HP-65

KEY NOTE

for HP-65 owners

AN UNUSUAL TRIAD!
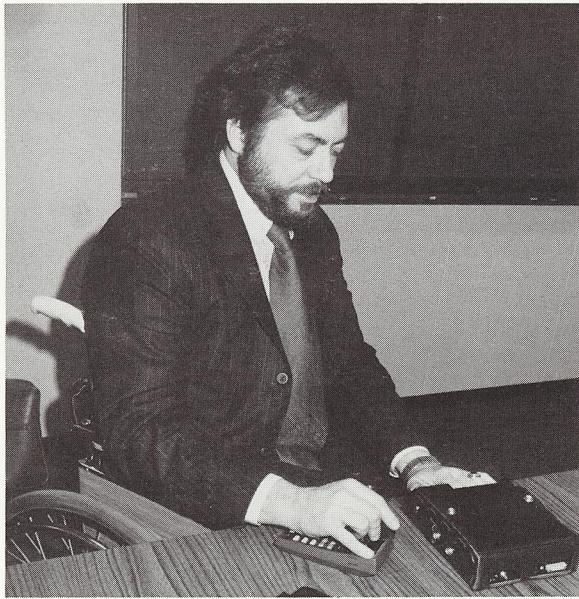
Ever wonder how you would use an electronic calculator if you were blind? Sure, it would be fairly easy to memorize the keyboard, but how would you read the display? You can't touch the light-emitting diodes in the display, and even if you could, you wouldn't be able to feel the numbers on them. Frustrating, isn't it?

Well, believe it or not, *Jim Caldwell,* of Austin, Texas, is totally blind, and he *can* read the display on his HP-65! Moreover, *Jim* has written many programs on his HP-65. He uses an *Optacon,* an electronic device that converts the visual images of letters and numbers into tactile forms that he can feel.

Twelve years ago, *Jim* was both blinded and partially paralyzed by an accident that occurred while lighting a barbecue fire. You'd think that that would severely hamper one's activities, right? Not so! A couple of years ago, *Jim,* realizing that he couldn't compete in his field without a calculator, wrote to several manufacturers and suggested ways to make a braille type of readout. He got one reply.
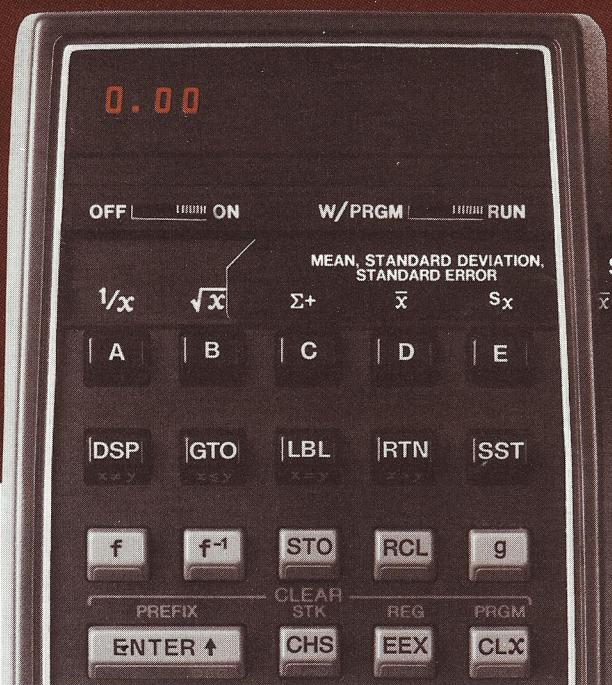
That one reply—from Hewlett-Packard's Advanced Products Division, which manufactures pocket calculators—started *Jim* on a new track. Here, for the first time, he heard about the remarkable *Optacon,* so he set about investigating the possibility of using one to read the display on an electronic calculator. Then, to top things off, HP came out with the HP-65. Although *Jim* already had an HP-80 on order, he was excited by the prospect of using the *Optacon* on the state-of-the-art HP-65.

The rest is history. Today, *Jim* uses the *Optacon* with a special head adapted to fit the display of his HP-65. This head makes a 1:1 image of
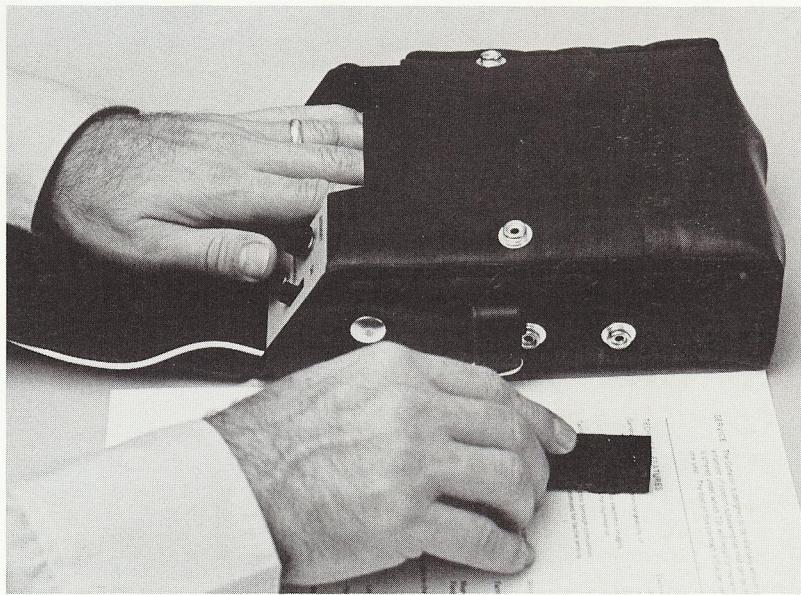
The Optacon is battery operated and conveniently portable. This remarkable device is produced by: Telesensory Systems, Inc., 1889 Page Mill Road, Palo Alto, Calif. 94304. Phototransistors, two tiny lamps, and a lens in the head read type—or a calculator display. Signals produced by the phototransistors are converted into a pattern of vibrating reeds, which produce an image on a "tactile screen" that a blind person can feel with one finger. Following training and practice, Optacon users have achieved reading speeds of more than 50 words per minute, and speeds have gone as high as 80 words per minute. *(Photo courtesy of Telesensory Systems, Inc.)*

what it sees. With it and his trusty HP-65, *Jim* can write a program, test and verify it, and be assured that he is not making errors. According to him, the credibility on a complicated computation is virtually 100 percent.

But how does he keep track of his programs on the magnetic cards? As you can imagine, it would be overwhelmingly tedious to have to read out the program every time you looked for a card. So *Jim* keeps his cards in pocket instruction card holders and uses braille to annotate and segregate the cards.

To give you an idea of the versatility of this threesome (*Jim*, the *Optacon*, and the HP-65) *Jim*, already a mechanical engineer, is presently a doctoral candidate in Management Science and Operations Research at the University of Texas Graduate School of Business in Austin, Texas. It also tells you something about the perseverance and indomitable courage of one *James L. Caldwell!*

USERS' LIBRARY CORNER

You'll be delighted to know that a new *Catalog of Contributed Programs* will come off the presses about the end of March. It will contain over 2000 programs—*over three times as many as the last Catalog!* And, because so many of you have requested it, the Catalog will be in loose-leaf form and punched for standard three-ring binders. As a loose-leaf notebook, it will be easier to add notes, hints, corrections, etc., and as a side benefit, it will stay open at any page you are using. We think you'll find it much handier than the old version.

What You Get
When You Order a Program

Primarily, you get a photo copy of the original documentation from the submitter, which includes:

1. **The Program Description**—with equations, variables used, operating limits and warnings, sketches (when applicable), sample problem(s), sample solution(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.

New Programs

There are now over 2000 programs in the Library. And they keep pouring in—really fine submittals. To pique your interest, here are some new programs submitted since the last Catalog.

If possible, use an order form from the Catalog to order these programs. **Use the program number shown here.** Send only checks or money orders, payable to Hewlett-Packard Company. Be sure to include any state or local taxes. (Each numbered program has a nominal charge of $3.00.)

HEXPAWN—GAME-LEARNING MACHINE (Order #01120A)

Hexpawn is a simple game played on a 3 x 3 playing board. What makes this implementation interesting is that the program starts out by knowing only the rules and then learns to play the game better and better as it is played. After playing about 20 games, the program should be unbeatable.
Author: Jacob R. Jacobs
      Mountain View, California

POLYNOMIAL APPROXIMATION (Order #01149A)

This program finds a least square polynomial approximation (up to the 4th order) to a set of equally spaced points. The special Chebyshev orthogonal polynomials for discrete intervals are used.
Author: HP-65 Users' Library

COFFEE GAME (Order #01489A)

Who, among a group of two or more players, will buy the coffee? The HP-65 picks numbers until a player presses R/S. Game proceeds in rotation. Each player tries not to guess the number that the calculator has chosen. Each predecessor has narrowed the limits of the guess.
Author: Asa N. Dean
      Long Beach, California

3 X K CONTINGENCY TABLE (Order #01338A)

Computes the chi-square statistic to test the null hypothesis that two variables are independent for a contingency table

with three rows and K (arbitrary) number of columns.
Author: Robert E. Sherman
      Minneapolis, Minnesota

SECOND ORDER DIFFERENTIAL EQUATIONS WITH FOURTH ORDER RUNGE-KUTTA METHOD (Order #01167A)

Second order differential equations or a system of two first order differential equations may be solved with the fourth order Runge-Kutta method. A second order differential equation is equivalent to a system of two first order differential equations. This program solves for a system in both cases. There are 23 steps and three registers available for the functions.
Author: J. Robert Cooke
      Ithaca, New York

HUNT A MOVING SUBMARINE! (Order #01957A)

The aim of the game is to sink an enemy submarine that has a random position in a 10 x 10 grid. At any move you can choose between using your sonar or dropping a depth charge. If you do not sink it, the submarine moves randomly to any contiguous position in the grid. You win if you hit it using 10 sonars or less and 3 depth charges or less.
Author: Moshe M. Breiner
      Cambridge, Massachusetts

FOUR-BAR FUNCTION GENERATOR WITH THREE ACCURACY POINTS (Order #01740A)

This program synthesizes a four-bar linkage that has a specified output crank angle for a specified input crank angle for three positions in the linkage travel. Given input angles PHI 1, 2, and 3 and corresponding output angles PSI 1, 2, and 3, the program returns the link lengths with the specified input/output angular relationship.
Author: Roger L. McCarthy
      Cambridge, Massachusetts

TWO-INSTRUMENT RADIAL SURVEY LAYOUT (Order #01667A)

Computes the horizontal distance between theodolite station and prism point for a two-instrument radial survey

method. Useful for laying out points in the field.
Author: James A. Haugen
Longmont, Colorado

S-PARAMETER DESIGN 1, STABILITY FACTOR, MAXIMUM GAIN (Order #01023A) AND S-PARAMETER DESIGN 2, LOAD AND SOURCE REFLECTION COEFFICIENTS FOR MAXIMUM GAIN (Order #01185A)

Given the two-port scattering matrix parameters, the first of these programs will compute the stability factor and maximum gain for a stability factor greater than one. The second program calculates source and load reflection coefficients for maximum power gain or, if the stability factor is less than one, it calculates C_1 and C_2 vectors.
Author: Fred O. Kask
Tempe, Arizona

FM SIDEBAND LEVELS (Order #01250A)

Given desired sideband number (carrier = 0) and either modulation index or peak phase deviation, this program computes (1) sideband level with respect to the unmodulated carrier level or (2) sideband level with respect to the modulated carrier level.
Author: James A. Hall
Palo Alto, California

NEW APPLICATION PACS

If you are even remotely interested in thermal and transport sciences or stress analysis, you'll be happy to know that *these* are the topics of our next two application pacs. The first new one, *Chemical Engineering Pac 1,* will be available after March 1, 1975. We must stress (no pun intended), however, that *Stress Analysis Pac 1* will not be available until after April 1, 1975. All orders that include this item will be held until it is available. Here's a rundown on both pacs.

Chemical Engineering Pac 1, 00065-67050, $45.00

18 Programs and 40 Magnetic Cards:
- Ideal Gas Equation of State
- Redlich-Kwong Equation of State
- Reversible Polytropic Process for an Ideal Gas

- Isentropic Flow for Ideal Gases
- One-Dimensional Normal Shocks for Ideal Gases
- Fluid Transport Numbers (Nusselt-Heat and Mass, Reynolds, Lewis, Schmidt, Biot, and Prandtl)
- Fanning Friction Factor and Conduit Flow
- Conservation of Energy
- Von Kármán Analogy for Heat and Mass Transfer
- Heat Exchanger Analysis (Heat Transfer and Effectiveness for Cross-Flow, Counter-Flow, Parallel-Flow, and Parallel-Counter-Flow Heat Exchangers)
- Heat Transfer Through Composite Cylinders and Walls
- Straight Fin Efficiency
- Natural Convection (Estimate Coefficients for Vertical Cylinders and Walls, and for Horizontal Cylinders and Plates)
- Black Body Thermal Radiation
- Temperature or Concentration Profile for a Semi-Infinite Solid
- Hydrocarbon Combustion
- Curve Fitting (Linear, Exponential, and Power Curve Fitting)
- Unit Conversions

Stress Analysis Pac 1, 00065-67051, $45.00

25 Programs and 39 Magnetic Cards:
- Two-Dimensional Vector Operations
- Static Equilibrium of a Point
- Static Equilibrium of a Rigid Body
- Properties of Rectangular Sections
- Properties of Circular Sections
- Properties of Annular Sections
- Composite Section Properties
- Binding Stress in Beams or Torsional Shear Stress
- Stress in Circular Shafts
- Linear or Angular Deformation of a Shaft
- Thin-Walled Pressure Vessels
- Stress in Thick-Walled Cylinders
- Interference Fits
- Mohr Circle for Stress
- Soderberg's Equation for Fatigue
- Circular Plates With Simply Supported Edges

- Circular Plates With Fixed Edges
- Rectangular Plates (Simply Supported and With Fixed Edges)
- Cantilever Beams
- Simply Supported Beams
- Beams Fixed at Both Ends
- Beams Fixed at One End and Simply Supported at the Other End
- Compressive Buckling
- Eccentrically Loaded Columns
- Rectangular, Reinforced Concrete Sections
- Bolt Torque

NOTE: All programs from these two new pacs are in the latest Users' Library *Catalog of Contributed Programs* and may be ordered separately. Refer to the notice in the **Library Corner** about the new Catalog.

APPLICATION PAC CORRECTIONS

If you own some of our application pacs, check the following corrections and mark them in your copy, or order a new card. If your copy is correct, you have a later, revised issue of the book and/or card.

Navigation Pac 1

Rhumbline Navigation, NAV 1-09A, page 28. Under Notes: on page 29, add a fourth note: "4. This program gives incorrect results when computing distances due east or due west across the date line. To obtain correct results, compute up to the date line and then proceed on the other side."

Great Circle Computation, NAV 1-11A, page 34. Under Notes: on page 35, add a fourth note: "4. If the vertex calculated does not seem reasonable, interchange points 1 and 2 and start again."

Composite Sailing, NAV 1-12A, page 38. The equations for λ_{v1} and λ_{v2} should contain the term "sgn ($|\lambda_2 - \lambda_1| - 180$)" instead of "sgn ($L_{max}$)" so that the program will work correctly when the initial and final positions are on opposite sides of the date line. If you need a corrected "B" version of this magnetic card, send your "A" version card to APD Customer Communications (address on back cover). *(continued)*

Aviation Pac 1

Flight Plan With Wind, AV 1-01A, page 10. This program halts prematurely during the heading calculation when wind vectors are from 90° or 270°. In this case, a zero is displayed instead of the correct heading. Pressing `R/S` will cause the program to continue to the correct result. If you need a corrected "B" version of this magnetic card, send your "A" version card to APD Customer Communications (address on back cover).

Rhumbline Navigation, AV 1-16A, page 50. This program requires an additional note on page 51, under Limits and Warnings, as follows: "This program gives incorrect results when crossing the international date line due east or due west."

Position Given Heading, Speed, and Time, AV1-18A, page 56.* This program fails to give correct results for flights due west and, in some cases, due east. The equation halfway down page 56 should read:

$$LNG_D = LNG_S - \left[\frac{DIST \sin HDG}{60 \cos LAT} \right]$$

If you need a corrected card, send the incorrect card to APD Customer Communications and they will send back a corrected "C" version card.

The book lists this program as AV 1-18A. However, the original magnetic card is marked AV 1-18B.

EE Pac 1

Parallel Resonant Circuit, EE 1-03B, page 14. Under Notes: 2 on page 15, the keystroke sequence is now longer. Just before "SWITCH TO RUN," add another line as follows:

Press `SST` seven times, then `1`

Finance Pac 1

Bond Yield, FIN 1-32A, page 92. This program gives incorrect solutions in cases where the redemption value (RV) is not 100. Send your incorrect "A" version card to APD Customer Communications and they will send back a corrected "B" version card (address on back cover).

55 + 21 ≠ 76

Since the last **KEY NOTE**, two new pocket calculators have been released by Hewlett-Packard. The first, the HP-55, is more capable than our HP-45, and it is programmable (but doesn't have a card reader). The HP-21 is similar to, but more capable than, the HP-35. Of course, prices are much lower: HP-55 is $395 and HP-21, an uncompromising scientific calculator with traditional HP quality, is an astonishingly low $125! If you haven't already passed your older HP calculator on to your son, here's the perfect opportunity to buy him either his "first" scientific calculator or—with June graduation coming soon—his "go to college" HP-55 programmable scientific calculator. You can even order them on the enclosed *Accessory Order Form.*

Of course, each HP-55 and HP-21 comes complete with:

- Battery Pack
- 115/230-Volt AC Adapter/Recharger
- Soft Carrying Case, with belt loop
- Illustrated Owner's Handbook, with step-by-step instructions and sample problems

In addition, each HP-55 includes a Safety Travel Case, a Quick Reference Guide that summarizes instructions, and a pad of Programming Forms.

HP-55: With its 49-step user memory, you can program the HP-55 yourself to solve your repetitive problems automatically. Single-step *and* back-step keys! Or go to any line in memory by pressing the "Go To" key and the number of the line. The display even indicates program line numbers! And look at all the other features:


HP-55 Programmable Scientific Calculator

- **86 Keyboard Commands!** More than any other scientific pocket calculator.
- **20 Storage Registers!** More than any other scientific pocket calculator.
- **100-Hour Digital Electronic Timer!** Indicates hours, minutes, seconds, and hundredths of a second. Takes up to 10 "splits" at a time. And all with 0.01% accuracy!
- **7 English/Metric Conversions!**
- **3 Angular Modes!** Degrees, radians, or grads.
- **5 Statistical Calculations!** Summations (+ and –), standard deviation, linear regression, means, and linear estimates.
- **Plus Dozens More!** Like HP's four-register stack, last x register, "RPN logic" system, and on and on. In its class, there's never been a pocket calculator like the HP-55! (Of course, your HP-65, with more memory, a card reader, and other functions, is the *ne plus ultra!*)

HP-21: In only 6 ounces, the HP-21 brings you all of the functions of the HP-35 plus:

- **Rectangular to Polar Conversions!** Automatically.
- **Display Format Selectivity!** Choose between scientific notation and fixed decimal point display format.
- **Automatic Overflow and Underflow Feature!**
- **Full Register Arithmetic!** An addressable memory for storing data. You can perform all four arithmetic operations directly upon this stored data.
- **Degree/Radian Mode Selection and Conversion Capability!**
- **10^x Key!** Allows you to evaluate common antilogs.
- **Even an Error Indicator!** If you happen to key in an improper operation, the word *Error* will appear in the display.

Another new feature in the HP-21 is its quick-charging battery pack. Under normal use, it will provide 3 to 5 hours of operation. Normal charging time from dead battery to full charge—with the calculator turned OFF—is only 6 hours. With the calculator turned ON, charging time is 17 hours.

In a package only 5-1/8" long by 2-11/16" wide by 1-3/16" high, the HP-21 represents a price-performance ratio that's simply unbeatable!
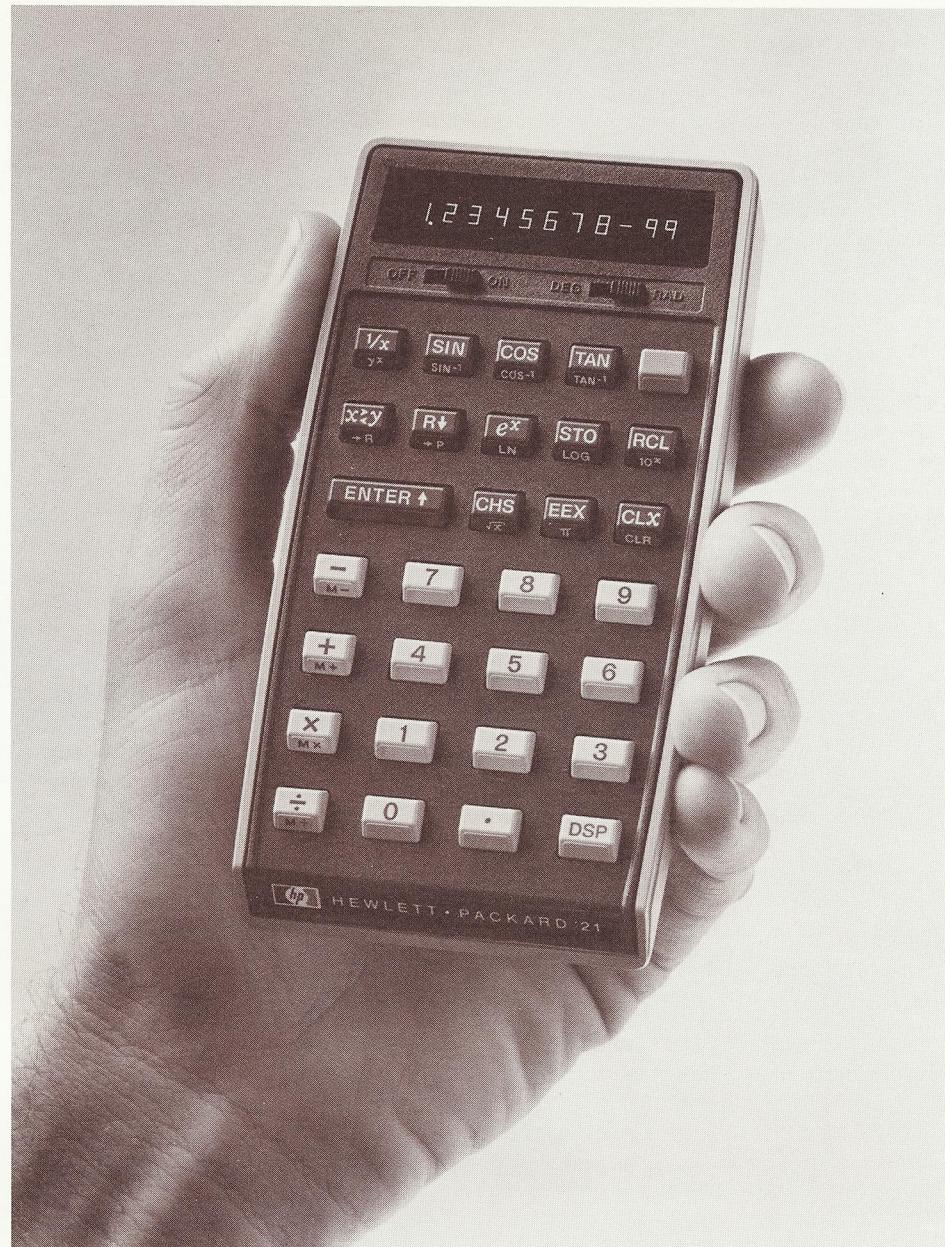
HP-21 Scientific Calculator

PROGRAMMING TIPS

As you become more adept at programming the HP-65, programs tend to become longer, more complex, and, sometimes, seemingly hopeless. Quite often, there are clever ways to handle a program problem—and save a seemingly hopeless mess. We'll continue to publish *your* ideas and hints, provided they are not too long and that space permits. Here are more from our bag of tricks.

Use SST for Multiple Inputs

Suppose you have a very long program that has three inputs (F, G, H) and you need to cut out a few steps. Normally, you'd program like Example 1; however, Example 2 will do the same thing and save six steps in your program.

EXAMPLE 1	EXAMPLE 2
LBL	LBL
A	A
STO 1	STO 1
R/S	R/S
LBL	STO 2
B	STO 3
STO 2	
R/S	
LBL	
C	
STO 3	
R/S	

The keystrokes for Example 1 would be: F [A] G [B] H [C] ; for Example 2: F [A] G [SST] H [SST] . This method also can be used for multiple outputs.

5

Undefined Subroutine Call

Although a more difficult tip to apply, this one can save many steps in a long program: If an *undefined* subroutine (say, E) is called in a running program, then E will be ignored and the first RTN encountered will act like an NOP. For example, consider this problem: $(\ln (x + 3))^2$ or $\ln (\sqrt{x} + 2)$. It would look like this:

```
LBL
 A                        LBL
 E ←  (UNDEFINED, BECAUSE   B
 3      THERE IS NO "LBL E")  f
 +                        √x
GTO                        2
 1 ─────────────────────→  +
```

```
              LBL
               1
THIS RTN WILL  f
BE IGNORED IF  ln    EXECUTION
   THE LBL A   RTN   WILL STOP
   ROUTINE IS  f⁻¹   HERE IF LBL
     USED      √x    B IS USED
               RTN
```
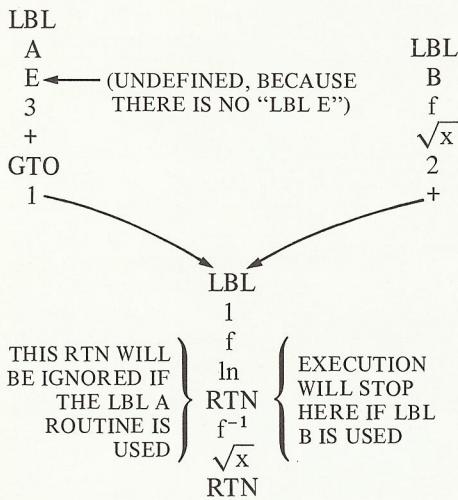
Now, when **A** is pressed, the pointer moves down through the program, ignores the first RTN, and stops at the *second* RTN. When **B** is pressed, the pointer stops at the *first* RTN.

There is, however, one caution: this will not work if a *defined* subroutine is called before a RTN is encountered.

And, now, here are a few tips from HP-65 owners.

Flagging Errors

To flag error conditions in a program, use ☐ ÷. No RTN is necessary. This method is convenient in that it can be used with a conditional to "error-stop" on true. (From: Jim McKelvey, Benicia, CA.)

Bulk Erasers*

If you have a lot of magnetic cards that you'd like to erase, try using a bulk magnetic tape eraser such as is used to erase cassette tapes or open-reel tapes. Most audiophiles (or hi-fi stores) will have them. (From: Glen R. Shepherd, Corona Del Mar, CA.)

*(Although some of you like to start with a "clean" card, it is not necessary to erase cards to reuse them in the HP-65. The HP-65 will "write-over" any program on a "used" card. Ed.)

5 Hours, 10 Minutes!

Although not exactly a tip, this will save you a lot of time—because it's already been done! Robert Altenhofen, Sunnyvale, CA, notified us recently that, using *Math Pac 1* program 1-01A, his HP-65 took 5 hours and 10 minutes to determine that 1.999999973×10^9 is the largest prime $\leqslant 2 \times 10^9$. Now, that's what we call perseverance! *(No! I didn't check it! Ed.)*

TWO BOOKS FOR THE HP-55

Today, at only $10.00 a copy, nearly *any* technical book is a bargain. But when the book is about HP programmable calculators and contains anywhere from 53 to 74 programs, it is, indeed, a bargain. Shown here are the covers to two new books written specifically for the new HP-55. If you've already invested in an HP-55, or if you intend to, these books will increase the already astonishing "power" of this new calculator. And they're included on the enclosed *Accessory Order Form.*

HP-55 Mathematics Programs contains 74 programs about:

- Complex Variables
- Business Mathematics
- Linear Algebra
- Integration and Interpolation
- Number Theory and Algebra
- Trigonometry/Analytical Geometry

*HP-55 Statistics Programs* contains 53 programs about:

- Probability
- Special Functions
- General Statistics
- Distribution Functions
- Curve Fitting
- Test Statistics

APPLICATION FOR EE 1-04A

We've had a number of inquiries about one of the programs in E.E. Pac 1. The inquiries were mostly: "Can you give us an example of how to use 04A?" So here is a typical application:

By using a frequency of $\frac{1}{2\pi}$ Hz, the *Impedance of Ladder Network* program (EE 1-04A) may be used when only the reactances of the network elements are known. Inductive reactances should be input directly and capacitive reactances should be input either as inverses (1/x) or as negative inductive reactances.

Suppose you wish to obtain the input impedances of the network shown.

$X_c = 50\Omega$

$X_L = 100\Omega$

The keystrokes are:

RTN R/S 2 g π × g 1/x

E D

100 B

50 g 1/x E B

or 50 CHS E C ──────→ 50.00

D ──────→ 90.00

Thus, the input impedance is $50\Omega \angle 90°$.

PROGRAMMING AID

In your eagerness to see or check your latest program creation, have you ever pressed the g or RTN keys while running back through a program in the W/PRGM mode? Exasperating, isn't it?

Well, thanks to Mr. Louis Valier of Honolulu, Hawaii, you'll never feel that way again. He designed this clever gadget that you'll surely want to construct if you do much programming.

Follow the directions to cut and fold a "hood" for your HP-65. Then, with the hood in place, only the SST key and the portion of the display used in W/PRGM mode are exposed. You can go through a program rapidly and never make a mistake. Be sure to use cardboard—or similar material—hard and/or thick enough to hold the weight of your hand, so keys cannot be depressed through the cardboard. It works! And very well! Even thick paper will do the job, but you won't be able to rest your hand on the paper hood.

Cut out all openings before folding. Lightly score top surface of hood along dotted lines before folding. Make all folds "down," away from top surface. Then use fast-setting glue to hold corners together. Tucking end-flaps inside the side pieces will make a neater-looking hood.

QUESTIONS— AND ANSWERS

Because we have heard many conflicting ideas about what can and cannot be done to mark your magnetic cards, we've devoted this column to the subject: *On Marking Magnetic Cards.*

Question: *I find the notation area on the present cards too small for my requirements. Are "plain white" cards available?*

Answer: Not right now, but soon! The cards are in redesign and should be ready for sale by late April or early May. We will notify you and show them to you in the *Spring* issue of KEY NOTE. Essentially, they will be all-white except for black "tic" marks between the five program control keys.

Question: *How can I get more information onto the cards—and neatly?*

Answer: A lot of HP-65 owners are using several kinds of pressure-sensitive, rub-on lettering to mark their cards. It is extremely neat, very small type sizes can be used, and it seems to be fairly permanent. The lettering generally comes on 8½" by 11" sheets. To use it, you place the desired letter over the spot on the card and burnish it with the blunt end of a pen or a similar instrument. Many different sizes, fonts, and colors are available. And the letters **can** be removed with an eraser or even with masking tape. The material, itself, is available in art supply, office supply, drafting supply, and similar stores. There are many tradenames; some are: LETRASET,* NORMATYPE,* ZIPATONE,* and CHARTPAK.*

Question: *If I use rub-on lettering to mark cards, will it come off and ruin my card reader?*

Answer: Various types of adhesives are used to make the letters stick; even wax is used. Under normal use, most letters will not "fall" off. However, **there is no guarantee they will stay on your card**, especially if you vigorously flex the card and/or subject it to a lot of "handling" abuse. A lot of HP-65 owners, realizing this, have added another touch; they spray "fixative" over the card after the rub-on letters have been applied. This leaves a tough, clear coating over the lettering, which should tend to prevent letters from coming off. *(continued)*
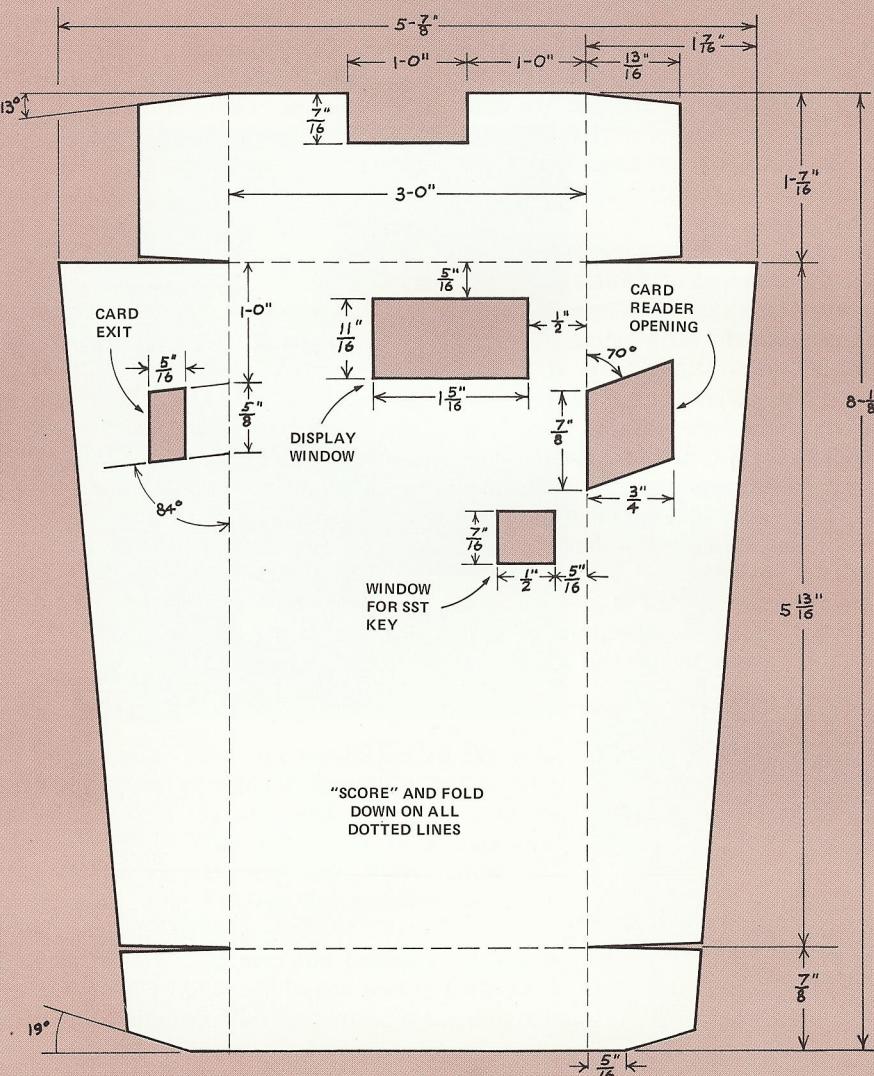
*Registered trademark.

The "fixative," sold under many tradenames such as KRYLON,* BLAIR NO ODOR SPRAY FIX,* etc., in pressurized aerosol cans, is also not perfect. If applied in light, thin coatings, it should not cause trouble. Heavy, wet coatings can cause some inks to run, and can cause the card thickness to build up and possibly damage the card reader. Also, the cards should be stuck onto masking tape (oxide-to-tape) before spraying so that the fixative does not get on the oxide.

This method does produce an exceptionally neat job. It **is** tedious and it **can** cause trouble; you have to weigh the results against certain marginal factors. Some people have been using this method for months, now, and have had absolutely no trouble.

Question: *Pencil (lead) markings on my cards smudge when I remove a card from the slot. How can I prevent this smudging?*

Answer: If you **must** use a pencil, it **will** smudge. Either use a pen (see below) or, if you insist on pencil, use one of the spray fixatives (mentioned above) over the pencil lead. The coating will prevent smudging and, depending on brand and type, can be written over. Follow the precautions stated (above) for the sprays.

Question: *What pens or inks will not run or smudge on the cards?*

Answer: This has been discussed before, but for the benefit of those who did not see it, here goes again.

Here are some products that have worked for us and for HP-65 owners.

*Registered trademark.

Remember: these are merely recommendations and not endorsements for these products.
1. Sanford's *Sharpie,** No. 49 (felt-tip pen).
2. *Magic Marker,** Studio Fine Line, Black F-100, Model 87 (felt-tip pen).
3. *Uni-Mark,* Micropoint, Unimark 960 (felt-tip pen).
4. *Drawing Ink Fountain Pens.* Found in any drawing, drafting, or graphics department. They use special "drawing ink" and have interchangeable points.

NEITHER RAIN NOR SNOW NOR HEAT NOR DUST...

You already know that you own the *ne plus ultra* of pocket calculators—the incomparable HP-65. However, it is nice to occasionally hear of an incident that solidly reinforces your original decision to buy "HP quality." In fact, we constantly highlight the term "HP quality," so it is gratifying to have that term substantiated by true stories such as the one that follows.

Recently, we received a letter from one of the members of a Surveys Section Crew for the California Department of Transportation. In early spring of 1973, an HP-35 pocket calculator that was permanently assigned to a field survey crew was found to be missing from their survey truck. You can imagine the chagrin of the survey crew. In fact, they spent three weeks looking for it and over a year being admonished for having lost it or letting it be stolen.

Then, in October 1974, a year and a half later, the Surveys Section received notice that a deer hunter had found the missing calculator. The site of his find was alongside a remote, dusty logging road atop Hatchet Mountain (altitude 5,000 feet), which is approximately 45 miles northeast of Redding, California. (The calculator was returned to the proper owner because the name was engraved on its case.)

It is significant to consider the area where the HP-35 was found. It is a rugged mountain area where temperatures drop to below freezing in winter and rise to over 100°F in the summer. It is not uncommon for snow to reach depths of 10 feet in winter and dust to accumulate to depths of a foot or more in summer. So it is not at all surprising that dust, grit, and water stains were found inside the calculator even though it was still in its plastic carrying case when found.

What is hard to believe, however, is the experience that the survey crew had when they first got back their long-lost HP-35. Out of normal curiosity, they immediately switched the calculator to ON. Imagine their complete surprise when they saw a dim red zero appear in the display!! No wonder their letter to us included plugs for such things as "well-designed" and "durable product" and "showing quality control by its manufacture."

And, of course, there's a happy ending to our story. The once-missing calculator, having survived the rigors of a fall from a moving truck, freezing, heat, and dust, was disassembled, thoroughly cleaned, reassembled, and recharged. That was all that was required to restore it to perfect operating condition. Needless to say, the original bad guys in this story—the field survey crew that had lost the calculator—were extremely happy to get back their trusty HP calculator.