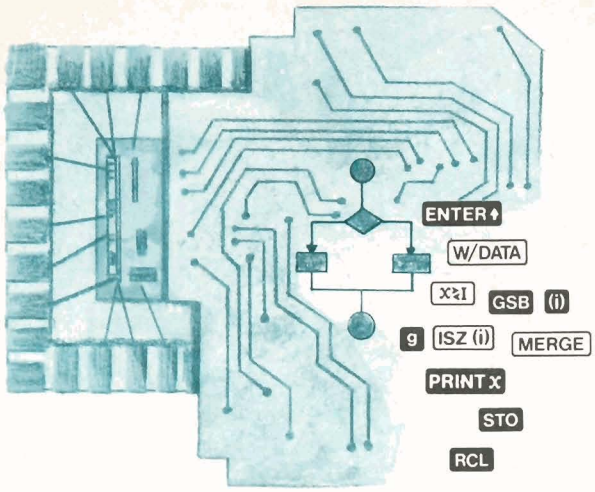

Computer Museum

Featuring, this issue:

HEWLETT PACKARD

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HP Key Notes

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HP-41's Again Aboard *Columbia*

Unless you have been hiding in an igloo near the North Pole for the last year or so, you know all about the space shuttle *Columbia*, which we featured on the cover of V5N1. And, because you read KEY NOTES, you know that the astronauts use our HP-41 handheld computers onboard *Columbia* for various flight-related, radio-contact, and backup operations. And, no, their programs are not in the Users' Library nor are they for sale. They contain NASA proprietary information and are for use only on the space shuttle.

For the last *Columbia* flight, near the end of last March, the two HP-41 computers were purchased over-the-counter by NASA from a Houston, Texas, office-equipment store, and were tested rigorously before being approved for flight. They are identical to the hundreds of thousands of HP-41's sold since 1979.

One HP-41 computer, dedicated to what NASA calls the acquisition-of-signal program, was the only convenient means the shuttle crew had to estimate the time, location, and radio frequency of their next contact with Earth. Also, if the astronauts are awakened at night by an alarm, they can tell at a glance how long it will be before they can discuss the problem with Mission Control.

The second HP-41 computer acts as an electronic secretary for the astronauts—reminding them of daily chores with alarms and flashing messages. Each morning, the astronauts programmed their computer with five to ten alarms. That way they didn't have to write down on paper all their scheduled activities. In other words,

(Continued on page 16)

Astronaut Gordon Fullerton aboard *Columbia* on the last flight, using his HP-41. Notice that he is "sitting" in midair, in the "zero" gravity of outer space. (Photo courtesy of NASA.)

We Get Letters...

And we *know* that you are going to not only *like* this one but also *use* it for *your* purposes. There's a lot of emphasis on a lot of words in that opening sentence, but for good reasons, as you will soon learn. Take a very close look at the photograph reproduced here; we'll bet you'll *never* suspect what it represents. Anyway, before you peek inside KEY NOTES, here's the letter we received from **Mrs. Keith Olson** of Cupertino, California.

"Some time ago, my husband bought an HP-41. Soon thereafter he wanted a safe,

(Continued on page 15)

All prices in this newsletter are suggested retail prices excluding applicable state and local taxes—Continental U.S.A., Alaska, and Hawaii.

Corvallis Library Corner

There are now over 4793 HP-67/97 programs and 1730 HP-41 programs in the Corvallis Users' Library, and we get more and more each and every day of the week. And, as much as we are grateful for your excellent output, there are a few subjects we'd like to see covered. For example, **Andrew N.C. Cruickshank**, a Town Planner and Economist who lives in London, England, recently wrote and asked if we had any programs in *his* field—programs such as population projection, property development, regional economic analysis, etc. And we are often surprised that there aren't more programs for farmers.

But one must admit that, all in all, you are a very prolific and excellent society of calculator programmers, and we congratulate each and every author who has taken the time to share a program through the Library.

ORDERING PROGRAMS

HP-67/97 and HP-41 programs featured in KEY NOTES are available from both the Library in Corvallis and the Library in Geneva (except where stated otherwise). **Readers in Europe should order from Geneva (address on back cover) to get quicker service.** Readers elsewhere should order from Corvallis. Each program includes documentation and prerecorded magnetic cards; HP-41 programs include bar code.

Mail your order and a check or money order to the Corvallis or GENEVA address on the back cover of KEY NOTES. Don't forget to include your State or local taxes. Or, in the U.S., you can place your order by calling toll-free: 800-547-3400, except from Alaska and Hawaii. (In Oregon call 503-758-1010, NOT TOLL FREE.)

When ordering from outside the U.S., **attach your payment to your order.** Much time is wasted and orders are held up trying to match checks and orders that are sent in separately. Your payment can be in the form of an International Money order, a Foreign Draft, or the equivalent. *Any payment must be in U.S. dollars, drawn on a U.S. bank, otherwise it will be returned to you.* Another option for payment is to use such major credit cards as American Express, VISA, or MasterCard.

Orders are usually shipped within 2 working days after they are received in Corvallis. However, if you need a program yesterday, call us today at 503-757-2000, extension 3371. Although we can't get it to you yesterday, if you call before 12:00 noon, we'll get it in the mail today.

SUBMITTING PROGRAMS (Corvallis)

Programs submitted to the Corvallis Users' Library should be on Hewlett-Packard standard Library submittal forms, or they should include at least the documentation required by those forms. To maintain the high quality of the programs submitted to the Users' Library, we encourage you to closely follow the *Users' Library Contributor's Guide for the HP-41, HP-67, and HP-97.* Complete and orderly documentation is essential to ensure the acceptance of a program into the Library.

We also encourage you to read the ongoing KEY NOTES column, "In the Key of HP." This column addresses some of the things we look for when we are reviewing programs that are submitted to the Users' Library.

Programs that are submitted to the Corvallis Library for the HP-67 or HP-97 must include magnetic cards, and HP-41 programs must include either magnetic cards, **reproducible** bar code, or a data mini-cassette for use with the new HP-82161A Digital Cassette Drive. (The cassette will be returned to you.) It would take far too long to check and review all the many program submittals if we had to key them in line by line. Also, there is always an increased chance of error when someone keys in handwritten keystrokes.

The management of the Corvallis Users' Library reserves the right to reject programs which, in its opinion, do not represent a significant contribution, are not clearly or sufficiently documented, or are not otherwise appropriate for the Corvallis Library.

THE CORVALLIS CONTEST

The 1982 Corvallis Users' Library Submittal Contest is well under way. The ten winners for March have been chosen and these winners are featured elsewhere in this column. All of our authors are to be congratulated for the fine contributions they have made to the Corvallis Library.

There are 50 more prizes to be awarded in this contest! Last year, 50% of the total contest entries arrived during the last month of the contest, so send your programs in early to increase your chances of winning. This contest runs through August, 1982.

THE POINT PROGRAM (Corvallis Only)

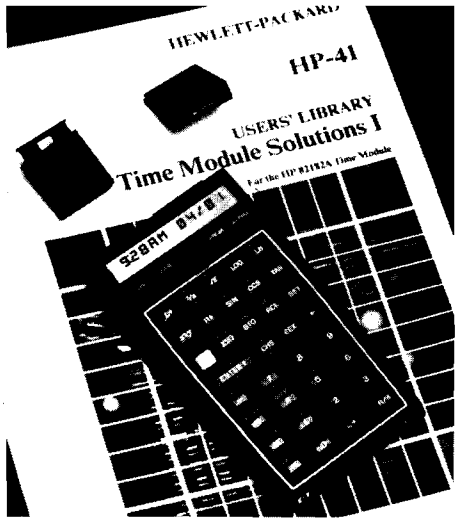
The Corvallis point program has been enthusiastically received by everyone. For those who missed the announcement, the authors of all HP-67/97/41 programs, currently accepted for the Corvallis Library, are being issued point certificates, (one per accepted program). These points are then redeemable, by the Corvallis Library, for a vast array of HP products. Depending on the amount of points you have accummulated, you can choose from products that range from a Solutions Book or a custom keyboard (presently valued at one point) to an HP-85 Personal Computer (presently valued at 100 points)! A complete list of the available merchandise can be obtained from the Corvallis Users' Library.

Now, in addition to the opportunity to win prizes in the contest, many diligent authors are well on their way toward earning enough Corvallis points to "purchase" their favorite HP products. The point program is not retroactive. **We cannot exchange Library coupons for points, nor can we redeem "Users' Program Library Europe" point certificates.**

THE CUSTOM KEYBOARD (Corvallis Only)

Foremost on the list of requested items is the custom keyboard. Everyone wants one! **The keyboard (with the standard key configuration) is presently obtainable only from the Corvallis Library** for one point, or in lieu of the 25% discount offered on orders of 6 or more Corvallis Users' Library programs. In other words, if you order 6 or more programs and *do not* take the 25% discount, you can request a custom keyboard in lieu of the discount.

MINI-SOLUTIONS



Our new Solutions Book, *Time Module Solutions I 00041-90395,* is in stock and is being shipped. It greatly compliments the HP-82182A Time Module, and demonstrates just how versatile and indispensible your HP-41 is. Time Module Solutions I and all solutions books are now available recorded. Magnetic cards are $20* per book; mini-data cassettes are $12* for the first Solutions Book requested and $6* for each subsequent book recorded on the same cassette.

MINI-SERVICES

A mini-cassette duplicating service is a new Corvallis Users' Library offering. Send us a cassette with your favorite collection of programs, and we will copy it for you—in any quantity. The cost for this service is $12* per cassette requested (that $12* includes the price of the cassette). This new service provides an ideal opportunity for businesses, clubs, and organizations to distribute their "custom" software collections to members.

MANY REQUESTS

In response to many customer requests, the Library, long ago, established standards by which programs are accepted for the Corvallis Users' Library. Our review staff checks each program for complete and accurate documentation, friendliness, and ease of use. All programs submitted must be accompanied by magnetic cards, bar code (HP-41), or mini-data cassette (HP-41), and should solve a problem sophisticated enough to warrant its purchase. These guidelines will ensure top-quality software for you.

Our review staff is available to answer any questions regarding either existing Library programs or programs that you are developing to submit to the Users' Library. Call 503-757-2000 and ask for extension 2886 between 9 am and 4 pm.

ORDER TURNAROUND TIME

The Library has finally reached its goal of giving you 48-hour turnaround on mail and TOLL-FREE phone orders, and we are proud to tell you that we intend to maintain that goal.

Orders telephoned directly to the Library (503-757-2000 X3371) always ship that same day, regardless of the number we may receive!

The Corvallis Users' Library is your Library. Write us with recommendations for services or with any suggestions on how we might serve you better.

"Old" Contest Winners

Because of the overwhelming number of programs submitted during December for the 1981 Users' Library Contest, the announcement of that month's winners and the Grand Prize winners did not make the press date for the last issue of KEY NOTES. We are featuring these winners in this issue.

The December winners all chose HP-41CV's as their prizes and, as you know, each of the Grand Prize winners is now the proud owner of an HP-85 Personal Computer!

DECEMBER WINNERS

(41) Sunpath Diagrams #01524C (Price: $10*)

SUNPATH calculates solar altitudes and azimuths for each daylight hour of the day, given date and site latitude. A blank chart is furnished for plotting sunpaths for each month. Illustrated procedures are given for using the results. Another program, labeled SUNTIME, converts from solar time to local standard time and vice versa. *Required Accessories: 2 Memory Modules for either SUNPATH or SUNTIME, 3 Memory Modules for both simultaneously.* (596 lines, 1396 bytes, 23 pages)
Author: **Ross McCluney**
Cape Canaveral, Florida

(41) General Network Reduction Program #01526C (Price: $12*)

This program analyzes networks of up to 80 elements. The allowed network elements are resistors, capacitors, inductors, reactors, and rigid voltage and current sources, in any serial or parallel combination. Output functions are voltages, currents, or impedances in any branch of the network. If the printer is available, either amplitude or phase transfer functions can be plotted. *Required Accessories: 4 Memory Modules for 80 network elements, Printer if plots are desired.* (443 lines, 905 bytes, 32 pages)
Author: **Dieter Lange**
Hamburg, Germany

And, the third winner for December was the game program **Flipo #01477C (Price: $12*)** that we featured in V6N1p5a. The author of Flipo is **Robert Swanson** of Portland, Oregon.

(Hearty congratulations are in order for these three authors! The time and effort that went into writing and documenting these programs is astounding. Thanks, to all three of you; we know you will enjoy using your HP-41CV's—Ed.)

Winning Programs

We announced the 1982 Users' Library Submittal Contest in the last issue of HP KEY NOTES. This contest began in March and it will run through August. Each month, ten winning programs will be chosen on merit by our review panel. And, the authors of these winning programs get to choose a fabulous HP product as their prize. The top two winners every month may choose a prize of either an HP-IL Digital Cassette Drive or an HP-IL Thermal Printer/Plotter (both include HP-IL Modules). The other eight winners may choose either a Time Module or an Extended Functions Module.

Here are the ten winners for the month of March. The authors of the first two programs chose a Printer and a Cassette Drive as their prizes.

(41) Sun Shade #01692C (Price: $12*)

Architects, engineers, and designers of solar-related equipment and structures will find this program useful. Its primary purpose is to compute the shadow cast by a shading device. The shading device may be horizontal, vertical, or oblique. Sun altitude, sun azimuth, and effective sun latitude are computed for daylight hours at any location in the world. Many other solar geophysical parameters are available such as declination, times of sunrise and sunset, Equation of Time, etc. Time may be specified as either apparent solar time or local standard time. A correction to standard time may be made for daylight saving time

Two powerful new design tools are introduced. A dimensionless S/L ratio that lets you calculate shading by a simple multiplication or division, and SHADE LINE, a sunrise to sunset history of a shadow and/or the S/L ratio. *Required accessories: Printer, 3 Memory Modules. Card Reader or Wand recommended.* (624 lines, 1317 bytes, 46 pages)
Author: **Bill Kraengel, Jr.**
Valley Stream, New York

(41) Fire Danger #01586C (Price $12*)

This program computes fire danger for both grasslands and forests; outputs include a numerical index, a hazard rating (LOW, MODERATE, HIGH, VERY HIGH, and EXTREME), rate of spread on level and sloping ground, and, in the case of forest fires, flame height, the hazard of crown fire, and spotting distance. A subprogram computes a drought index required for quantifying forest fires, and another subprogram computes relative humidity from basic meteorological data. Fire danger can be forecast and projected forward from conditions in the morning or on the day(s) before.

The complete program has three parts; the main program—Fire Danger—and two subprograms—Drought Index, and Relative Humidity. The main program can be used separately, or with either, or both subprograms. A flow diagram for the complete Fire Danger program is included. *Required accessories: 4 Memory Modules, and Printer is advantageous but not essential. (863 lines, 2054 bytes, 45 pages)*
Author: **Dr. Wilfred J.B. Crane**
Canberra, Australia

The authors of the following eight programs chose a prize of either a Time Module or an Extended Functions/Memory Module. They are listed in no particular order.

(41) The Ultimate Calendar—A.D. and B.C. #01593C (Price: $8*)

Complete calendar from January 1, 45 B.C. to February 28, 4904, the entire period of the Julio-Gregorian calendar that can be calculated with certainty. Computes days between dates, day of week, Julian day, date of a specified number of days before or after a given date, converts Julian day to calendar date. Rejects invalid dates. Program allows for Roman errors in inserting leap years between 45 B.C. and 8 B.C. as well as the Augustan and Gregorian corrections. *Required accessories: 3 Memory Modules.* (815 lines, 1554 bytes, 17 pages)
Author: **William Hutchins**
Los Angeles, California

(41) 1,2, or 3 Way ANOVA's #01579C (Price $8*)

One-, two-, or three-way ANOVA's (ANalysis Of VAriance), without or with replication (equal or unequal), are calculated by the unweighted means method modified to employ exact total sum of squares. This is a friendly program! Just set factors, levels per factor, whether or not you desire a

(Continued)

printer output (if the printer is attached), whether or not you desire replication (yes or no), and enter the values. The ANOVA table will come out either printed or flashed sequentially. *Required accessories: At least 3 Memory Modules.* (600 lines, 1194 bytes, 17 pages)
Author: **Dr. Nicholas Sinclair**
London, Ontario, Canada

(67/97) Trigg's Trend Analysis #04775D (Price: $6*)

Levey-Jennings control charts are commonly used in laboratories to monitor analytical variation. Unfortunately, they do not permit the simple detection of nonrandom trends with much sensitivity. This program provides Trigg's technique for the quantitative detection of trends in quality control data. Data may be stored on cards for ongoing evaluation. (105 lines, 7 pages)
Author: **Mike McDonald**
Berkeley, California

(41) Auto Banner #01691C (Price: $6*)

This program, using commands from the Extended Functions Module, will translate an ALPHA string and automatically print a Banner output. This program is incredibly fast. The user simply keys in the ALPHA string, the HP-41 does the rest. In addition to the keyboard characters, 106 of the 127 special characters are also supported by keying in the character number and executing the function XTOA to add the character to the ALPHA string. *Required accessories: One Memory Module, Extended Functions Module, Printer.* (103 lines, 205 bytes plus 92 data registers, 8 pages)
Author: **Christopher Erickson**
Pullman, Washington

(41) Equilibrium Flash #01569C (Price: $8*)

Given the number of moles and the K values (ratio of the fraction of the component in the vapor phase to the fraction in the liquid phase) of up to 10 compounds, this program will compute the equilibrium phase compositions. Ideal K's are calculated if the critical properties and boiling points of the components are furnished. A rugged algorithm is used that always comes to a solution. *Required accessories: 3 Memory Modules.* (487 lines, 1081 bytes, 11 pages)
Author: **Norman Samish**
Houston, Texas

(41) Vented Loudspeaker Box Tunings #01451C (Price: $12*)

Using data on the loudspeaker in question, this program solves for the "optimum" vented enclosure and permits the user to vary the tuning parameters to test alternate tunings. A 1/3-octave response listing is provided and, with the accessory printer, the frequency response is plotted. *Required accessories: 4 Memory Modules.* (660 lines, 1643 bytes, 29 pages)
Author: **Thomas Bouliane**
Buffalo, New York

(41) Symbolic Logic—Summary and Applications #01694C (Price: $12*)

This program is a relatively complete treatment of elementary symbolic logic. Logical operators defined include AND, OR, NOT, IMPLICATION (if and only if), and EXCLUSIVE OR. The operators are based on the definitions of Lukasiewicz (WookashAYveech; the "father" of RPN) and thus hold for one kind of three-valued logic. These same definitions will work for Boolean Logic when the base is 2. Thus the program may be used to simulate digital logic circuits. The user must write the programs to simulate these circuits, but examples are given to show how to do this expeditiously. A "cookbook" of compound conditionals is included in the documentation. *Required accessories: 1 Memory Module.* (186 lines, 398 bytes, 31 pages).
Author: **Edward Keefe**
Ankeny, Iowa

(41) Thermodynamic Properties of Saturated and Superheated Steam #01693C (Price $12*)

Calculate the thermodynamic properties: specific volume, enthalpy, and entropy, of saturated (liquid and vapor) and superheated steam given temperature and pressure. One equation of state, Martin's, is used over the entire range of temperature and pressure, down to $Vr = 0.56$. The calculated properties are within the tolerances given by the International Skeleton Tables (Steam). *Required accessories: 4 Memory Modules; Printer helpful.* (1047 lines, 1765 bytes, 36 pages)
Author: **Robert Wooley**
Midland, Missouri

GRAND PRIZE WINNERS

And now (drum roll), this is the announcement that you have been waiting for. Here are the **Grand Prize winners** of the 1981 Users' Library Contest. **These three winners each received a fabulous HP-85 Personal Computer as their prize!**

(41) Superbeam #01044C (Price: $10*) Author: Steven F. Dusterwald

(41) Acid-Base Factors for Blood and Brain Interstitial Fluid #01030C (Price: $10*) Authors: Thomas Adams and S. Richard Heisey

(41) General Network Reduction Program #01526C (Price: $12*) Author: Dieter Lange

The abstracts for the first two programs were featured in V5N3p4,5. They were winners for the month of September. And, the third program is listed as a December winner in this issue.

We are very happy to express our thanks to these three **(whoops, four)** authors for their contributions to the Users' Library. Through the efforts of these authors and thousands of others, the Library will continue to expand its services to the hundreds of thousands of HP calculator users.

Best Sellers

We have had a lot of queries lately about the popularity of certain programs, and this is usually followed with the question: "What are the most popular programs in the Library?" So we compiled a list of the best-selling programs since January 1982, and here they are. They are presented in numerical order, which is not necessarily their order of sales. Notice that most of them have already appeared in KEY NOTES. We congratulate these authors and encourage them to continue their level of excellence in the future.

HP-67/97 PROGRAMS

- Star Trek Advanced #00369D (Price: $6*) Author: **L.G. Schneider**
- English Metric Conversions #00434D (Price: $6*) Author: **E.R. Kool**
- Stock Selection: Criteria of Ben Graham and James Rea #01544D (Price: $6*) Author: **K.L. Hellams**
- Feeder Sizing and Voltage Drop #01878D (Price: $6*) Author: **N.J. Peros**
- Tape Recorder Counter Conversions #01917D (Price: $6*) Author: **P.M. Gehlar**
- Perspective Plot #02849D (Price: $6*) Author: **L.H. Anderson**
- Oil or Gas Downhole Pressure Build-up Analysis #03246D (Price: $6*) Author: **D.G. Olson**
- Hex/Decimal, Hex Arithmetic for Microprocessors #04350D (Price: $6*) Author: **D.T. Brown**
- Astrophotography Exposure Guide #04551D (Price: $6*) Author: **J.P. Patterson**
- Curve Fits #04719D (Price: $12*) Author: **E.A. Taylor**

HP-41 PROGRAMS

- Simplex Algorithm #00320C (Price: $6*) Author: **L.A. Esterhuizen**
- Wizard of Pinball #00361C (Price: $6*) Author: **C.A. Pearce**
- Plot of 2/3 Functions on one Graph #00732C (Price: $6*) Author: **J.L. Gilby**
- Hunt the Wumpus II #00783C (Price: $6*) Author: **B.J. Wheeler**
- Football Super III #00803C (Price: $6*) Author: **J.P. Dublirer**
- The Caves #00900C (Price: $6*) Author: **J. Surber**
- Microcalc #01115C (Price: $6*) Author: **N.C. Shammas**
- Advanced Star Trek #01321C (Price: $12*) Author: **J.P. Patterson**
- Rubik Cube Solution #01342C (Price: $12*) Author: **J.L. Gilby**
- Phone Directory #01459C (Price: $6*) Author: **J.F. Glass**

**U.S. dollars. Orders from anywhere outside the U.S. must include a negotiable check (or money order), in U.S. dollars, drawn on a U.S. bank. All orders from anywhere outside the U.S. and Canada must include an additional 10 percent fee for special handling and air mail postage. (For example, an order for two programs = $6 × 2 = $12 + $1.20 = $13.20 total.) If you live in Europe, you should order KEY NOTES Programs directly from the Geneva UPLE, but make certain you make payment as required by Users' Program Library Europe; the above $6 fee is good only for orders to the Corvallis Library.*

If *you* would like to see what makes a program popular and would like to order any of the above programs, they are available from the Corvallis Library for the listed prices. However, if you live outside the U.S., don't forget to add an additional 10 percent handling and postage fee for the order, and make sure that payment in U.S. dollars accompanies your order.

Book Reviews

Books are reviewed or announced in KEY NOTES only as a service to our readers. A review here does **not** represent an endorsement by Hewlett-Packard. If you are unsure about the contents of a book, we suggest you first check with a local bookstore; if that fails, write to the publisher. Availability problems also should be addressed to the publisher, not to KEY NOTES.

COCKPIT COMPUTERS, by **Paul Garrison**, a new book just released by the McGraw-Hill Book Company, is a 249-page hardbound book (with dust cover) in 7.3 by 9.1 inch format (18.5 by 23 cm). A main selection of the Flying Book Club, it is replete with practical tips for the conscientious aviator, and it shows how to use today's aviation calculators and computers effectively, thus making any flight more efficient and saving considerable fuel in the process. Although there are many aviation computers and calculators described in *Cockpit Computers*, readers of KEY NOTES will be interested in the fact that the HP-41 is included. However, most of the actual programs are for other types of calculators. We recommend that you look before you buy.

On the plus side, the author *thoroughly* discusses such specific aviation problems as the time, fuel, and distance to climb; true airspeed; estimate time en route; area navigation; range and endurance; weight and balance; and so on.

Paul Garrison, the author of this new book, is not a new writer. He is not only a professional pilot but also a well-known freelance writer who has written over 300 articles for such national flight magazines as *Air Progress Aero*, *Private Pilot*, and *Plane and Pilot*. He is the author of 20 prior books, including *Inside Private Aviation*, *Cross Country Flying*, and *Gliders—How to Build and Fly Them*.

Although this book has just been released, it does not include the new Hewlett-Packard Interface Loop or its peripherals, or even the new Time Module. So if you combine these new products with the information in the book, the book takes on a whole new flavor.

Because it is a new book, you might not see it in your local bookstore for a month or more, especially if you live in faraway places. The price of the book is $24.95 (U.S. dollars) and the publisher is McGraw-Hill Book Company of New York. They also have offices in St. Louis and San Francisco, and in Aukland, Bogata, Hamburg, Johannesburg, London, Madrid, Mexico City, Montreal, New Delhi, Panama, Paris, Sao Paulo, Singapore, Sydney, Tokyo, and Toronto. Check at your local dealer or call the publisher's agent to locate or order this book. As a last resort, write to the publisher:

McGraw-Hill Book Company
1221 Avenue of the Americas
New York, NY 10020 U.S.A.

FEEDBACK, by **Fred D. Waldhauer**, is another new book just off the press. It is hardbound (with dust cover), 651 pages, and in 6.3 by 9.1 inch format (16 by 23 cm). And because the programs in this book deal specifically with the HP-41, we know a lot of our readers will want to see it.

The author, Fred D. Waldhauer, is a supervisor in the Transmission Technology Laboratory at Bell Laboratories in Holmdel, New Jersey. His work has concentrated on feedback processes and digital communications. He is the author of papers on circuits, feedback, and high-speed digital transmission, and holds 14 patents in these fields. Mr. Waldhauer is also a Fellow of the IEEE (1977), a professional engineer (New Jersey), a member of the Audio Engineering Society, and he received his M.S. in electrical engineering from Columbia University.

This book describes the first new, original approach to feedback in over 50 years, with important applications for electronic circuit design. Mr. Waldhauer greatly simplifies feedback analysis and design by adopting a new pattern based on "anticausal analysis"—the analysis of feedback from output to input. This approach makes the feedback analysis problem easy to trace from the initial rough approximation to the final exact analysis and design. It offers a neat solution to what has always been a difficult problem.

In the book there are many examples and calculator programs that enable the reader to apply its principles to all problems involving feedback structures. Most of the examples are derived from electrical circuits. These examples range from audio-frequency design to microwave integrated circuits. The Table Of Contents is:

1. Feedback Amplifiers: An Alternate Foundation
2. Polynomials of Loss: Various Descriptions of Polynomials
3. Elements of Feedback Synthesis: A Case Study
4. Signal Flow Graphs of Polynomials, Rational Functions, and Circuits
5. Signal Delay in Feedback Systems
6. Two-Port Analysis of Circuits and Devices
7. Feedback Analysis of the Bipolar Transistor
8. Two-Port Feedback Analysis
9. Analog Integrated Circuit Design: Feedback and Feedforward
10. Output-Stage Design
11. Noise and Input Stages
12. Differential and Operational Amplifiers

Appendix A. Programs For Manipulating Polynomials
Appendix B. Feedback Analysis and Synthesis Programs
Appendix C. Two-Ports, Transistors, and ABCD Matrices

For readers who want to apply the new methods directly to their own designs or to check the designs given in the book, 31 programs are provided, all written for the HP-41C or HP-41CV. These programs cover most aspects of the material in the book. One of these programs synthesizes feedback systems for a prescribed performance; another converts the HP-41 into a "two-port network calculator." Included are the four basic functions of addition, subtraction, multiplication, and the matrix inverse, as well as lead interchange operations. This "calculator within a calculator" is itself programmable, and can convert numerical results into network properties including loss, input and output impedances, and sensitivities as functions of frequency.

An outgrowth of courses taught by the author in Bell Laboratories, this book will serve as a text in courses and professional seminars. Electronics engineers, scientists, technicians, and upper-division electrical engineering students should find it a more direct approach to the design of feedback systems and circuits.

The price is $47.50 (U.S. dollars) and, before you rule it out, remember that it contains 31 programs for the HP-41, replete with example, listing, etc. Check your local bookstore or agent first, and remember that this is a new book that might take months to get to faraway places. As a last resort, in Europe and Asia contact:

John Wiley & Sons, Ltd.
Baffins Lane, Chichester,
Sussex PO 19 1UD
England

In Australia and nearby areas, contact:
Jacaranda-Wiley, Ltd.
GPO Box 859
Brisbane, Queensland 4001
Australia

In the U.S., Canada, and Mexico, contact:
John Wiley & Sons, Inc.
Wiley Interscience Division
605 Third Avenue
New York, NY 10158

Something For Nothing

In the V5N3 issue of KEY NOTES, **John Loux** discussed inoperative functions in the "In The Key of HP" column under the subtitle "Indices." This discussion brought in a lot of mail dealing with "no-ops," and indices in general, and we thought you would enjoy seeing some of the suggestions that we received.

First, **Robert Whipple** of Washington, D.C., has this to say.

My candidate for filling the inoperative line following an ISG or DSE is a single, solitary decimal point. As I understand it, this takes only one byte (the same as CLD) and it has the documentary advantage that it is visually as close to a completely blank line as you can get

(Continued)

in a program listing. (This advantage is less pronounced, of course, in a program listing done in TRACE mode.) Instead of initializing a nontested index with a value like 1.999 and incrementing it with a simple ISG, I initialize it with the value 1 and follow the ISG with a single decimal point, thus saving 3 bytes of memory.

And, from **John Allen** in Nashua, New Hampshire, we have this.

KEY NOTES is great and I appreciate your suggestions for a "NOP" following DSE or ISG instruction. In the program I was writing, I couldn't use CLD because I wanted to preserve an AVIEW report. And X<>X, as you point out, takes one more byte, and also takes too long to write (I'm lazy). So why not DEG? It works fine and only takes one byte! So do RAD or GRAD, if you're in one of those modes.

Now, **Miles Abernathy** of Austin, Texas, has this to say.

A handy "do nothing" step is LBL nn. If nn is 00 to 15, it's only one byte, and it doesn't change any register.

Thanks, to you three, and to everyone who sent us setters dealing with this subject.

In the Key of HP

Most of the information you find in KEY NOTES is contributed by HP calculator users, just like yourself, who live in all parts of the world. This ongoing column is, for the most part, written by **John Loux** who is a Technical Advisor in the Corvallis Users' Library. His articles contain information, tips, and techniques that will help you to write more useful and efficient programs. Here's his latest.

THE DIGITAL CASSETTE DRIVE

The HP-41 has been recently endowed with the ability to access and manipulate large amounts of data and program information. I am speaking, of course, of the introduction of the HP 82161A Digital Cassette Drive. But, as with all technological innovations, the advantages gained are coupled with increased responsibility. The Users' Library is most concerned with the programmatic manipulation of the cassette drive. We know that program authors need to be made aware of the potential advantages and disadvantages inherent to the device before they can effectively generate application programs that use it. Hence, this article.

MANUAL MANIPULATION OF CASSETTE FUNCTIONS

To a computer user, the computer's access to mass storage is seldom a concern and is often transparent. This is as it should be. The user should not be burdened with how the currently used application program stores and retrieves data or chains program sections. It is for just this reason that all functions of the cassette drive (except NEWM) are programmable. The combination of the necessary functions being programmatically accessible with the powerful decision-making ability of the HP-41 makes it possible for a well-written program to handle virtually all aspects of cassette drive manipulation.

The program author should keep in mind that one of the main reasons that programmable calculators exist is for user convenience. The Library therefore feels that it is generally unacceptable for a submitted program to require manual intervention to deal with programmatically manipulable features of a device.

DATA SAVING

Because the HP-41 has a limit to the amount of read/write memory that it supports, programs that deal with (comparatively) large volumes of data often find themselves critically limited in the amount of information that can be stored. Even if room can be found, many times data must be destroyed by manipulations in the program. In the latter case, further calculation on the same data must be preceded by re-storing the data. For this reason, perhaps the greatest advantage that the cassette drive affords is the ability to retain this data for further and future uses. Cassette data files make it possible to access data without loading all of it into calculator memory, thereby reducing the need for a large number of calculator data registers. The cassette data file also can be easily reused without being modified.

Programs that generate and/or manipulate data files should take advantage of the cassette drive's ability to preserve initial data and not force the destruction of any accumulated data. In submitted programs, the purging or zeroing (clearing) of any data file should be well justified and well documented.

SINGLE VS. MULTIPLE DATA FILES

What appears to be a convenient way to segregate groups of data turns out to yield the slowest rate of data access. Multiple data files are an excellent way to segregate unrelated information but one must weigh the benefits of segregation against the speed and efficiency of access.

Movement through a single data file is relatively fast. Multiple blocks of information can be stored in the same data file if "pointers" to the beginning register of each block are stored in calculator memory. These pointers can be recalled and used with the SEEKR and READRX functions to access the desired block. Also, short routines can be devised to calculate the necessary pointer value. In contrast, addressing a new data file each time a different block of data is needed requires the same seek function, and, in most cases, the added delay of searching the cassette directory for the file location and the delay of moving to the file.

There is no set rule to follow in judging between the two methods of data block access. Both have their merits. All that the Library asks is that the authors of programs that use large or multiple data files consider their options.

DOCUMENTATION

A point that again must be stressed is that a main reason that calculators and software exist is for user convenience. Program authors should realize that much of a useful program's friendliness is lost if it is not documented well enough for the user to learn how to use it in a reasonable amount of time.

Documentation of the content and use of data files can be critical. The most obvious time that documentation of data file contents becomes a concern is when a file of constant values is destroyed. The user must be supplied with enough information to be able to resurrect the file. Another hopefully more common situation is where the user desires to write his/her own routines that access the author's data files. To be able to do this, it is obviously important that the user understands the internal organization of the file.

The Library expects that the documentation that accompanies each program dealing with data files completely describes the contents of any constant file and completely describes the internal organization of any variable file. The reasons for and methods in which the program manipulates the file(s) also should be well described.

ERRONEOUS ASSUMPTIONS

Most critical problems with programs stem from assumptions that the author has made about the configuration and/or state of the calculator. Some invalid assumptions that may arise in dealings with data files on the cassette drive are:

1. **The interface is in MANIO or AUTOIO mode.** The assumption of one or the other mode is invalid unless the program itself has set either mode. This is not to say that the program must set one or the other mode. Many application programs may run equally well in either mode, so long as the selected device in MANIO is of the appropriate type. If either mode is required, the program should set it. In certain instances, a program may work differently (intentionally) in either mode. In this type of program, calculator flag 32 should be tested in order to determine the current mode.
2. **The file pointer is currently pointing to the desired file.** This assumption is also invalid unless the program itself has performed the required SEEKR function.
3. **The file to be output to exists or doesn't exist.** It is dangerous to assume that if a file exists whose name is the same as that which the program uses that it is necessarily the file the user wants to be accessed. If the named file exists, the user should be warned either by the program or by the documentation that the program may alter its contents. Unconditional creation of

data files can also cause problems if another file exists that has the same name or if the program destroys any file of the same name before creation. Creation, destruction, and modification of file information must be well documented. In each of these cases, the program could query the user before the action is taken, thus making certain that it is desirable.

PROGRAM FILES

The reader's first thought about the usefulness of the cassette drive in conjunction with program storage is probably along the lines of structuring a personal program library. Although this is a reasonable pursuit, it may not be the most important program application of the cassette drive.

One way to optimize the use of calculator memory is to split the program into functional segments that can be loaded as necessary from mass storage into calculator memory. This technique may require more logical planning in order to maintain program integrity and consistency, but the advantages gained by calculators with a limit to their memory are in most cases well worth the effort. The program's sections may "chain" each other into memory, each calling the next as its usefulness is exhausted. Alternatively, one master program may call several slave routines that replace each other in memory.

The Library recommends that program files and subprogram files be documented in the same complete fashion as that expected of all submitted programs. Subprograms require more documentation than "stand alone" programs in order to aid the user who desires to write his/her own routines that access the subprograms.

The cassette drive supports status, write-all, and key-assignment files. Because the Library is a *user-oriented* organization, we recommend that you follow certain guidelines whenever you consider submitting one of these types of files. First of all, many users feel inconvenienced by programs (or documentation) that *require* key-assignments or that *require* a certain calculator status. For this reason, the Library recommends that submitted programs do not call key-assignment or status files without first giving the user a choice. Defining the keyboard or status of the calculator is best done in optional routines within the program, and these definitions should be well described in the documentation. Secondly, write-all files cause difficulties both for the Library and for program users. Plus, programs recorded as PRIVATE present the Library with obvious reproduction problems. For these reasons, the Library discourages the submittal of write-all files and PRIVATE programs.

DEVICE DEPENDENCY

It is not always obvious when a program requires a peripheral. For example, a program may use peripheral functions in such a way that if the peripheral is not in the system the functions are not encountered. Therefore, a program does not require a peripheral simply because it uses functions found only in that device. Neither can a program claim to require a mass storage device simply because the Library requires some sort of mass storage media with each submittal. A program requires a peripheral only when it cannot perform its function without the device.

In order to make programs accessible to the largest possible number of users authors should not write programs that require peripherals unless they feel that the requirement is a definite enhancement to the program.

New Special Service Offered

We now offer at Corvallis, HP Dealer location, product information, prices, Users' Library information, and service prices and status for TDD (telecommunications devices for the deaf) and TTY (teletypewriter) users with hearing or speech impairments. Please dial 503-758-5566 (not toll-free).

Addendum for 82180-90001 Manual

If you own the *HP 82180A Extended Functions/Memory Module Owner's Manual*, part number 82180-90001, dated November 1981 or April 1982, you should mark the following changes in your copy of the manual. Later versions of the manual will have either the Addendum with them or the corrections will be incorporated in the manual.

Page 8, under Configurations. If you have the HP 82104A Card Reader plugged into the calculator and an HP 82181A Extended Memory Module plugged into port 2, and you execute the card reader function [VER], some information in that extended memory module may be changed. Therefore, you should avoid using the [VER] function if you are also using an extended memory module in port 2.

Page 17, under Clearing Programs. If you execute [PCLPS] from the keyboard, be sure the calculator is positioned in program memory. You can position the calculator in program memory in any of the following ways:

- Press [CATALOG] [1] followed by [R/S] (as described under "Using [CATALOG] for Positioning" in your calculator owner's manual).
- Press [GTO] [ALPHA] *label* [ALPHA] using a label in program memory (one that is listed in CATALOG 1).
- Press [GTO] [·] [·].

If the calculator is positioned to a program in a plug-in application module or device when you execute [PCLPS], the information in the calculator's memory will be lost and the calculator will display **MEMORY LOST**.

Page 24, under [PURFL]. After a file in extended memory is purged, there is no working file. Therefore, before subsequently executing functions that operate on the working file, you should execute a function (such as [SEEKPTA] that defines the working file (that is, makes the specified file the working file-refer to "Working Files," page 23). For example, after executing [PURFL], write the name of an existing file in the ALPHA register, then execute [FLSIZE]—that file now becomes the working file. After executing [PURFL], you should *always* define a working file before executing functions that operate on it; otherwise, all files in extended memory will be lost.

Page 25, before Program File Operations. If a register in a file contains a string of seven characters all having character code 255, and if another file closer to the beginning of extended memory is purged, then all information from that register to the end of extended memory may be lost. To ensure that this doesn't occur, avoid appending, inserting, or adding to a file more than six consecutive characters having the character code 255.

Page 25, under Program File Operations. If you execute [SAVEP] from the keyboard, be sure the calculator is positioned in program memory (as described above). If the calculator is positioned to a program in a plug-in application module or device when you execute [SAVEP], the information in the calculator's memory and in extended memory may be changed or lost.

New HP-IL Video Interface Available

The new HP 82163A Video Interface will be available at your local HP Dealer sometime in June—probably by the time you are reading this KEY NOTES. With this new device, the HP-41 will be capable of displaying on a monitor or TV, 96 Standard ASCII or inverse video characters, with up to 32 characters per line and 16 lines per display. The HP-41 also will be capable of screen control and cursor control. The HP 82180A Extended Functions Module will help to create the necessary commands to enable screen and cursor control.

The new HP-IL Video Interface is *all* that is needed if you want just a convenient way to output data and programs in video. The HP-41 printer commands in this new module will allow all normal character output to occur in a very friendly manner. Flags 15 and 16 in the HP-41 will control the PRINT (output) mode to the video display. For example, when flag 15 is SET, it will make the video display act like a printer in TRACE mode; and when flag 16 is SET, it will make the video display act like a printer in NORMAL mode. And, when both flags are SET, they will put the

(Continued)

video display into a new "TRACE WITH STACK OPTION" mode that will cause stack registers X, Y, Z, and T to be "printed" (displayed) after each operation. Now you'll be able to "see" how you left the stack and what is in it! (Very nice, yes?) Finally, with both flags CLEAR, the video display will be in MANUAL mode.

Best of all, this new video interface is an HP-IL device! Therefore, it will be compatible with future HP-IL devices. And, although you may be excited about "seeing" your HP-41's innermost "secrets" on TV, be sure you call your local HP Dealer before you rush down to the store. This is going to be a popular peripheral, so make sure the Dealer has one and can demonstrate it for you.

Add "Racing Stripes" to Your Bar Code

In KEY NOTES V5N3 we proposed a method to increase security for programs reproduced in bar code. The method consisted of printing the bars over red background. After some further testing (including some tests volunteered by Richard Nelson and Noel Brinkley of PPC), we are back with the promised update.

It was found that some copiers checked relative contrast between printed information and a background color. These copiers could easily produce duplicates that a wand will read.

Introducing the racing-stripe approach! Several patterns and narrower stripes were tested. The stripes proved the most successful, especially when printed to overlay the leading and trailing edges of a row of bar code. These areas appear to be the most critical for the wand to successfully read the code.

The second discovery was that a thermal copier would not reproduce the red (as gray) because there is no carbon content in red ink. This problem is easily overcome by printing the bars using a carbonless black ink. Now the thermal copier won't "see" the bars either!

A combination of the two techniques should produce bar code that cannot be reproduced successfully by over 95% of the copiers on the market.

In case you missed the specifications earlier, the color of inks recommended (all "reds") in order of preference are: PMS #199, PMS #485, PMS #185, PMS Warm Red.

A Change is in Order

Starting June 1, 1982, Corvallis Division will no longer accept direct-mail and telephone orders for calculators and accessories. To order calculators and accessories in the future, please contact your local authorized HP Dealer. They should have stock on hand for immediate purchase. To locate your nearest HP Dealer in the continental United States except Oregon, please call toll-free (800)547-3400. In Oregon, Alaska, and Hawaii, call (503)758-1010.

If you do not live near an HP Dealer, you can order calculators and accessories through the HP Corporate Parts Center. They will accept purchase orders ($20 minimum), checks, money orders, and cash. However, C.O.D., credit card, and telephone orders will not be accepted. Be sure to include a $3.50 handling charge, plus your state and local taxes. Mail your orders to:

Hewlett-Packard Company
Mail Order Department
P.O. Box 7220
Mountain View, CA 94042

This notice and the above changes apply only to domestic orders. Neither Corvallis Division nor the above Mail Order Department will handle orders from anywhere outside the U.S.

The Corvallis Users' Library will continue to accept and process orders for subscriptions (KEY NOTES and Library) and programs. **But remember that the Library does not accept purchase orders for orders under $20.**

KEY NOTES Corrections

Here is a letter from **Nai Chi Lee**, of Stony Brook, New York, concerning an error (our error) that appeared in the last issue of KEY NOTES.

With reference to my integer-packing routine printed in V6N1p11, please be informed of the following:

1. The program will not work as printed! The error is in line 16. Delete it and replace with −1, ABS (this is not equivalent to 1).
2. In the description, paragraph 2, first line: "number uvwxyz" should be "number abcdef."

Also, in V6N1, on page 13, column a, the second line in the routine MAG should be LBL A; and the name of the author of this routine is **Jeffrey Smith** not Jeffery Smith. Sorry, Mr. Smith. In V6N1p11b, the second paragraph of the description preceding **John Hendricks'** PRDMS routine should read: For HHhMM'SS, substitute 104, ACCHR for lines 08 through 19.

The description of the "Stock Plotting" routine on the back page of V6N1 fails to mention that the calculator must be set to a minimum size of 18 and that the printer mode switch must be set to MAN.

The "In the Key of HP" article in V5N3 on page 7 has a confusing sentence in the description of the modulo function. The second sentence of the second paragraph of this description should read: A number can be determined to be within a certain range if RANGE MOD X < RANGE.

In V5N2, there is a typographical error on page 8. In answer 22 of the answers to the HP-67/97 test, STO 1 should be STO I.

New Club Formed in Germany

If you can read the German language, you might be interested in a new Club that was founded in November of 1981. Called CCD, for Computerclub Deutschland, the Club had over 1,000 members by February 1982! And all of the members are HP-41 users.

The Club prints a monthly newsletter, PRISMA, that contains many HP-41 programs, technical notes, Synthetic Programming, self-produced hardware, and much more. The newsletter is entirely written in German. Nearly all of the programs are for professional use, but a few games are printed. And all printed programs include bar codes.

Regular Club meetings are being held in nearly every large city in Germany, and members come from nearly all West-European countries. In German law, the Club is a "gemeinutzig anerkannter eingetragener Verein," which, in English, means a nonprofit, legal club, controlled by public commissions. However, there is a fee for membership.

If you are interested in the CCD, write to the first chairman:

Oliver Rietschel, 1. Chairman
Computerclub Deutschlande. V.
P.O. Box 373
2420 Eutin, W. Germany

Be sure to include a self-addressed, stamped envelope. If you can't include stamps, you can include at least two magnetic cards.

(Note: CCD is not sponsored, nor in any way officially sanctioned, by Hewlett-Packard—Ed.)

Linear Interpolation On The HP-41

Here is a routine from the biggest state in the "lower 49." Austin is the capital of this state—Texas— and it is the home of **Philip Petersen**, who sent this routine.

(41) This short routine linearly interpolates multiple times after initial conditions are set, using only register 00 for safekeeping. Besides the two ALPHA prompts (that take up many bytes), the routine is at peak efficiency and optimum ease of use.

```
01♦LBL "IN"        10♦LBL 00
02 "KNOWN?"        11 ST- Y
03 PROMPT          12 X<>Y
04 ST- Z           13 RCL 00
05 -               14 /
06 /               15 +
07 STO 00          16 STOP
08 "UNKNOWN?"      17 GTO 00
09 PROMPT          18 .END.
```

Operating instructions: For tabular data such as,

a	x
r	(unknown value)
b	y

where a corresponds to x, b corresponds to y, and r corresponds to the unknown value.

At the prompt—KNOWN?—key in: a [ENTER] r [ENTER] b [R/S]

At the prompt—UNKNOWN?—key in: x [ENTER] y [R/S]

Example problem:

Given the following properties of steam at 1.5 MPa and 1.75 MP, estimate the values of T, Vf, and Vg at 1.58 Mpa.

P(MPa)	T(C)	Vf	Vg
1.50	198.32	0.001154	0.13177
1.58	?	?	?
1.75	205.76	0.001166	0.11349

Solution:

KEYSTROKES	DISPLAY
[XEQ] [ALPHA] IN [ALPHA]	KNOWN?
1.5 [ENTER]	
1.58 [ENTER]	
1.75 [R/S]	UNKNOWN?
198.32 [ENTER]	
205.76 [R/S]	200.700800 (T at 1.58MPa)
.001154 [ENTER]	
.001166 [R/S]	0.001158 (Vf at 1.58)
.13177 [ENTER]	
.11349 [R/S]	0.125920 (Vg at 1.58)

On Creating and Using Cassette Data Files

Data files must be "created" before they can be used. Unlike program files, a data file has to be created so that you can specify its size. With the HP-41, the HP 82160A HP-IL Interface Module, and the HP 82161A Digital Cassette Drive, a file is created by placing into the ALPHA register the name of the file (not more than 7 characters), and by placing in the X-register the number of required registers. For example, if we key in: [ALPHA] BILL [ALPHA] 3000 [XEQ] [ALPHA] CREATE [ALPHA], the cassette drive will "create" a file named "BILL" and the file will have 3000 registers.

Now, suppose we want to store 10 registers (R_{10}-R_{19}) of information into cassette file "BILL" at locations 100 through 109. All we need to do is key in: [ALPHA] BILL [ALPHA] 100 [SEEKR]* 10.019 [WRTRX]. The first part of this sequence will position the cassette drive at register 100 in file "BILL," and the second part will write HP-41 registers 10 through 19 into cassette drive registers 100 through 109.

But suppose we now want to recover those same 10 registers of information and place them into registers 00 through 09 in the HP-41. That's no problem. Just key in [ALPHA] BILL [ALPHA] 100 [SEEKR] 0.009 [READRX] and you can view those 10 registers in the HP-41 by recalling registers R_{00} through R_{09}. In essence, we have made a duplicate copy of the information in R_{10} to R_{19} and put it into R_{00} to R_{09}.

* *You can assign these functions to keys or use the form:* [XEQ] [ALPHA] *SEEKR* [ALPHA].

Sending 8-Bit Data With the HP-41

(Note: This article presents the theory behind Library Program #01644C, Bar Code Generator, which appears in this issue of KEY NOTES—Ed.)

There are two methods currently available to the HP-41 user who wants to build 8-bit binary bytes of any value. (For example, in constructing bar code such as that used in Library Program #01644C.) The easiest method uses the XTOA function contained in the HP 82180A Extended Functions Module. The other, a more difficult method, uses the BLDSPEC function contained in the HP 82160A HP-IL Interface Module. It is this second method that forms the topic of the following discussion.

First, take a quick glance at figure 1. Now, if we were to look at the decimal equivalent value of each bit in a binary byte, we would find that the value of any byte with bit 7 set (the high order bit) would yield a value equal to or greater than 128.

128	64	32	16	8	4	2	1	Bit Value
x	x	x	x	x	x	x	x	A binary 8-bit byte
7	6	5	4	3	2	1	0	Bit number

Figure 1. A Binary 8-Bit Byte

The byte value is the sum of all of the bit values.

Bit Set	Bit Value	128	64	32	16	8	4	2	1	Bit Value
1	2	1	0	0	0	1	0	1	0	
3	8	7	6	5	4	3	2	1	0	Bit Number
7	128									
	138 ← BYTE VALUE									

Figure 2. Byte Value Example

Creating a byte (or bit pattern) using BLDSPEC is easy, and a simple matter, until we exceed 127 (decimal). But, first, take a look at figure 3 in order to create a byte with a value of 0 to 127.

Creating a binary byte with a decimal value of 32.	CLX ENTER↑ 32 BLDSPEC

Figure 3. Creating a Byte Value 0 to 127

This will leave in the X-register an alpha data byte—seen as a character—that is actually a bit pattern equivalent to the decimal value used prior to the BLDSPEC command. The CLX and ENTER commands are used to ensure that the Y-register is clear and to prevent the BLDSPEC command from making an unwanted combined pattern. However, being able to combine patterns *is* useful in making byte values of 128 or greater. Keying in 127, BLDSPEC would yield a bit pattern of 01111111. To set the 8th bit (which is actually bit 7; see figure 1), follow the example in figure 4.

Creating a binary byte with a decimal value of 160.	CLX ENTER↑ 1 BLDSPEC 32 BLDSPEC

Figure 4. Creating a Byte Value Greater Than 127

The 1, BLDSPEC followed immediately with a number 0 to 127 BLDSPEC will create byte values from 128 to 255.

As these special characters (byte values) are built in the X-register, they should be recalled into the ALPHA register. When the string is complete, the OUTA function is used to send it to the selected device.

This technique was used in the Bar Code Generator program (#01644C); however, it would be valuable to anyone wishing to send binary bytes, other than the standard ASCII set, to any HP-IL device.

(Because of the present data-handling routines in the HP-41, null or zero bytes cannot be used as the first byte in a data string. Additionally, the OUTA function ignores them even in the middle of a string. Life is never perfect, n'est-ce pas?*—Ed.)*

Generating Bar Code With the HP-41

Because many readers have expressed a desire to be able to "create" bar code at home or at the office—or anywhere, for that matter—we have included in this issue a program that will satisfy *most* of that desire. If that word "most" gives you the idea that this is not a *perfect* solution for home-generated bar code, you are right. But this program *will* enable you to print usable bar code.

There are some basic operating limits you need to know. First, you **must** use the new HP 82160A HP-IL Module and the new HP 82162A Thermal Printer. Second, you **must** use the new black HP 82175A Thermal Printing Paper. Third, you **should** read, in this issue, the article, "Sending 8-Bit Data With the HP-41," because it explains the theory behind the following program and a few software limitations. But make no mistake about this: With the HP-41 the HP-IL Module, the new printer, the new black paper, and the following program, **you can generate immediately usable bar code.** Here is an expanded abstract.

(41) Bar Code Generator #01644C (Price: $6*)

This program, when coupled with knowledge from the 82153-90019 *Creating Your Own HP-41 Bar Code* manual (pages are included in program), will allow the user to print up to 16 continuous bytes of bar-coded information. Required inputs are made as the decimal equivalent of the binary code. The program uses the BLDSPEC function to create the binary codes needed to print bar code. This entire operation could be

(Continued)

simplified by using the XTOA COMMAND IN THE HP 82180A Extended Functions Module. However, this program is designed for the users who do not have other modules but still want to make their own bar code. So the Extended Functions Module is NOT required for this program. *Required accessories: HP 82160A HP-IL Module and HP 82162A Thermal Printer.* (74 lines, 189 bytes, 13 pages)

Author: **Bill Schafer**
Corvallis, Oregon

Although this method does work, for really first-class long-term bar code that you might want for your day-to-day program use, you can't beat manufactured bar code. Look back to page 5 of V5N1 and review the article about our bar code supplier, **George Lithograph.** Their service is good, their product is excellent, and the price is right. They print all of the bar code that you see in the Library programs. For more information regarding this service and an order form/price list, contact:

Dan Riopel
George Lithograph
650 Second Street
P.O. Box 77085x
San Francisco, CA 94107 USA

What's So Great About the "New" HP-IL Printer?

If you have had reservations about buying the new HP 82162A Thermal Printer, here are some features you might not have thought about. When you examine these at the counter display in your local HP Dealer's store, you will get a better insight of what this new printer can do for your system.

FORMAT: The FORMAT function allows you to automatically center text, or you can even left- or right-justify two columns of text or numbers or even a combination of both. For example, make a simple grocery list as follows:

[ALPHA] GROCERY [ALPHA] [ACA] [FMT] [PRBUF] You will notice that GROCERY will be automatically centered on the printout. Now, list the items and prices.

[ALPHA] MILK [ALPHA] 1.05 [ACA] [FMT] [ACX] [PRBUF]
[ALPHA] EGGS [ALPHA] 1.10 [ACA] [FMT] [ACX] [PRBUF]
[ALPHA] BREAD [ALPHA] .85 [ACA] [FMT] [ACX] [PRBUF]

Actually, this could be made into a simple subroutine that would do this task for *any* listing.

PARSE: The PARSE mode, as demonstrated here, needs the Extended Functions Module to simplify its implementation. However, if you look at the Bar Code Generator program on page 9, you will get some ideas on how to use BLDSPEC to implement PARSE without using the Extended Functions Module. The PARSE mode will be supported in a much more "friendly" manner with a future "extension module" (we're still working on it); however, it *is* accessible.

The printer in this example is at device location 2 (see HP-IL Module Owner's Manual, page 43). Key in: 2, [SELECT] [CLA] SF 17 252 [XTOA] 27 [XTOA] 38 [XTOA] 107 [XTOA] 49 [XTOA] 72 [XTOA] [ALPHA] ASTO 01 [ALPHA] [OUTA]. This sequence sets your printer to PARSE mode. The ALPHA string used to set the printer to PARSE mode is now stored in register 01 and can be used again ([ARCL] 01 [OUTA]). The SF 17 suppresses the printer carriage return and line feed. Now, "type-in" the following:

[ALPHA] —I-WANT-TO-SEE-PARSE- [ALPHA] [ACA]
[ALPHA] MODE-OPERATE-WITHOUT-THE-
[ALPHA] [ACA]
[ALPHA] EXTENDED-I/O-ROM-INSTAL
[ALPHA] [ACA]
[ALPHA] LED. [ALPHA] [ACA] [PRBUF].

This might not be the best operating mode, but you have to admit it *does* work.

BARCODE: Refer to the Bar Code Generator (#01644C) program and the article "Sending 8-bit Data With the HP-41" that appear elsewhere in this issue.

STANDBY MODE: This one is easy! From the ON position, just set the power switch to STANDBY, then key in: [XEQ] [ALPHA] PWRDN [ALPHA]. You will notice that the POWER Light is now off, but the HP-41, as the controller in the HP-IL system, can turn on the printer and shut it off.

However, nothing is totally "free." We do not recommend leaving your printer continuously in STANDBY mode during normal operating conditions; that is, using your computer system at your desk, recharger plugged in, etc. The STANDBY mode (on both the printer and the cassette drive) is provided to conserve battery power during "remote" or automatic, unattended conditions. (In other words, when the calculator is set to run a program unattended.) The recharger/AC adaptor might not always be able to keep up with the recharge rate plus supply continuous power for operations, so use STANDBY Only for its intended purpose. However, you must admit that it is a powerful and extremely useful new mode.

Both of the HP-41 printers are excellent additions to your portable computer system, but if you own the HP-IL Module, you owe it to yourself to check the added features of the new HP 82162A Thermal Printer at your local HP Dealer. Don't forget to take along this article!

You, HP-IL, and Control Functions

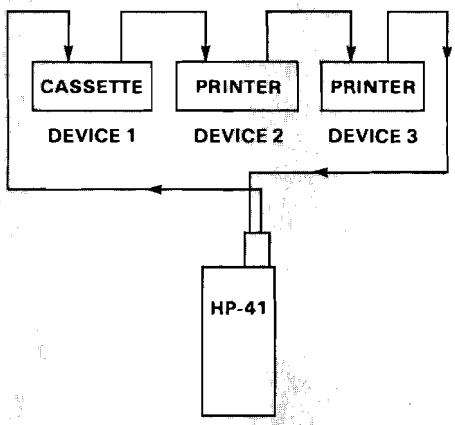
Have you asked yourself: "What good are the general I/O functions in the HP 82160A HP-IL Module?" You have? Well, then, let's take a look at some of them.

CONTROL FUNCTIONS

On page 43 of the *HP 82160A HP-IL Module Owner's Manual,* the general I/O functions are referred to as "Interface Control Operations," There are 15 of these functions and, as it so happens, for some applications they are the only method that can be used to make certain things happen on the Interface Loop. Although these functions are really very basic, they are a powerful set that allows a programmer to access information on just about any HP-IL peripheral.

Because it is not possible to discuss all of these Control Functions in this short column let's look at just a few.

AUTOIO: As you know, the HP-41 was designed to be a fully "friendly" device. The AUTOIO (automatic input/output) function also was designed to continue this trend in its I/O operation. In this mode, the HP-41 will automatically locate friendly printer and mass storage peripheral devices connected to it, then initiate printing when it's supposed to occur, and also interact with the mass memory (e.g., HP 82161A) when it is supposed to transfer data and/or programs. In either case, the HP-41 will automatically go to the first available printer or mass memory device in the Interface Loop and attempt its operation there. For example, if you have two printers in the Interface Loop and you want to cause an output on the *second* printer (see diagram), then you must "select" that device prior to sending the data to it. AUTOIO is, however, the normal "cold start" condition.



SELECT: If you want the second printer in the Interface Loop to be the active device, then you must select that device. As great as the HP-41 is, unfortunately it cannot read your mind. So here's how it does this. There are two different plug connectors for the HP-IL Module, a male (small) and a female (large) connector. The male connector indicates the direction of data flow around the Interface Loop and thus controls the location of devices in the loop. The Controller (the HP-41) is *always* device 0 and, counting around the loop in the direction of the male connectors (designated by the arrow) in the above diagram, the second printer is at device location 3. So, if you want that particular printer to be the primary printing device, key in the following:

3 [XEQ] [ALPHA] SELECT [ALPHA]

Now, all you need to do is execute a PRX or another print-command, and the second printer will happily start printing whatever you are sending to it.

MANIO: How many times have you wanted to do things with your HP-41 computer system that were not necessarily "the norm?" Well, MANIO allows for such times by giving you more direct control over what happens on the Interface Loop. An example of this can be found right here in this issue of KEY NOTES, wherein we wanted to create bar code on the HP 82162A Thermal Printer without using an "extension" module. Placing the printer in the MANIO mode allows the HP-41 to send 8-bit commands for bar code quite easily. (The 8-bit mode instruction set is shown in tabular form on page 14 of the owner's manual for the HP 82162A.) But, in order to print bar code, you first must understand what bar code really is. And a good way to learn is to look at program #01644C and the article, "Sending 8-Bit Data With the HP-41," appearing elsewhere in this issue. Included with the documentation for #01644C are some pages from the book, "Creating Your Own HP-41 Bar Code." (This HP book was reviewed in V5N1p5.)

To send 2 bytes of bar code, you first must put the printer in column mode, then tell it that you want to send 2 bytes of bar code. Using the HP 82180A Extended Functions Module and the following routine you will be able to do this.

Notice that, in this example, the printer is at location 2, which explains lines 02 and 03. And lines 10 through 13 specify the byte values of decimal 32 and 16.

```
01♦LBL "BCDE"     10 32
02 MANIO          11 XTOA
03 2              12 16
04 SELECT         13 XTOA
05 CLA            14 OUTA
06 210            15 AUTOIO
07 XTOA           16 RTN
08 129            17 .END.
09 XTOA
```

In the next issue (due in the mail by August 26), we will present more articles of this nature.

67/97 Routines and Tips

Pretoria is a capital city of South Africa located close to some major diamond mining areas. Also, Pretoria is the home of **J.M.E. Graindor**, the author of this next routine.

(67/97) Many programming tips referred to the use of the HP-97 as a timer. Although we fully realize the inaccuracy of the calculator as a timer, it nevertheless is possible to use it as a rather accurate digital watch.

Here is a surprisingly short routine to this effect. Key in the present time in format HH.MMSS, press [A], and presto, your digital watch is running. If you perceive that the watch is somewhat slow, key in, during a pause display, a small number (usually 1 or 2), and press [E] to adjust the watch. Repeat if necessary. Similarly, if the watch is somewhat fast, a negative 1 or 2 will do the trick. For a fine setting, a fractional number like 0.5 or 0.2 might be required.

It is very interesting to note that, similar to a real digital watch, this watch also switches from 24.0000 hours to 0 hours.

```
001  *LBL4      015     4
002   DSP4      016  RCL0
003   HMS→      017  X≷Y?
004   STO0      018  ST-0
005      5      019  →HMS
006      4      020   PSE
007    EEX      021  GTO1
008    CHS      022 *LBLE
009      5      023   EEX
010   STO1      024     5
011  *LBL1      025     ÷
012   RCL1      026  ST+1
013   ST+0      027   RTN
014      2
```

And, back in the United States, **Carl Vancini** is busy working with his HP-97. Mr. Vancini lives in Stamford, Connecticut.

(67/97) I noticed that the short routine "Weighted Mean," developed for the HP-67/97 by D.L. King (V5N2p10b) does not produce the standard deviation. Here is a routine that produces the weighted mean with the corresponding standard deviation. The only limitation is that the weights shall be non-zero integers (1,2,3,...). To run, clear all registers, key-in the number, press ENTER, key-in the weight, press b. After all numbers and their weights are entered, press $\bar{x}$ to obtain the weighted average, then press s to obtain the standard deviation.

```
001  *LBLB      008  *LBLb
002      1      009     Σ+
003   ST+0      010   LSTX
004   X≷Y       011   DSZI
005   X≷I       012   GTOb
006    R↓       013   RCL0
007   X≷Y       014   RTN
```

Now, here is a short and interesting routine. **Mathew Tomczik** of St. Cloud, Minnesota contributed this.

(67/97) I have found a special routine on my HP-67 to use when trying to find the log, in any base, of any number. $\text{Log}_b x$: $x > 0$, $b > 1$.

```
001  *LBLA      005    R↑
002     LN      006     ÷
003    R↓       007   RTN
004     LN
```

Example	Input	Output
$\text{Log}_3 9 = 2$	9 [ENTER] 3 [A]	2
$\text{Log}_{81} 3 = ¼$	3 [ENTER] 81 [A]	.25
$\text{Log}_{1000} 10 = ⅓$	10 [ENTER] 1000 [A]	.333

Routines, Techniques, Tips, etc.

The routines and techniques furnished in this column are contributed by people from all walks of life and with various levels of mathematical and programming skills. While the routines might not be the ultimate in programming, they do present new ideas and solutions that others have found for their application. You might have to modify them to fit your personal application.

Now, from San Diego, California, we present **Jaroslaw Czajowski's** "song and dance" routine. How much is that goose in the window? The one that goes [BEEP] [BEEP] [TONE] 9...

(41) This subroutine is an improved version of the "Flying Goose" routine that appeared in V3N4p3, with a little spice of sound added to it. Run, see, and hear it!

```
01♦LBL "GOOSE"    18♦LBL 01
02 SF 01          19♦LBL 01
03♦LBL 01         20♦LBL 01
04 9              21 FS? 01
05 STO L          22 TONE 1
06 FC?C 01        23 FC? 01
07 SF 01          24 TONE IND L
08♦LBL 15         25 DSE L
09 FS? 01         26 GTO 15
10♦LBL 01         27 .009
11♦LBL 01         28 STO L
12♦LBL 01         29♦LBL 16
13♦LBL 01         30 TONE IND L
14♦LBL 01         31 ISG L
15♦LBL 01         32 GTO 16
16♦LBL 01         33 GTO 01
17♦LBL 01         34 .END.
```

The mention of Oak Ridge, Tennessee, brings to mind the sweet sound of a bluegrass mandolin echoing over the rolling green hills on a muggy, lazy, midsummer day. Thoughts turn to base-conversion on the HP-41, and we bring you this routine from **Richard Lyon**, who lives in Oak Ridge.

(41) I enclose a short program for converting an integer between 1 and 100,000,000 (base 10) to another integer base between 2 and 16. The result is recorded in the ALPHA-register, and the individual digits can be copied down as they are posted if the result contains more than 12 digits, or even if digits will be lost from the ALPHA-register, as in the conversion of numbers greater than 16,777,215 to base 2. Posting of the digits can be slowed down by squeezing-in a delay loop, such as:

```
30a 20
30b STO 18
30c ST+Y
30d −
30e LBL A
30f DSE 18
30g GTO A.
```

(Continued)

With 20 as the input to register 18, the delay is about 4 seconds between postings of successive digits on my HP-41C, with my current battery condition.

Initially, ALPHA characters (0,1,...9,A,...F) for the sixteen digits must be stored in registers 00 to 15.

The principle behind the program is that after finding the first (lefthand) digit by successive divisions by the base number, the fractional part of the quotient will disgorge successively lower digits when multiplied successively by the base number.

Possible round-off error limits the initial integer to about 100,000,000 and also requires addition of a fractional increment to the initial integer. I use 0.5.

```
01♦LBL "F10"
02 1.1
03 STO 16
04 "NMBR"
05 PROMPT
06 STO 17
07 .5
08 +
09 "BASE"
10 PROMPT
11 STO Z
12 STO T
13♦LBL 00
14 X>Y?
15 GTO 01
16 /
17 X<>Y
18 ISG 16
19 GTO 00
20♦LBL 01
21 .1
22 ST- 16
23 CLA
24 RDN
25 X<>Y
26♦LBL 02
27 RCL X
28 INT
29 ARCL IND X
30 AVIEW
31 -
32 *
33 DSE 16
34 GTO 02
35 .END.
```

C. Lamar Williams, previously known for his elaborate work with letter-banner printing on the HP-41 (V5N3p4), is keeping up the good work in San Jose, California. Here is one result of his work.

(41) Budget planners frequently need to distribute an odd amount of money (Z) over some odd number of time periods (N). This distribution usually needs to be nearly uniform, i.e., approximately the same amount of money for each individual period. However, the total amount of money (Z) must be correct; i.e., it cannot suffer round-off errors when summing the "amount" for all of the periods. The following routine "DISTR" does the trick! Just key-in the total number of periods (N), press [ENTER], key-in the total amount (Z), [XEQ] "DISTR", and witness the answer. This routine works with or without the printer.

The problem is:
$Z = AX + BY$,
$N = A + B$,
where each variable is an integer; given N and Z, find A, X, B, Y.

The solution is:
$A = MOD(Z,N)$
$B = N - A$
$Y = INT(Z/N)$
$X = Y + 1$

Program lines 04-20 solve for A, B, X, and Y. The other program lines are for display with or without the printer. Have fun...!

```
01♦LBL "DISTR"
02 FIX 0
03 CF 29
04 STO 00
05 X<>Y
06 STO 01
07 MOD
08 STO 02
09 RCL 01
10 X<>Y
11 -
12 STO 03
13 RCL 00
14 RCL 01
15 /
16 INT
17 STO 04
18 1
19 +
20 STO 05
21 CLA
22 ARCL 00
23 "├ OVER"
24 XEQ 01
25 CLA
26 ARCL 01
27 "├ PERIODS="
28 XEQ 01
29 CLA
30 ARCL 03
31 XEQ 03
32 ARCL 04
33 "├ +"
34 XEQ 01
35 CLA
36 SF 01
37 ARCL 02
38 XEQ 03
39 ARCL 05
40♦LBL 01
41 AVIEW
42 FS? 55
43 GTO 02
44 PSE
45 PSE
46 PSE
47 PSE
48♦LBL 02
49 FC?C 01
50 RTN
51 ADV
52 ADV
53 ADV
54 ADV
55 ADV
56 ADV
57 RTN
58♦LBL 03
59 "├ AT "
60 RTN
```

Don MacDonald of Newport Beach, California, sent this next tip. And, in his letter, he asked that we give credit to PPC member **Tim Kay**.

(41, 67, 97, ...) Here is the quickest way to determine if x is even or odd:

```
-1
X≷Y
Y^X
```

You will see 1 if x is even and -1 if x is odd. These steps leave x in the LAST X register.

(On the HP-41, the sequence: 2; MOD, will work as well. However, x will not be preserved in the LAST X register—Ed.)

Now, from London, England, we have this tip. It was sent to us by **W.A.C. Mier-Jedrzejowicz**.

(41) If you want to prompt for a value in the middle of a program, and to store the value to use it, but you do not want to disturb the stack, you can do it neatly on the HP-41 as follows:

```
01 X≷nn
02 RDN
03 "message"
04 PROMPT
05 X≷nn
```

Line 01 saves the present X-value in register nn; line 02 rolls the stack down in preparation for line 04; line 03 is the ALPHA message requesting the new value. In line 04 the new value lifts the stack, restoring Y, Z, and T; line 05 saves the new value in register-nn and restores X.

This next contribution describes an interesting technique that many will find useful. It came to us from **Humbert Hans Suarez**, who is a student at the University of Geneva in Switzerland.

(41) There is one problem that often occurs while creating HP-41 programs: You have two programs, one that begins with, say, LBL "MAIN", and one that begins with LBL "USER" that has a LBL 01, a LBL 02, and a LBL 03. The program "MAIN" wishes to call as subroutines sometimes LBL 01, sometimes LBL 02, and sometimes LBL 03. But the calculator searches numeric labels solely in the program from which these labels were called.

One solution could be to put global ALPHA labels by the LBL 01, LBL 02, and LBL 03. However, this solution consumes lots of memory space and search time. A better solution is to put a GTO IND X at the beginning of the "USER" program and to call LBL 01 by—1; XEQ "USER", and LBL 02 by—2; XEQ "USER", and so on.

1st solution	2nd solution
LBL "MAIN"	LBL "MAIN"
⋮	⋮
XEQ "1"	1
⋮	XEQ 00
XEQ "2"	⋮
⋮	2
XEQ "3"	XEQ 00
⋮	⋮
END	3
⋮	XEQ 00
LBL "USER"	⋮
⋮	LBL 00
LBL "1"	XEQ "USER"
⋮	⋮
LBL "2"	END
⋮	⋮
LBL "3"	LBL "USER"
⋮	GTO IND X
END	⋮
	LBL 01
	⋮
	LBL 02
	⋮
	LBL 03
	⋮
	END

(This is a good demonstration of "the law of conservation of bytes through conservation of global-ALPHA labels," Mr. Suarez; however, your second solution does not conserve search time, as implied by your letter. The first solution requires one global label search, while the second solution requires a global label search, and then—because of the indirect GTO statement—a step-by-step local label search. So, our advice is: weigh the byte savings against the increased execution time before using this technique—Ed.)

This technique came to us in a letter titled, "How to Double Your Local (ALPHA) Labels From 15 to 30." Undoubtedly, this method has its drawbacks but, then again, it may be just what you're looking for. The letter was sent to us by **Vandale John**, who lives in Adinkerke, Belgium.

(41) This way of programming is very interesting in programs made for such conversions as feet<>meters, inch<>mm, gallons<>liters, Farenheit<>Celsius, and so on. For example:

```
01♦LBL "F<>M"     07 STOP
02♦LBL A          08♦LBL 01
03 X=Y?           09 RDN
04 GTO 01         10 .3048
05 .3048          11 /
06 *              12 .END.
```

How to use:

(a) Position the calculator to the program (GTO [ALPHA] F<>M [ALPHA]);
(b) Press [USER] on;
(c) To convert 2.25 feet to meters, press 2.25 [A], and see 0.6858;
(d) To converting 0.6858 meters to feet, press 0.6858 [ENTER] [A] and see 2.25 feet.

As you can see, the [ENTER] key becomes a shift function. This gives us 30 labels—A, A', B, B', ... a, a', ... e, and e'—good for 15 conversions.

Here's a routine to help us through the day. **Don Thayer** of San Leandro, California, sent in this one.

(41) While converting my HP-67 programs for use with my HP-41 and its printer, I discovered many of them required the conversion from a Gregorian Date to the equivalent Julian Day number. Not wanting to restructure the data register assignments, I developed the following program, titled "DAY," which uses only 72 bytes and does not require any data registers other than the stack. The routine is valid from March 1900 through February 2100 and was derived from the Standard Pack for the HP-67.

To use, enter the date in the form MM.DDYYYY and execute DAY. Example: July 4, 1980 (7.041980) = 2,444,425.

```
01♦LBL "DAY"      20 +
02 ENTER↑         21 1
03 INT            22 ST- Z
04 STO Z          23♦LBL 00
05 -              24 CLX
06 1 E2           25 1
07 *              26 +
08 ENTER↑         27 30.6001
09 INT            28 *
10 STO T          29 INT
11 -              30 X<>Y
12 1 E4           31 365.25
13 *              32 *
14 X<>Y           33 INT
15 3              34 +
16 X<=Y?          35 +
17 GTO 00         36 1720982
18 CLX            37 +
19 12             38 .END.
```

Next, we have two nice inputs from **Robert Swanson** of Portland, Oregon. This is the man who brought us the extraordinary game program "Flipo" (V6N1p5a), and both of the methods that he is discussing here were used to create that program.

(41) If a program does not otherwise use the trigonometric mode flags (flag 42, GRAD mode; flag 43, RAD mode) for trigonometric instructions, then one or both of them may be used as general purpose flags. Some advantages are: (1) display annunciators; (2) setting (GRAD, RAD) and clearing (DEG) are one byte instructions; (3) the execution time to set and clear these flags is only 20 msec (compared to 30 msec for other user flags); and (4) the status is maintained when the calculator is off. Remember, however, that DEG clears either of the flags and that only one of the two flags can be in set mode at a given time. Flags 42 and 43 are particularly useful in programs with three-way branch points. The following routine, "LOGIC," is an implementation of the truth table for the three types of AND logic, and also illustrates the use of the trigonometric mode flags at a three-way branch point. In this example, the user determines the branch (lines 11 through 14) by pressing key 11 (XEQ A), 12 (XEQ B), or 13 (XEQ C) in USER mode.

```
01♦LBL "LOGIC"    19 GTO 04
02♦LBL B          20♦LBL 02
03 GRAD           21 X<Y?
04 GTO 01         22 X<=0?
05♦LBL C          23 FS? 30
06 RAD            24 GTO 05
07 GTO 01         25 GTO 04
08♦LBL A          26♦LBL 03
09♦LBL 01         27 FS? 01
10 "DO"           28 X=0?
11 FS? 42         29 FS? 30
12 GTO 02         30 GTO 05
13 FS? 43         31♦LBL 04
14 GTO 03         32 "SKIP"
15 FS? 01         33♦LBL 05
16 FC? 02         34 DEG
17 FS? 30         35 PROMPT
18 GTO 05         36 .END.
```

Instructions: Have your calculator in DEG mode. To test flag:flag logic, set or clear flag 01 and flag 02 as desired, then XEQ A. If both flags are set, the routine halts with the message DO in the display; otherwise, SKIP appears. Arrange the stack at will and XEQ B to test stack:stack logic. See DO whenever $x < y$ AND $x > 0$. Finally, XEQ C and observe that DO is displayed only when flag 01 is set AND $x \neq 0$ (flag:stack logic). It is easy to prove that if another pair of flags is substituted for flags 42 and 43, this simple routine would require at least one additional byte. By the way, when you key in this routine, remember to use the top row of keys for the postfix instructions, like GTO 01, LBL 05, FC? 02, to reduce the number of keystrokes.

Here is a routine that will toggle a flag (e.g., flag 02) on alternate executions of a section of a program (such as a loop). It requires that another flag (here, flag 01) be toggled every time.

```
FC? 01
FS?C 02
FS? 30
SF 02
FC?C 01
SF 01
```

The always-false filler, FS? 30 (Catalog flag), for the AND Logic used to toggle flag 02, alternatively may be replaced by an always-false stack conditional whenever the relative status of the stack is known.

Feedback

This new column contains reader feedback about articles or routines that appeared in previous issues. Though much of the information presented here is useful on its own, you will find that it is a good idea to have your library of KEY NOTES handy while reading this column.

Here's a notable comment from the land of windmills and wooden shoes. **W.L.C. Brunings** from Bilthoven, Holland, read the "In the Key of HP" column in the last issue with a critical eye.

(V6N1p7b) KEY NOTES gives many useful tips. But, one of the tips can be a pitfall—the shortest way to divide by 100 using: 1 [%]!

Look at this program fragment.

```
RCL 00
RCL 01
1
%
+
```

Store 100 in register 00 and store 12 in register 01. You wish to compute 100 + (12/100) = 100.12! But, with the above routine you get 12.12

Of course, you can change the routine to:

```
RCL 01
1
%
RCL 00
+
```

But, that is not always possible; i.e., when, instead of RCL 00, the X-register contains the result of a previous computation.

(You're very right, Mr. Brunings. It would not be wise to go through all your programs and indiscriminately change every 100; / to a 1; [%]—Ed.)

Palmdale, California, is the home of **Paul Burke**. Though Mr. Burke claims that he isn't interested in stocks, he is interested in making the "STOCK" routine that we printed on the back page of the last issue easier for us to use. Here's his letter.

(V6N1p16) (41) The routine for plotting the weekly stock chart, "STOCK," does not exploit the capabilities of the HP-41 and HP 82143A combination to their most useful extent. Specifically, I prefer program initiation to start at the front of the program, and then branch to subroutines only after the input data has been handled. The inputs for plotting itself could be entered from PROMPT's asking

(Continued)

for the specific item as known to the user, instead of the input name used by PRPLOT, which may not make too much sense in the context of the program. This method then uses PRPLOTP for the actual plotting.

I have found that this approach leads to faster use of any program, especially if you haven't used it for some time. The input prompts tailored to the particular requirements of the program prevent confusion as to what is meant by the input request. I am sure that only a few stock analysts could interpret "AXIS?" and "X MIN?" correctly if they did not use the program frequently enough to become familiar with the basic inputs required by PRPLOT, but they would need no refresher to understand "PURCHASE PRICE?" or "START DAY?." The listings enclosed indicate the way I would initialize the program, and request the necessary plotting inputs, in terms the user could identify without reference to a coding sheet.

I use this approach a lot. It takes up some room in the machine for "gingerbread," but the CV has room to spare for most programs. Also, having the program keep track of its own inputs prevents the occasional "oops!" when a prompt is misinterpreted due to ignorance of the proper program functioning internally, which should not have to be reviewed every time a program is run.

Anyway, here is an amended listing and output of what my "STOCK" routine would look like... if I was interested in stocks.

```
01♦LBL "BEGIN"
02 "START DATE,"
03 "MMDD.YYYY"
04 PROMPT
05 GTO "DATE"

92♦LBL "IN"
93 "STOCK"
94 ASTO 11
95 "MIN PRICE?"
96 PROMPT
97 STO 00
98 "MAX PRICE?"
99 PROMPT
100 STO 01
101 "PURCHASE PRICE?"
102 PROMPT
103 STO 04
104 "START DAY?"
105 PROMPT
106 STO 08
107 "TIME SPAN,DAYS?"
108 PROMPT
109 STO 09
110 "WEEKLY PTS."
111 AVIEW
112 7
113 STO 10
114 XROM "PRPLOT"
115 .END.
```

(This does make the Stock Plotting routine easier to use. Just add lines 92 to 115 to the end of the listing from V6N1p16, and add lines 01 to 05 to the beginning of that listing, then execute "BEGIN." The HP-41 will ask the necessary questions and then prompt you for the weekly data to be plotted. Be sure to set a minimum size of 18 and to have your printer switch set to MAN—Ed.)

If you have ever had to wait one second or longer while your HP-41 is searching for a local-ALPHA label, you will appreciate this next subject. **Joseph Senecal** of Roseville, California, contributed this elaboration of a previous suggestion.

(V5N3p13a) (41) I have found Julius Zechmeister's idea, on how to find local labels quicker, very useful. My most commonly used program has many local labels and some large routines. The search for a label often took as long as the routine itself. With the example in KEY NOTES as an inspiration, I developed a routine to do the same from any spot in a program for any label. Here is how I implemented it.

```
01 LBL 99          31 LBL I
02 STOP            :
03 RTN             38 XEQ 99
04 GTO 99          39 GTO I
05 LBL F           40 LBL A
06 X<>Y            : {INITIALIZATION}
07 GTO 99          51 "INPUT?"
08 LBL G           52 AVIEW
09 RDN             53 XEQ 99
10 GTO 99          : {COMPUTATION}
11 LBL A           75 GTO 99
12 GTO A           :
13 LBL B           899 END
14 GTO B
:
21 LBL H
: {SHORT ROUTINE}
30 GTO 99
```

This procedure allows for fast execution of X<>Y and RDN as well as faster local label location after any pause in execution. It allows a user to continue a routine or choose a new routine with a minimum of label search time. The key to this procedure is lines 01 to 04. Line 02 stops to show results or prompt for input. Line 03 returns if LBL 99 was XEQ'ed but not if GTO'ed. Line 04 stops extra R/S's from doing anything. Lines 05 through 10 do the X<>Y and RDN functions rather than letting the HP-41 search for them (always the longest search). Unfortunately, this prevents them from being used in response to a prompt (leaves the HP-41 at line 03). The following lines are branches to long routines followed by short routines. An XEQ 99 will stop, then return when R/S is pressed. A GTO 99 will stop and not continue.

(The concept used here is well worth studying. The slow response of many lengthy programs can be eliminated by taking advantage of the "jump-distance storage" characteristics of the local-label GTO and XEQ statements. We do have a suggestion, though. Rather than using LBL F for X<>Y and LBL G for RDN, try assigning these functions to their respective keys. Then, when you press one of these keys at a halt in the program, the local-label search is bypassed and the function X<>Y or RDN is performed immediately. Using the local-ALPHA labels F and G will both move the program pointer, as mentioned in the letter, and clear the subroutine return stack. Of course, if you can work around these two drawbacks, the method of using local-ALPHA labels has the advantage of not requiring you to make key-assignments—Ed.)

Next, we have a valuable suggestion for those with a card reader. This information came from **Tom Flegal** of Berkeley, California.

(V5N3p14) (41) Regarding **Vally Lambrecht's** routine, this and other routines with card reader prompts should have flag 21 clear before the AVIEW statement. Otherwise, the program may halt at the AVIEW and a normal program card-read will result. Incidently, RSUB (XROM 30,04) will not clear the same program that contains it. I find it will work correctly without an END.

(By the way, Vally Lambrechts' routine can be adapted to call subroutines from the HP-IL Digital Cassette Drive or to call routines from Extended Memory—Ed.)

Routines to solve the quadratic equation are a popular subject in KEY NOTES, and these routines keep getting shorter and shorter. The quadratic equation is $ax^2 + bx + c = 0$ and the roots of this equation are $x_1 = \frac{b + \sqrt{b^2 - 4ac}}{2a}$ and $x_2 = \frac{b - \sqrt{b^2 - 4ac}}{2a}$

This routine was contributed by **Paul Baker** of Stillwater, Oklahoma. The program works entirely in the stack, it handles both real and complex roots, and the body of this routine—excluding the LBL and the END—is only 26 bytes. Can you beat that?

(V5N3p13c) (41) When I saw **Brent Tranberg's** quadratic solution routine, I became curious as to how it could be modified to solve for complex roots. Here's my simple suggestion:

```
01♦LBL "SLV"      12 X>Y?
02 X<> Z          13 SF 01
03 ST/ Z          14 -
04 /              15 ABS
05 -2             16 SQRT
06 /              17 ST- Z
07 ENTER↑         18 X<>Y
08 ENTER↑         19 FC? 01
09 X↑2            20 +
10 R↑             21 .END.
11 CF 01
```

The user executes the program just as before; however, flag 01 will remain activated in the display to indicate complex roots of the form '$x_{1,2} = U \pm iV$' where the real component U is in the X-register and the imaginary component V is in the Y-register.

Thank you for a most informative newsletter. I read KEY NOTES cover to cover!

(Thank you, Mr. Baker, for a fine example of efficient programming, and for the nice words about KEY NOTES—Ed.)

Here's an input from the northeast corner of the U.S., by a dedicated, prolific HP-41 *aficionado*, **Alan Zeichick**, who lives in Bangor, Maine.

(V6N1p13b) (41) I was reading the "Routines, Techniques, Tips, etc." column in the new KEY NOTES and saw HP's condensed version of Mr. Price's Hyperbolic Trig program. Well, I thought, the HP version is more aesthetically pleasing, but less functional; it really should have the inverse hyperbolic functions, too. So, I wrote them. I kept the same format as the "HYP" routine, assigning ASINH, ACOSH, and ATANH to local-ALPHA keys [C], [D], and [E], respectively—the most logical locations, since there are no local-ALPHAs in the same place as the inverse trigonometric functions. I've set up my routines to be physically placed after the "HYP" routine.

```
23♦LBL E        35 SF 01
24 1            36♦LBL C
25 X<>Y         37 ENTER↑
26 +            38 X↑2
27 1            39 1
28 LASTX        40 FS?C 01
29 -            41 CHS
30 /            42 +
31 SQRT         43 SQRT
32 LN           44 +
33 RTN          45 LN
34♦LBL D        46 RTN
```

I hope you find this worthy of attention. By the way, if ATANH is not needed, lines 23-33 can be deleted, the same as mentioned in your "HYP routine. I like to be consistent.

(Definitely worthy of attention, Mr. Zeichick. One thing you might want to try, though; replace LBL E, LBL D, and LBL C, with LBL 10, LBL 09, and LBL 08. Then, use the XEQ key as an "inverse" key. For ATANH press [XEQ] and then [TAN] (which the calculator understands as [XEQ] 10). Now, you have the hyperbolics and their inverses all "assigned" to the most logical keys—Ed.)

Now, let's travel to Sollentuna, Sweden, where **Gerhard Rombach** is keeping busy by reading KEY NOTES and programming his HP-41. Here is his contribution.

(V5N3p14c) (41) Fred Lipshultz's program "GEN2" was very clever—but you have to do the conversion the other way (converting a number in any base to a number in base 10.)

Here is my solution: Change the last line (line 42) in "GEN2" to STOP and continue as follows. Otherwise you have to store the base in register 04 and the number in register 01.

```
43 CLX          58 X>0?
44 STO 03       59 SF 01
45 STO 05       60 RCL 04
46♦LBL 03       61 RCL 03
47 RCL 01       62 Y↑X
48 X=0?         63 *
49 GTO 04       64 1
50 1 E-1        65 ST+ 03
51 *            66 X<>Y
52 INT          67 FS?C 01
53 STO 01       68 ST+ 05
54 LASTX        69 GTO 03
55 FRC          70♦LBL 04
56 1 E1         71 VIEW 05
57 *            72 .END.
```

New Club Formed in England

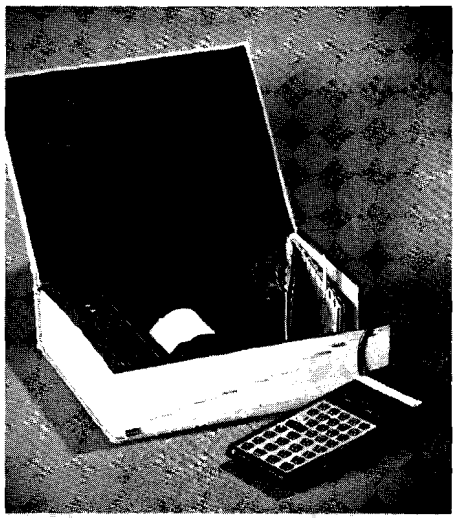
Elsewhere in KEY NOTES you will find a notice about a new calculator club in Germany. Just before we went to press, we received a letter about one more new club. Here's the letter.

"I have recently formed a Users' Group for HP Personal Programmable Calculators in Britain and would be grateful if you could give the Group a mention in the next issue of KEY NOTES. The Group is called "PPC-GB" (Personal Programming Center-Great Britain) and is a chapter of PPC in the USA, but membership is open to *all* users of HP programmable calculators.

(Continued)

(Continued from page 1)

usable carrying case for it. So he carved-out the interior of a large book and lined it with vinyl. The HP-41 equipment is always together, very inconspicuous, and can be used without having to take it out of its *book*. He had these pictures taken, but never got around to sending them to you. So here they are!"



(Continued)

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To get KEY NOTES in Europe, contact the UPLE (Geneva address on back cover). To get KEY NOTES elsewhere, contact your nearest HP Sales Office or send your name, address, and calculator serial number to the Corvallis Users' Library.

** U.S. dollars. See note at bottom of page 4.*

"I hope that the Group will compliment KEY NOTES, UPLE, and PPC by becoming a *local* forum for exchange of information, programs, and applications; for personal contact between members; for arranging meetings; and for the very important provision of a local "expert" to aid new users (or even a shoulder to cry upon when a program doesn't work).

"At present I am working on the prospect of a summer conference (half or one day meeting) and am trying to arrange with HP-UK and Dealers to provide demonstration equipment, speakers, and perhaps even a visit to HP here in the UK.

"I shall keep you informed of progress as the Group becomes more established and send you a copy of our newsletter when it is published. In the meanwhile, I would be grateful for any advice or help that you can offer—especially regarding user groups and producing newletters."

With many thanks, **David M. Burch**

We are happy to see our valued customers get together and form little groups, because it is a very good way to spread information, ideas, and comradeship. If you are interested in this new Group or want further information, contact Mr. Burch at the following address. It would be a nice gesture to include a self-addressed, stamped envelope.

David M. Burch/PPC-GB
Astage,
Rectory Lane,
WINDLESHAM, Surrey,
GU20 6BW England

(Note: PPC-GM is not sponsored, nor in any way officially sanctioned, by Hewlett-Packard.)

Columbia... *(Continued)*

the HP-41 helped them to keep on top of all of their daily "housekeeping" activities.

In addition to helping the crew organize its time, the second HP-41 computer was kept ready for flight-critical, deorbit-burn calculations. Once during each orbit around the Earth, the shuttle has an opportunity to land at one of six contingency locations. During a routine flight, Mission Control supplies the shuttle crew with deorbit-burn information. Should the shuttle encounter an emergency, however, the astronauts would rely on the HP-41 for these calculations.

Two other programs—one to help balance the *Columbia* prior to re-entry, and another to pin-point Earth observation sites—also are available to the crew and would be run on the HP-41's.

The HP-41's do not take the place of the shuttle's larger, general-purpose computers. However, they do complement the shuttle's larger systems and provide the crew with personal-computer convenience. Also, new and different HP-41 programs can be written between flights—quickly enough to keep up with many of the astronauts' changing computational needs.

We are very proud of the HP-41, and we are happy that NASA chose this handheld marvel for use on the space shuttle. Already the new Time Module is an asset to this mission and, in the future, the new HP-IL Module and the various HP-IL peripherals will surely prove their usefulness. We'll keep you informed as NASA makes more use of the HP-41 system.

Letters... *(Continued)*

Well...you can imagine how many HP-41 system "cases" we see every month, but we have to admit this one is, as they say, "far out." But we also have to admit that it's very clever and that it certainly does fulfill the security requirements that were intended. We congratulate **Keith Olson** and nominate him the "HP-41 Owner of the Quarter."

Mr Olson works for Sperry/Univac in the Bay Area and uses his HP-41 system extensively at the office to make his job easier. If he is as clever at his job as he is in contriving unique cases for his calculator, his employer should hold onto him! And, before we forget it, thank you, Mrs. Olson for the letter and photos.

Now, here's another letter you will enjoy. How many people do you know who have "HP-41CV" on their automobile license plate? Well, *now* you know at least *one*! Here's his letter.

"Thought you might like to see my portable office! I am just finishing teaching a graduate course, "Hydrologic Analysis With Programmable Calculators," with Professor Lloyd W. Gay, at the University of Arizona. The course was accepted, like my license plate, with much enthusiasm.

"Being Assistant City Engineer, I could let the little wonders [*HP-41 system*] evaluate some of the city's turnoff problems. We plan to present the HP-41 programs to practitioners in a 3-day short-course this November."

The letter was signed, "Waiting for my new tape drive, Very truly yours, **Dr. Brian M. Reich.**" We thank you, Dr. Reich for the photograph and for taking the time to share your thoughts and your truly unique license plate with our readers. KEY NOTES is *always* interested in hearing about unique applications, situations, or what-have-you.

We might add that Dr. Reich is a Consulting Engineer and Hydrologist who lives in Tucson, Arizona.

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