each candidate, and the percentage of blank or spoiled ballots.

Radio broadcasting station in Luxembourg.

ANOTHER BATTERY TIP

An HP-65 owner in Vail, Arizona, wrote: "I (and probably others) would be interested in a graph of battery-pack charging kinetics. I note that while it takes 14 hours for a complete charge, a 'worthwhile' charge can be obtained in much less time—the rate seems to drop off. Sometimes my use of my HP-65 is very heavy, and I have found that I can get more usable time by charging two packs for 5 hours each than I can by charging one pack for 10 hours. A graph of percent of total charge x charging time would permit users to make an intelligent choice about charging times if they want to get the greatest operating time out of more than one battery pack with the least amount of time in the charger."

Thank you for the note. We checked with the engineering staff and they contributed the following graph for a typical battery. Now all you need is the accessory Reserve Power Pack (#82004A) to keep one battery charged while the other is in use. It's included on the handy order form enclosed with **KEY NOTE**.

DIPLOM
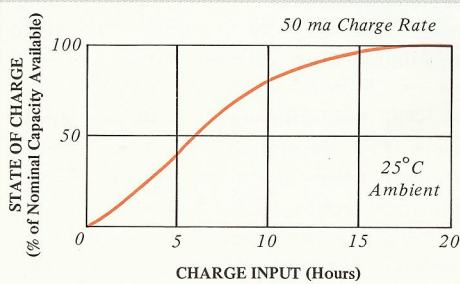
HP-65 USERS' CLUB*

Some HP-65 owners are so enthusiastic about their calculators that they have actually formed their own club—replete with newsletter, etc. The spark behind this dynamic new club is Richard J. Nelson, an Application Engineer for a crystal manufacturer.

The first newsletter was mailed in June 1974. It is published monthly and contains information on all aspects of using and programming the HP-65. There is, of course, a subscription fee. If you are interested in joining the club and reading the newsletter, which is called "65 NOTES", write or call:

65 NOTES editor
Richard J. Nelson
2541 West Camden Place
Santa Ana, California 92704

Home phone (evenings only):
(714) 557-6614

Work phone (4:00-5:30 P.M. PST only):
(714) 639-7810

NOTE: This club is not sponsored by nor in any way officially sanctioned by Hewlett-Packard.
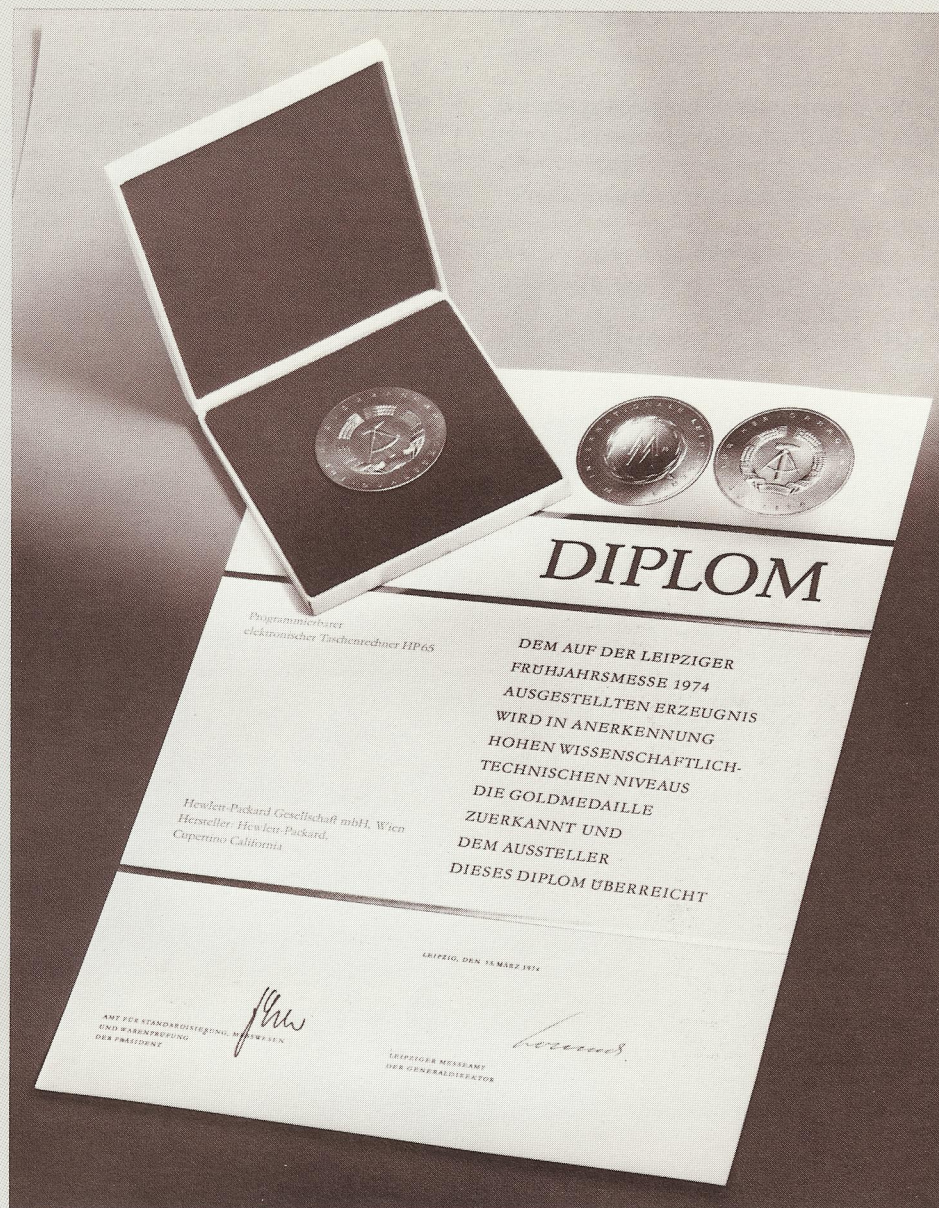
HP-65 WINS GOLD MEDAL AT LEIPZIG FAIR

Earlier this year Hewlett-Packard attended a technical exhibition in Leipzig, East Germany. The event, the Leipziger FRUHJAHRSMESSE 1974 (*Spring Fair*), was very well attended by an audience anxious to see the latest in technical products. Hewlett-Packard showed its new HP-65 Programmable Pocket Calculator.

The HP-65 was selected by the Leipzig Fair as an outstanding product and was awarded a *Gold Medal*. Because products receiving *Gold Medals* are evaluated not only for their technical contribution to the customer but also for their product appeal, this was quite an honor. We certainly are excited about our HP-65 receiving such recognition at a major technical exhibition.

APPLICATION PAC CORRECTIONS

If you own some of our Application Pacs, check the following corrections and mark them in your copy. If your copy is correct, you have a later, revised issue of the book.

E.E. Pac 1, EE1-02A, Page 11

The equation for MAG[Z] should read:

$$MAG[Z] = \frac{R_p\left[(1-\omega^2\, LC)^2 + R_s^2\, C^2\, \omega^2\right]^{1/2}}{\left[(1-\omega^2\, LC)^2 + (R_s+R_p)^2\, C^2\, \omega^2\right]^{1/2}}$$

Notice that R_p was missed in the original book.

E.E. Pac 1, EE1-03A, Page 14

Because of a programming error after step 80, it is possible to get the shift function stuck when card EE1-03A is used. This mistake has been corrected in EE1-03B, which is available by sending your "A" version card to APD Customer Communications, Hewlett-Packard Co., 19310 Pruneridge Avenue, Cupertino, California 95014.

If your E.E. PAC 1 book is dated September 1974, the program listing is correct. If not, you have an original book; change the program listing on page 110 as follows:

Delete step 81 (32 f^{-1}).
In its place, add two steps:
    35 07   g x⇄y
    31   f

E.E. Pac 1, EE1-14A, Page 46

In the schematic diagram, L_1 should be labeled L_2, and C_2 should be labeled C_3. (This has been corrected in books dated September 1974.)

In the equation for b_i on page 47, γ should be squared.

E.E. Pac 1, EE1-17A, Page 52

The variable R should be defined as "radius of coil to center of wire in inches."

E.E. Pac 1, EE1-18A, Page 54

The expression for Q yields answers too large by a factor of 1000. Change the constant in the equation from 25.59 to 0.0256. Change the answer on page 55 from $Q = 1.08 \times 10^5$ to $Q = 1.08 \times 10^2$. Change the program listing on page 128 as follows:

STEP	FROM	TO
67	02 2	83 .
68	05 5	00 0
69	83 .	02 2
70	05 5	05 5
71	09 9	06 6

A corrected EE1-18B card is available. Send your -18A-version card to the address listed under the EE1-03A correction, above.

Finance Pac 1, FIN1-07A, Page 137

The listing has an error at step 46. The **STO 8** should be **STO 7**. The recorded program card is correct.

Surveying Pac 1, Page 85

In the original book, the sample problem of *Azimuth of the Sun* (Surveying 1-30A) reads: Hour difference in declination (ephemeris): 0°26′24″. The value should be –00°00′26.4″ (–26.4 seconds). Note that the number correction was made in the book dated June 1974, but the *minus* sign was omitted. Also, in the original book (undated), "Calculated north azimuth of sun:" should be changed to 268°07′54″.

Navigation Pac 1, NAV1-08A, Page 24

In the argument list at the bottom of the page, d_i should be λ_i.

Navigation Pac 1, NAV1-25A, Page 75

The second line of the keystroke solution should read:

0 [ENTER↑] 20 [C] [R/S]
1.30 [D] [E] ⟶ 185.03

The [R/S] keystroke was left out.

FROM KEY NOTE TO KEYBOARD

There's a high probability that many HP-65 owners also use Hewlett-Packard's larger desktop calculators (HP 9100 and 9800 series). These larger calculators are produced at our Calculator Products Division (CPD) in Loveland, Colorado. If you do use these products and do not get CPD's magazine, **KEYBOARD**, you're missing some interesting and informative news and useful applications information for our desktop calculators.

To get copies of **KEYBOARD**, or information about this truly informative publication, contact:

Mr. A.B. Sperry, Editor
HP KEYBOARD
Hewlett-Packard Co.
P.O. Box 301
Loveland, Colorado 80537
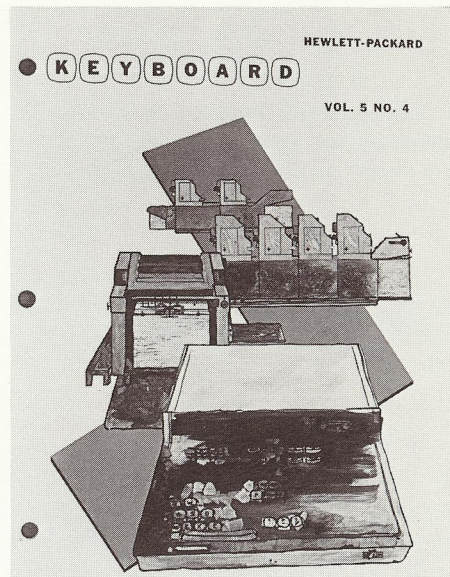
WILL THE HP-65 FLOAT?

Probably not! But it sure can be quite an asset while *you're* afloat, particularly if you're navigating a racing yacht.

By now you know that the American 12-meter yacht, *Couageous,* won the America's Cup races. What you probably didn't know was that an HP-65 was aboard during the races. *Halsey Herreschoff,* navigator on board the winning *Courageous,* was particularly impressed by the HP-65's ability to make rapid calculations by keyboard or magnetic card and by its ability to make rectangular to polar conversions.

The two principal uses of the HP-65 were (1) estimating the time to the starting point—important information in prestart tactics, and (2) calculating the relative position (ahead or behind) between *Courageous* and Australia's *Southern Cross* in downwind and upwind racing, especially when ranges and bearings between the two were constantly changing.

Between races, the HP-65 was used on-shore to evaluate data collected during actual sailing time. Then, plans were set for tactics to be used in the next race. And, imagine, all of this *before* the Navigation Pac was released. Perhaps if they had had the new pac . . . ?

Here are some of the most frequently asked questions we get on the telephone or in the mail.

Question: Occasionally, I find in memory a "41" code that I didn't put there. What is it? How did it get there?

Answer: Turn on your HP-65. In **W/PRGM** mode, press `f` `PRGM`, then key in:

LBL	23
A	11
B	12
RTN	24
LBL	23
B	12
R/S	84
RTN	24

In **RUN** mode, press `A`. The subroutine call (**B**) in program A will leave the first pointer between the **B** and **RTN** of program A. The **R/S** in subroutine B stopped us, so the "41" is still in program A awaiting completion of the subroutine. Therefore, in memory, you have:

LBL	23
A	11
B	12
pointer	(41)
RTN	24
LBL	23
B	12
R/S	84
RTN	24

Right now we're stopped at the **R/S**. (Switch to **W/PRGM**; you'll see 84 in the display.)

Now, in **RUN** mode, press `GTO` `A`. Switch back to **W/PRGM** and press `SST` twice. You'll see the elusive 41 in the display. Still in **W/PRGM** mode, press `g` `DEL`. When you delete the "41," the HP-65 has lost its first pointer. Now, in **RUN** mode, press `RTN`. The HP-65 will blank out. It isn't dead. It's just looking for that "41," which you just deleted, to put it at the top of memory.

The only remedy now is to shut off your HP-65. This isn't a normal operation, of course, but if you've been having troubles, sometimes its fun to send something else on a wild goose chase.

Question: I was single-step (`SST`) executing and I switched to W/PRGM mode just to check where I was in memory. When I switched to RUN mode and continued single-stepping, I got strange results. What happened?

HP-65 AT LE MANS

Sunday, June 16, 4:00 P.M.—Matra Simca wins the 24 Hours Race of Le Mans. And for Hewlett-Packard, that victory marked a new "win" for the unique HP-65. Why? Because in the pocket of one of the technicians of the pit crew was the HP-65 programmable calculator that contributed to Matra Simca's huge success.

Available from the conception of the Matra Simca 670C and the new 680, the

Answer: You probably switched between modes and broke up a prefixed operation. For example, suppose:

LBL	23
A	11
f	31
SIN	04
RTN	24

is in memory. If you switch to **W/PRGM** mode and see 31, you're at the "f." Switch back to **RUN** mode, press `SST`, and you'll get 4.00, not the **SIN** function. As you can see, switching between modes interrupts the prefix.

You also can "unmerge" a merged code by switching to **RUN** mode while keying in a program. For example, in **W/PRGM** mode, press `g`, switch to **RUN**, and then switch back to **W/PRGM**

HP-65 was used to successfully determine dimensioning of parts and to calculate aerodynamic loads and chassis "tuning." During the race itself, the HP-65 proved its unique usefulness by rapidly and accurately performing fuel consumption calculations and, simultaneously, the "index of performance" classification. When you consider that all of this high-technology capability came from a battery-powered calculator that weighs only 312 grams, it was, indeed, also a triumph for the HP-65!

and press `x≷y`. This will give you an unmerged x–y interchange. (It's possible that you might sometime use this as a programming trick.)

Question: I'd like to know more about underflow. What is it and when does it occur?

Answer: Underflow occurs when the result of a calculation is $<10^{-99}$ (the lower limit of the HP-65). The calculator is preprogrammed to halt an executing program when underflow results from a multiplication or a division, or for the functions $1/x$, e^x, and y^x. When the calculator underflows, the underflowed register is set to zero.

Since no underflow test is made for trigonometric functions, this will not halt

an executing program. The **SIN** and **COS** functions return underflow zeroes for 0° and 90°, respectively. Internally, a value $<10^{-99}$ is calculated and the display is set to zero. A halt may occur, however, when $r\text{COS}\theta$ is computed in the [f⁻¹] [R→P] function for r small and θ close to 90° (or odd multiples of 90°). This halt occurs because the underflowed **COS** value is multiplied by r (necessarily less than 1) before it is set to zero. A test is made for multiplication, and a halt will occur when the product is $<10^{-99}$.

Similarly, underflow occurs in the y register during polar to rectangular conversion when $r\text{SIN}\theta$ is computed for $\theta = 0°$, 180°, ... There is no halt in execution because only the x-register is tested for an underflow value.

IS WHAT YOU SEE, WHAT YOU GET?

Thanks to Mr. David Crouse of Allison Park, Pennsylvania, here's a handy tip you can use to see *what* you've got when you *can't* see it! (??Read on.)

There are times that, when using fixed notation, the answer displayed is zero; however, it is possible that this is the result of rounding off. If it is important to know whether or not the x-register really is empty, press the [CHS] key twice. If there is any quantity in the register, the display will first indicate negative and then positive. If, however, the x-register really is empty, the sign will remain negative. This sign is then discarded with the next entry. (*You also can tell if there's a quantity in the x-register by pressing* [DSP] [9] *; however, the above tip really is quite handy. Ed.*)

Now there's something for everyone! Three new application pacs for the HP-65 have been released. If you're a pilot, a sailor, or a financier, you'll want to add some more usefulness to your HP-65 with:

Aviation Pac 1,	00065-67042
Finance Pac 1,	00065-67044
Navigation Pac 1,	00065-67045

You'll find yourself making time-consuming calculations in minutes or seconds—calculations that used to be a real chore and a bore. You'll have more time to enjoy your flights, your voyages, your investments.

If you want to see a complete rundown of the programs in these new pacs, look in appendix A (page 5-1) of your new *Catalog of Contributed Programs*. Under each application pac you'll find a listing of the program titles for each pac, and a cross reference to the abstract for each program. And don't forget, you can buy each program separately.

So why go through the tiresome ritual of calculating, table-searching, and memory-jogging when it's all done for you in an easy-to-carry-and-use HP-65 Application Pac? We've even made it easy for you to order one. Use the order form included with this **HP-65 KEY NOTE**.

THOSE ETHEREAL DISPLAYS

If you often turn on your HP-65, set it to **W/PRGM**, key in a program, and get mysterious answers in the display, you're probably the victim of a missed step. Based on the number of telephone calls we get about this, here's a reminder that cannot be overemphasized: **Always press** [f] [PRGM] **before keying in a new program!** (It is not necessary when a magnetic card is used.)

When you turn on your calculator and set it to **W/PRGM**, remember that you now have the five "default" programs ($1/x$, $\sqrt{x}$, y^x, etc.) automatically set in the five "label" keys, A through E. If you now key in a program, say, starting with **LBL A**, it goes in at the *top* of program memory and moves the default programs down. The first time you run *your* program, it executes to the **RTN**, and you get the correct answer. However, the next time you enter data and press [A], you actually execute the "A" default program, which is $1/x$. So, again, to prevent this problem, **always press** [f] [PRGM] **before keying in a new program!**

ONE TOO MANY?

For various reasons, we have two addresses for some HP-65 owners. Since we want to be sure you get **KEY NOTE** at your correct address, please send us the two labels, appropriately marked. Use the business reply envelope included with your **KEY NOTE**.

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