

# Series 40— When and What

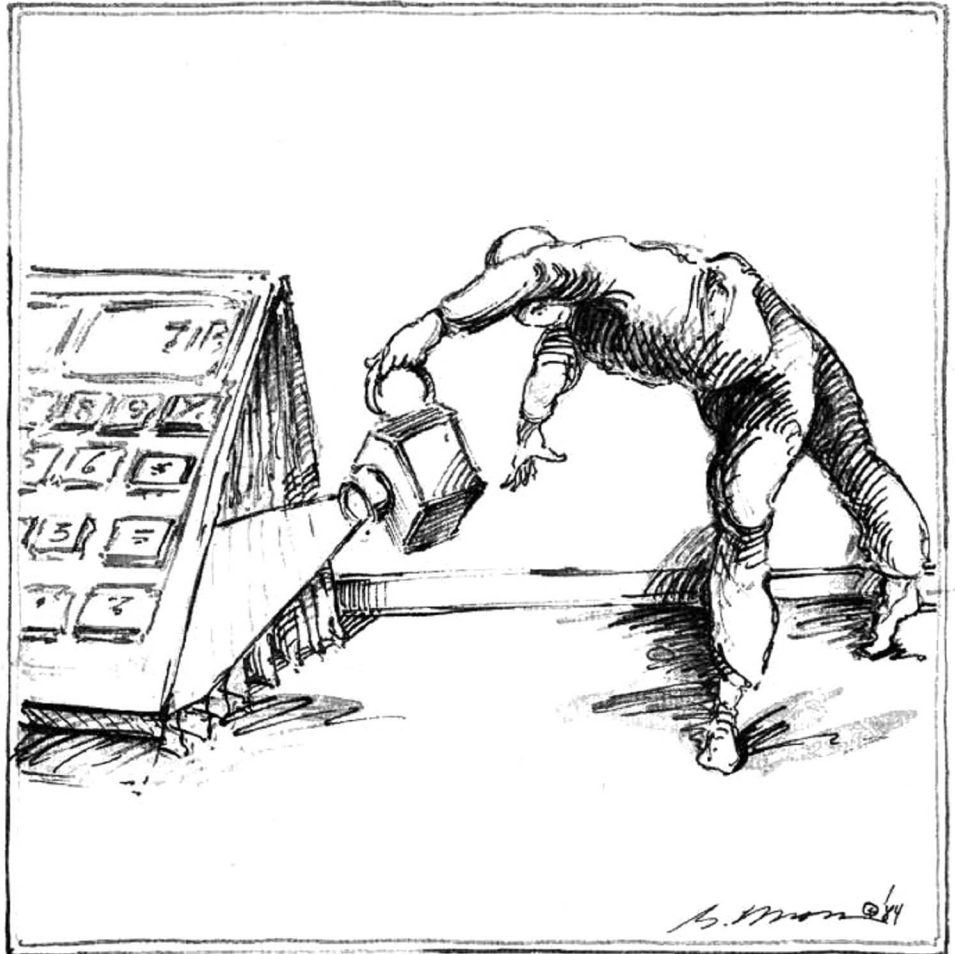
BY MARTIN HANSON

Many users have wondered about the history behind the Series 40. It can be traced back to the introduction of the HP-41C on July 16, 1979. The HP-41C was promoted as the first alphanumeric, fully programmable, continuous memory, handheld calculator. The first HP-41 contained many first-time features such as liquid-crystal display and redefinable keyboard. The HP-41C has 441 bytes of program memory or 63 data registers in the main memory configuration. The major peripherals available at introduction were the HP 82143 thermal printer and HP 82104 magnetic card reader. The HP 82153 optical wand for reading bar coded programs and data became available on July 1, 1980.

An expanded version of the HP-41C appeared at a trade show in Las Vegas on Jan. 7, 1981. The "HP-41CV Alphanumeric Full-Performance Programmable Calculator With Maximum Continuous Memory" is equivalent to the basic HP-41C with four memory modules or one quad memory module. The main memory configuration of the HP-41CV is 2,233 bytes of program memory or 319 data registers.

The HP interface loop module, introduced on December 21, 1981, allowed up to 30 HP-IL compatible devices to be connected in series and controlled by the HP-41. The first HP-IL peripherals to be released were the HP 82161 digital cassette drive, HP 82162 thermal printer, and the HP 3468 digital multimeter. The list of new HP-IL devices has grown to include video displays, 80-column impact printers, modems, and graphics plotters.

A new, revised HP-41, the HP-41CX, was announced on Nov. 1, 1983. The device is similar to an HP-41CV with a time module and extended functions/memory module, although there are differences. The HP-41CX has several new functions, redesigned catalogs, new alarm functions, and it comes with a completely rewritten users manual. The main memory configuration of the HP-41CX is the same as the HP-41CV. All programs developed for the HP-41C and HP-41CV will execute correctly on the new HP-41CX. The converse is not necessarily true. The compatibility question is similar to the HP-67/97 and HP-41 compatibility requirements; that is, the called func-



tion must be contained in the executing machine.

All three models of Series 40—HP-41C/CV/CX—are currently available.

## USER QUESTIONS

*Q. When making intermediate calculations during a PROMPT or other stop in an executing program, and using a keyboard function in USER mode, there is a considerable delay in execution as compared with executing the same function in NORMAL mode.*

A. The delay or pause is actually the time required for the operating system to perform a search sequence. The pause will tend to vary with the number of programs, number of global labels, and number of local labels currently in memory. When a key is depressed while the HP-41 is in USER mode, the calculator first checks the system key assignment flags. The status of these flags can be checked or viewed using synthetic techniques.

When the system key assignment

flag is set for the depressed key, a program or function assignment has been previously made. The calculator then searches the key assignment registers for the program or function name assigned to the selected key. The processor searches from the permanent end (.END.) through each global label. If the assigned program name corresponds to a global label, the program pointer moves to that global label and execution begins. If a corresponding global label is not found, the assignment is a CATALOG 3 function, which is performed on the current stack contents. It should be mentioned that the global label search includes application ROMs that are installed.

When the system key assignment flag is clear for the depressed key, the calculator must still perform a search if the selected key is in the top two rows or a shifted top row key. These keys act as an XEQ "local alpha label" corresponding to their respective local label designations. The processor searches downward from the current program pointer position for a



corresponding local alpha label. The search wraps around at the program END to the top of the program and continues down to the point where the search began. If a corresponding local alpha label is found, the program pointer moves to that label and execution begins. If a corresponding local alpha label is not found, the calculator executes the NORMAL mode function assigned to the selected key.

This process is illustrated in the accompanying flow chart. To avoid the searching delay and maintain the program pointer position, switch to NORMAL mode to perform any intermediate calculations not requiring the key assignments of USER mode.

**Q.** Alpha registers M, N, O, and P can be used for additional "scratch" registers and for data if the Alpha register is not disturbed. I am having problems STOing and RCLing with register P.

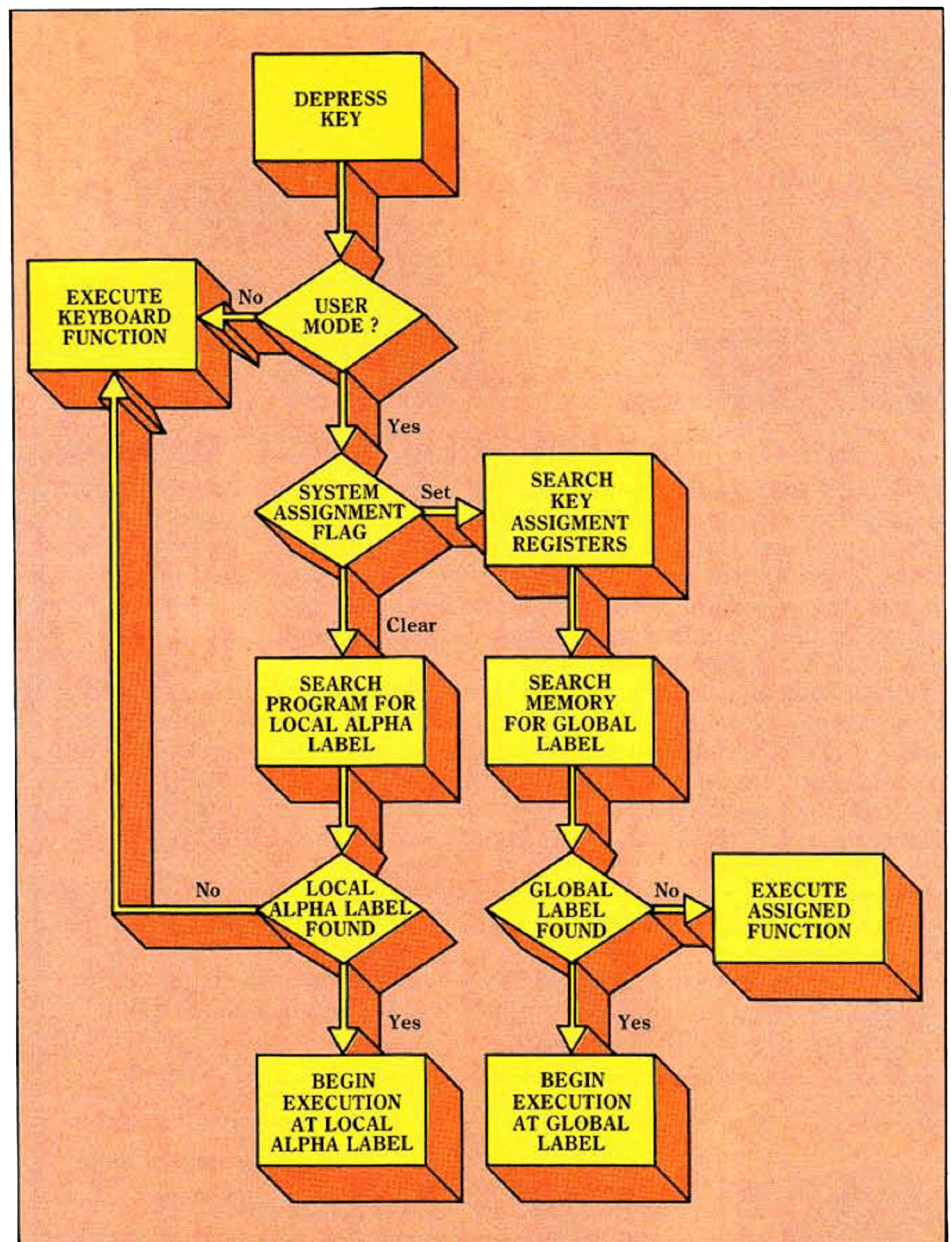
**A.** Your question exhibits one of the useful applications of synthetic programming. For those of you not familiar with synthetic program lines, they are program lines that cannot be keyed into the calculator using normal keyboard methods. Synthetics can be useful for flag control, key assignments, non-standard tones, graphics, and as in this case, for additional scratch registers. The problem with register P is that the processor uses part of register P for its own scratch purposes. This seriously impairs the reliability of the register. In an executing program, if you can avoid the use of VIEW, AVIEW, and number entry lines, the contents of register P should be reliable.

**Q.** I purchased the HP 82143 dedicated printer with my HP-41C several years ago. I would like to use the video interface for "soft-copy" output. Can the dedicated printer and the video interface be connected at the same time?

**A.** No. Both the HP 82143 thermal printer and HP-IL module contain some of the same printer functions (XROM 29, ii). The small slide switch on the back of the HP-IL module must be set to the disable position when using the HP 82143 printer. The slide switch must be set to the enable position when using the video interface. The disable/enable refers to the printer functions in the HP-IL module. If you have the dedicated printer connected and HP-IL module installed and set to enable, you generally will put your HP-41 into a "lock-up" state. This is caused by the duplication in ROM

addresses. The HP 82162 thermal printer can be used with the video interface in the IL loop. Output must be directed to the desired device using the

is no global label START in program memory, NONEXISTENT will be displayed, the program pointer will not advance, and execution stops. Alpha



device's address on the loop. This can be accomplished either manually or under program control.

**Q.** I have read the manual section on indirect addressing, but still have questions on indirect alpha addressing and its possible applications.

**A.** Indirect addressing is an alternative method of specifying the argument of a function. It has many interesting and useful computational and branching applications. For example, if the alpha string START is currently stored in register 10, GTO IND 10 will cause the program pointer to move to the global label START and begin or continue execution at that point. If there

branching can be used to move to desired programs in response to a prompt. Consider:

AON  
"PROGRAM?"  
PROMPT  
AOFF  
ASTO X  
GTO IND X

*This column is intended to be a users forum for exchange of information on Series 40 systems. We will feature new ideas, news items, interesting applications and answer several questions on Series 40 hardware/software in each issue. We invite your questions, comments, tips, suggestions, applications, and other ideas.*