

August 1983
Vol. 9, No. 8
\$2.95

Computers
And People

Creative Computing®

the #1 magazine of computer applications and software

In-Depth Evaluations:

- TRS-80 Model 100
- Texas Instruments CC-40
- Mattel Aquarius
- Information Master
- Word Plus—PC
- HomeBrain
- The Eye

The Heartbreak Of Cyberphobia

Marriage In The Computer Age

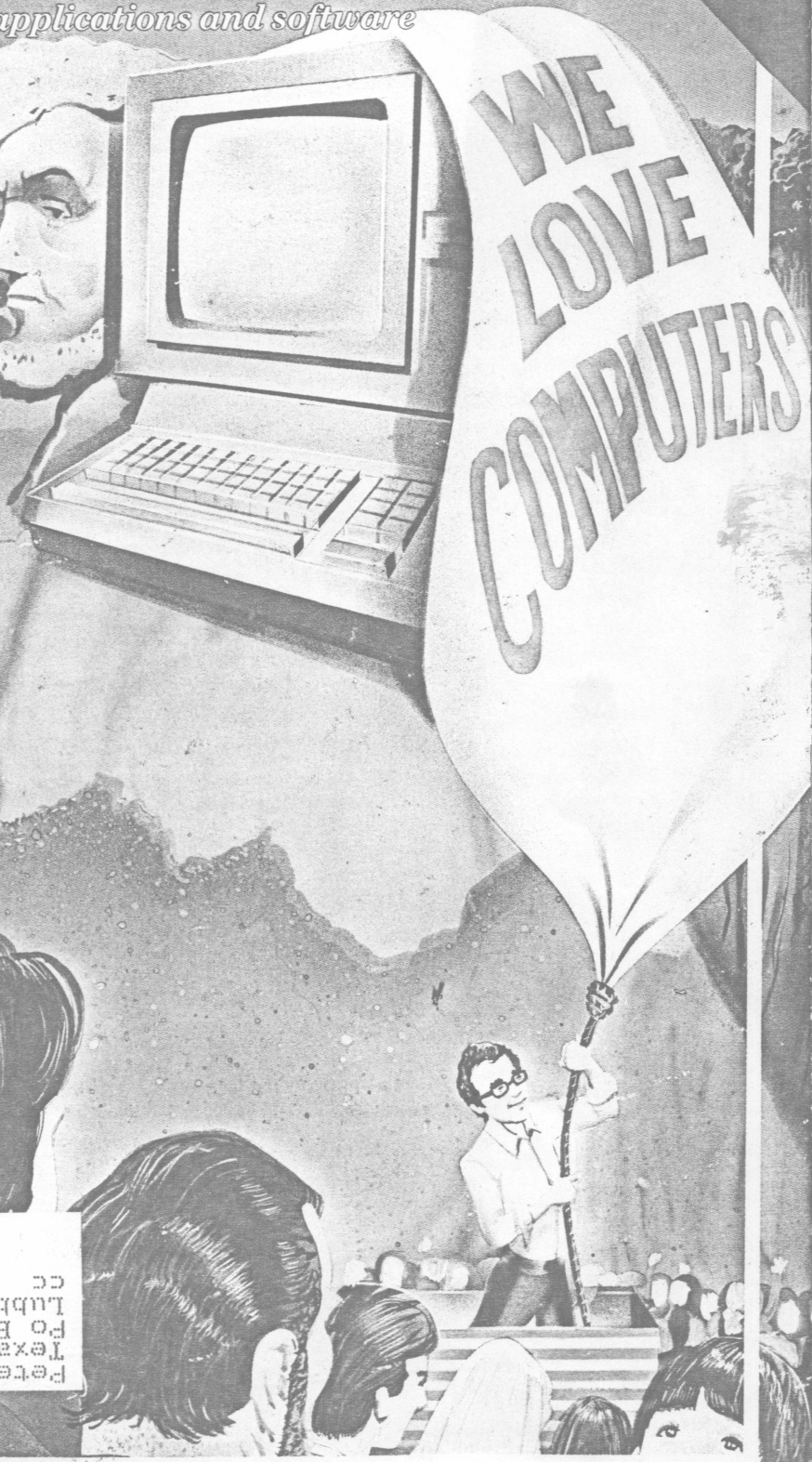
Are You A Creative Person?

Report From NCC '83

New: Street Price Index

Home Control

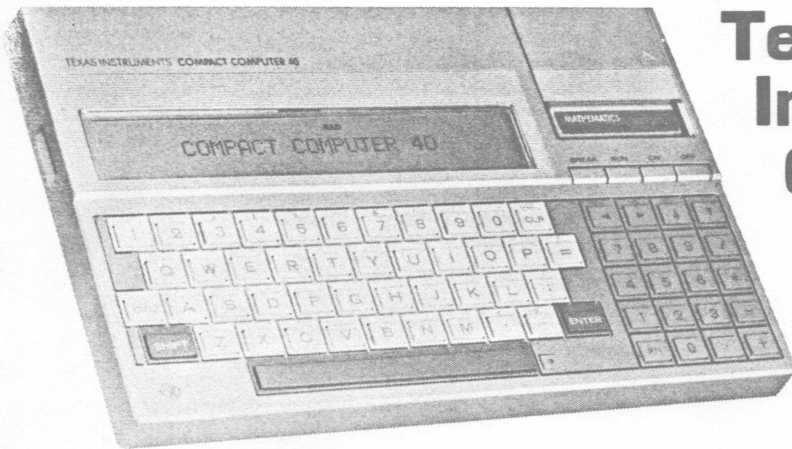
Computer Ethics



Pete Bonfield
 Texas Instruments
 P.O. Box 10508
 Lubbock, TX 79408
 CC



5884



Texas Instruments CC-40

When I first saw the Texas Instruments Compact Computer 40 (CC-40) I assumed it was a diminutive example of the notebook computer. Notebook computers are a new breed of machine. They are small (notebook-sized) computers that feature a type-writer style keyboard, a nonvolatile memory that retains information in memory when the computer is turned off, and a built-in display screen.

Closer examination, however, reveals

The TI CC-40 At a Glance

Computer: Texas Instruments CC-40

Microprocessor: 8-bit CMOS TMS 70C20

RAM Memory: 6K standard, 18K maximum

ROM Memory: 34K with Basic

Language, standard: TI Basic

Languages, optional: Editor/ assembler
Keyboard: calculator style, numeric keypad

Display type: LCD

Character resolution: 1 line x 31 characters

Graphics resolution: 1 x 31 (5 x 8 dots)

Mass storage: cassette, disk, wafertape, plug-in cartridge (up to 128K)

Interface, standard: 8-pin Hex bus

Interface, optional: RS-232

Size, Weight: 9.5" x 5.75" x 1", 1 lb., 6 oz.

Joe Devlin

that although the CC-40 is quite a little powerhouse and has much in common with the notebook machines, it lacks some of the features needed to compete in the notebook class.

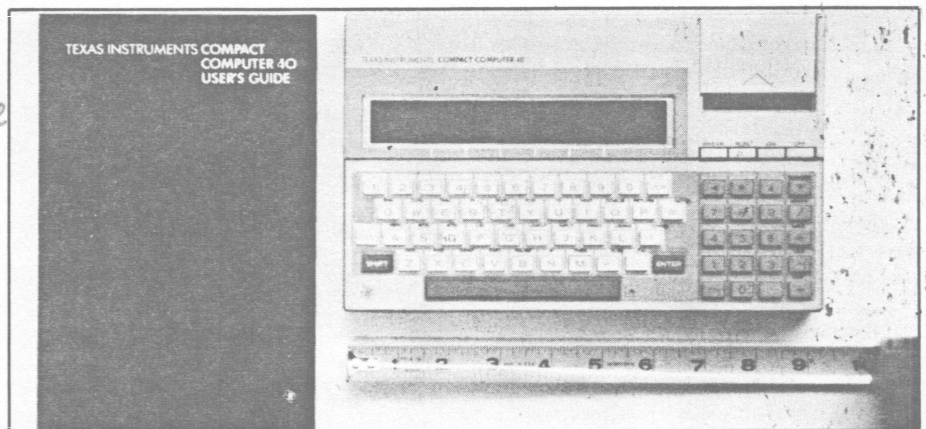
The CC-40 is a handsome silver computer the size of a large paperback novel. This small size (9.5" x 5.75" x 1") is one of the factors that places it in the pocket computer rather than the notebook class. The machine is slightly larger than most of the hand-held computers such as Radio Shack's PC-2 and PC-4 and the Hewlett-Packard HP-75C, but smaller than notebook machines such as the Radio Shack Model 100. As such, the CC-40 provides a link between the hand-held programmable calculator and the desktop personal computer. The CC-40 packs a lot more

power than most of the pocket units, but this power is trapped within a tiny body that makes it hard for the CC-40 to express itself.

CMOS Processor

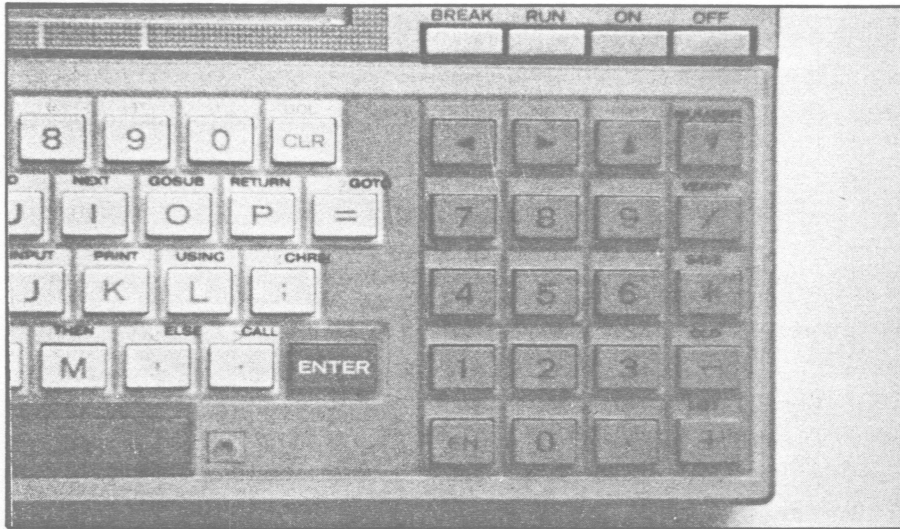
The heart of the CC-40 is an 8-bit CMOS processor. CMOS processors use very little power as compared with normal chip technology. This means that the CC-40 can be powered by batteries alone. More important, memory can be sustained, even after the machine has been turned off, with very little drain on the batteries.

The four AA alkaline batteries that power the system will last for up to 200 hours of powered-up use and will maintain your program in memory for months. Type in a program, turn the machine off, and the program will remain in memory and reappear when the machine is turned back on and the program is called back.



The CC-40 is not much bigger than the instruction manual. Keys are calculator-style, but have positive action and both tactile and aural feedback.

TI CC-40, continued...



Directional keys control position of cursor and LCD display (1 line x 31 characters) within program. Black markings over keys are actually on a removable, transparent overlay. Reset button is flush with the case to prevent accidental activation.

In addition, there is an automatic power down feature that shuts the machine off when it is left unattended for more than ten minutes. If you prefer, the unit may also be connected to an optional \$15 AC adapter and plugged into a wall outlet.

A Tour Of The Keyboard

The keyboard on the CC-40 features a well built miniaturized typewriter-style (QWERTY) key arrangement and a nu-

meric keypad. A tilt stand is built into the back of the console to provide an optimum viewing and keying angle.

By using the left SHIFT key, the typist can type both upper- and lowercase letters. The uppercase lock is activated by pressing the SHIFT and UCL keys simultaneously. The uppercase lock causes all the alphabetic keys to be shifted to uppercase while leaving the operation of the numeric and punctuation keys unshifted.

There is no right shift key; there is an ENTER key where the right shift key would be.

The numeric pad on the right includes the numbers 0 to 9 arranged in calculator fashion and a few other keys. Above the numbers on the top row of the pad lie the four cursor control keys. The right and left cursors provide easy access to an 80-character line even though only 31 characters are displayed. The other two cursor keys provide an easy way to page through the lines of the program stored in memory.

Above the numeric pad is a row of keys that includes, the ON and OFF keys along with RUN and BREAK. The BREAK key will halt an executing program. Pressing the RUN key followed by ENTER causes the current program in memory to execute.

The Display

The CC-40 uses a single-line, 31-character liquid crystal display (LCD) screen capable of supporting both upper- and lowercase letters as well as numbers and a variety of special graphics characters.

The display can be scrolled back and forth revealing a 31-character window that opens upon the 80-character screen memory. A contrast control (actually display angle) is provided to adjust the screen for optimum viewing.

The LCD screen also displays several special status indicators above and below

I recently wrote a book, *The Texas Instruments Home Computer Ideabook*. As a result, I became very familiar with TI 99/4A Basic, a bare bones implementation of the language with virtually no bells and whistles. Hence, it was with mixed emotions that I approached the CC-40.

My excitement started to build as I read the first few sections of the manual. Good grief, could CC-40 Basic really have come from the same folks in Texas who brought us 99/4 Basic?

The CC-40 has a truly excellent Basic. In addition to all the expected commands and functions, there are some that set this computer apart.

- 15-character variable names.
- 1-, 2-, or 3-dimensional arrays.
- Function calculations in either radians or degrees.
- Multiple statements on one line.
- Accuracy to 11 decimal places.
- Numeric range from 10^{-128} to 10^{128} .
- Logarithmic functions LOG and LN.
- Six trigonometric functions including arcsin and arccos.
- Subprograms using SUB and CALL.

TI Compact Computer 40 Basic

David H. Ahl

- Functions to provide both floating point and integer random numbers.

- Five methods of entering input data: INPUT, LINPUT, ACCEPT, KEY\$ (like INKEY\$ in other versions of Basic), and CALL KEY (reads keyboard buffer without halting program).

- Two methods of displaying output data: PRINT and DISPLAY (more versatile than PRINT). IMAGE can be used to format either PRINT or DISPLAY (similar to PRINT USING).

- Ten user-defined function keys with up to 80 characters per function. A function can be an entire subprogram callable from either Basic or immediate mode.

- Immediate mode calculations do not require a PRINT statement to precede the calculation. In this sense, the CC-40 is exactly like a powerful scientific calculator.

- Automatic line numbering and renumbering commands.

- Quotation marks possible within a string, for example, the following is a legal string:

She said, "I love you," and left.

- Simplified editing of Basic statements. The cursor keys are used to move within a statement. When a change has been made, RETURN is pressed without having to move the cursor to the end of the statement.

Of course, there are some idiosyncrasies as well. The first program I wrote (a very simple one) just would not display any output. I finally traced this to the fact that the output was displayed so quickly that it could not be seen before the computer went on to the next command (or stopped). When the CC-40 finishes a program, the last line of output is not left on the screen; presumably this is to conserve battery life. Hence, to see any output, you must instruct the program to pause briefly before going on. Fortunately, this is easily done with the PAUSE command which causes the CC-40 to pause for the number of seconds specified, i.e., PAUSE 2 pauses for two seconds.

Bottom line: CC-40 Basic is one of the best I have seen and is all the more remarkable for being on a computer this size.

TI CC-40, continued...

the single line text display. These indicators warn when the uppercase lock has been set and when the function or control keys have been activated. Other indicators show if degree, radian or grad modes are active, whether I/O is in progress, if left or right scrolling or one of six user-settable flags has been set, if there has been an error, or if the battery is low.

Is There Such A Thing As Too Small?

There is a great deal of power in the little mite. The problem is that the human interface is not all it might be. This is primarily the result of the small size of the unit which necessitates the use of the single line LCD display and the calculator style keyboard.

I suppose it won't be long before it will be technically possible to produce a computer the size of an olive. Imagine trying to work a keyboard the size of an olive pit! Fortunately the keyboard on the CC-40 is calculator sized rather than olive pit sized.

Calculators, however, are worked with a single hand. The keys on the CC-40 are so closely spaced that single finger pecking rather than touch typing is the usual mode of data entry. On the other hand, the keys have positive action and provide both aural and tactile feedback. There was no hint of the keybounce that is a frequent plague on other computers with "Chiclet" style keys.

The single line LCD display aggravates the problem with working with the machine. It is difficult to enter and edit either text or a program when you can see only a portion of one line of text at a time.

Documentation

The User's Guide that comes with the CC-40 is slightly smaller than the computer. It is divided into five chapters, twelve appendices, and an index. It is a thick, well written tome that covers all the ground it should. One nice feature is an alphabetically arranged section with a page-long explanation of each Basic command, function, and built-in subroutine.

Basic

The Basic included in CC-40 ROM is a sophisticated one, with many features that appeal to those who are used to programming in higher level languages such as Fortran. Along with all the standard PEEKS, PRINTS, LISTS and control loops, the CC-40 provides several interesting bells and whistles.

For example, CC-40 Basic contains an ACCEPT command which accepts data at any position in the display, can sound an audible beep to alert the user that data

are being solicited, checks the data for type (numeric, positive, negative, character) and length, and provides a de-

The designers have thoughtfully provided function keys that will enter an entire command at the press of two keys.

fault in case null data are input. What convenience! What class!

CC-40 also provides an IMAGE command that allows Fortran-like format-

ting of output data. PAUSE waits for any key to be pressed, or for a specified length of time (good for waiting for user acknowledgement that a message has been read). The ON ERROR command allows the programmer to preset the action to be taken when an error occurs during the execution of a program. The DEBUG command allows access to an assembly language debugger. INDIC lets you set display indicators on or off through software. In short, there is a lot to this Basic.

The most wonderful feature in CC-40 Basic is the provision for full parameter passing, by value and by reference in subroutine calls (called subprograms by TI) through the CALL statement. The programs in the box below perform almost the same functions. One is written in standard Basic, using GOSUB (which is

Subprogram SUMIT in Listing 2 and the subroutine in lines 200-230 of Listing 1 both add two numbers and store them in a variable called SUM. The only difference is that subroutine 200-230 zeroes variable B and SUMIT does not touch it.

Unlike a standard Basic GOSUB, the CALL statement includes a list of the variables that the subprogram will use from the calling program. Any other variables mentioned in the subprogram are unique to it, and the storage for them is not retained when the program exits the subprogram (as, for example, variable A). Notice also that two of the variables being passed to subprogram SUMIT are in parentheses. This means

that only their values are passed. SUMIT cannot change the values of J and B; it knows only what their values were when SUMIT was called. (This is just as well, because if J were set to zero, our FOR...NEXT loop would be messed up.) SUM, however, is passed by reference, which means that SUMIT is free to change it, which it does, by returning the SUM of J+B in it. The J, passed by the CALL, is renamed A inside the subprogram. Any integer can be passed to SUMIT, and we do not always have to store it in a variable with the name J before calling SUMIT.

Listing 2.

```
10 REM CALL VERSION
20 FOR J=5 TO 500 STEP 5
40 B=J+10
50 CALL SUMIT (<<J>>,<B>,> SUM)
60 PRINT J,B,SUM
70 PAUSE
80 NEXT J
90 STOP

200 SUB SUMIT(A,B,SUM)
210 SUB=A+B
220 A=0
230 B=0
240 SUBEND
250 END
```

Listing 1.

```
10 REM GOSUB VERSION
20 FOR J=1 TO 100 STEP 1
30 A=J*5
40 B=A+10
50 GOSUB 200
60 PRINT A,B,SUM
70 PAUSE
80 NEXT J
90 STOP

200 SUM=A+B
210 A=0
220 B=0
230 RETURN
240 END
```

TI CC-40, continued...

available on the CC-40 for those who want such things). The other uses parameter passing by reference and by value to create a much neater version.

Structured programmers will be delighted with this CALL instruction. And even those who are not always as structured as others might like them to be will find it exhilarating to be able to name a function, instead of just giving it a number. CALL statements can also be used to access some built-in subprograms such as CLEANUP, which deletes unused variable names from the system and SETLANG, which can change the language in which the prompting messages are displayed.

This Basic is nifty. Not only that, but despite the small size of the keyboard, it is easy to enter. This is because the designers have thoughtfully provided function keys that will center an entire command at the press of two keys. The plastic keyboard overlay provided with the machine is the path to easy access of Basic keywords. Hold down the FN (function) key on the numeric pad, press the appropriate key as indicated by the keyboard overlay and *voila!* Basic in an instant. Control functions are similarly accessed by pressing the CTL key followed by some other key.

The programmer who wants more than the built-in Basic commands can program his own user-assigned strings. These can be strings of characters, commonly used math expressions, or even memos of up to 80 characters. User-assigned expressions can be recalled by hitting the FN key along with the numeric key (1 to 9) assigned to the phrase.

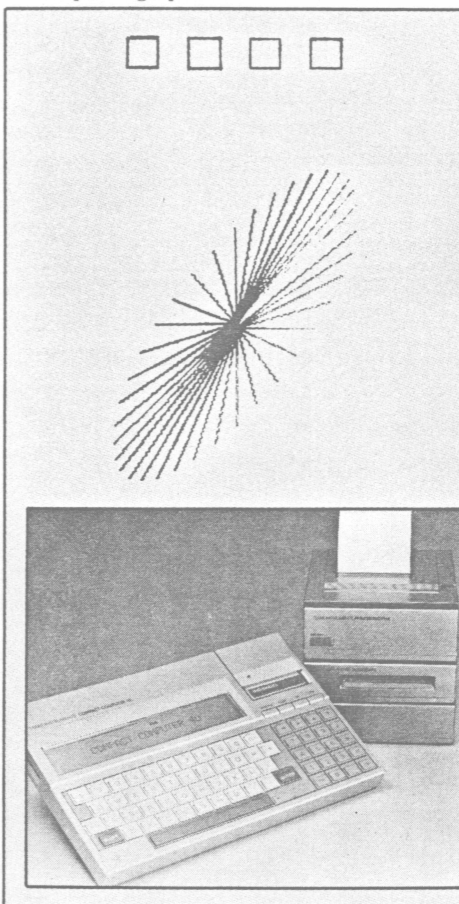
All Basic calls, whether typed in or entered with the help of a function key, are edited with the line editor. Left and right arrows allow for non-destructive movement through the text line. Up and down arrows move you from line to line, as does the LIST key. Individual characters in a line can be deleted or inserted. A character is changed by being typed over.

One quirk of this editor is that to delete an entire line you must DELETE it—just typing its line number does not suffice. I won't get into a debate as to whether this is a safety feature or just a pain.

I/O

There are two openings on the back of the unit. The most important is the 8-pin hex-bus peripheral port. Three peripherals that plug into the hex-bus port are currently offered—an RS-232 interface, a printer/plotter, and a wafertape drive. Next to the peripheral port is a socket for attaching the AC adapter. The cartridge port, which can accept either ROM cartridge software or

This figure, plotted by the program below, was printed by the TI Printer/Plotter shown in the photograph.



memory expansion cartridges, is located in the upper righthand corner of the CC-40. On the bottom is a panel that covers the battery compartment.

Peripherals

Even though the CC-40 has a permanent memory, the size of that memory is limited to 18K, and sooner or later most users will want to save information on an external storage device. For this purpose Texas Instruments offers a \$140 Wafertape drive (also called a stringy floppy). It uses removable, continuous-loop cartridges that can store up to 48K. Continuous-loop cartridges offer a compromise between faster but more expensive disk storage and slower but less expensive cassettes.

Those who wish to attach a modem or 80-column printer to the computer can purchase an RS-232 interface for \$99.95.

The x-y printer/plotter uses four tiny ballpoint pens to sketch color graphs or to print up to 11 characters per second. The plotter uses 2 1/4" wide plain paper and costs \$199.95. The three peripherals are desktop units, not designed to be portable. Each is packaged in a silver box designed to be stacked one on top of the other, taking up the minimum amount of space on a desk.

```
20 INPUT "Enter ma
  Jor axis radius(0-
  100)";A
25 IF A>100 THEN 2
  0
30 INPUT "Enter mi
  nor axis radius(0-
  100)";B
35 IF B>100 THEN 3
  0
40 INPUT "Phase re
  lationship(-90-90)
  ";ROTATION
45 IF ROTATION>90
  OR ROTATION<-90 TH
  EN 40
50 PRINT "Pen colo
  r":PAUSE 1
60 INPUT "1-black
  2-blue 3-green 4-r
  ed ";COLOR
65 IF COLOR<1 OR C
  OLOR>4 OR COLOR<>I
  NT(COLOR)THEN 60
100 DEG
110 OPEN #1,"10",O
  UTPUT
120 PRINT #1,CHR$(
  19)
130 PRINT #1,"M(11
  0,-120)"
140 PRINT #1,"0"
145 PRINT #1,"C";S
  TR$(COLOR)
150 FOR TA=0 TO 35
  9 STEP 10
160 X$=STR$(INT(B*
  COS(TA)))
170 Y$=STR$(INT(A*
  SIN(TA-ROTATION)))
180 PRINT #1,"L(0,
  0),( ";X$;" ";Y$;" "
  "
190 NEXT TA
```

Software

It is likely that most of the initial software packages for the CC-40 will be produced by TI. There are several factors that may prove to be barriers to the rapid proliferation of software for the

CC-40. The CMOS processor that is the heart of the CC-40 is relatively new and has never before been used as the CPU of a microcomputer. The Basic built into the machine is very powerful but not necessarily compatible with software offered for the popular Texas Instruments 99/4A computer. Neither the cartridge nor the Wafertape cassette is compatible with previous offerings by Texas Instruments.

Software for the CC-40 will be made available on either plug-in ROM cartridges or Wafertape. ROM cartridges retail for from \$40 to \$125. Initial offerings include *Mathematics*, *Finance*, *Perspective Drawing*, and *Business Graphics*. Wafertape cartridges sell for \$19.95 and include *Elementary Dynamics*, *Production and Planning*, *Inventory Control*, *Photography*, *Electrical Engineering*, and *Profitability Analysis*.

For the CC-40 to become a success, it will have to find a niche for itself. There is no way that a calculator sized computer with a single-line LCD and a Wafertape drive will be able to perform many of the tasks performed by a personal computer with a full sized display screen, keyboard, and disk drive.

Nor will this machine be competitive in the world of notebook computers. Most notebook computers see a great deal of use as portable word processors, and the single-line display, tiny keyboard and minimal editor of the CC-40 limit its use as a word processor.

The most likely market for the CC-40 is probably in competition with hand-held computers like the Hewlett-Packard 75C or the Radio Shack PC-2 and PC-4. The CC-40 is well equipped to compete in this market.

The permanent memory and powerful Basic exceed the capabilities found in most hand-held computers. The large size of the machine results in a larger typewriter style keyboard, which, though not meant for touch typing, is better than that found on any hand-held.

The CC-40 is an attractive machine, even with its drawbacks. Just look at the possibilities it offers. If you are looking to learn Basic, it offers a very powerful and portable learning tool. If you are a salesman or engineer, it will calculate the solutions to formulas you use every day. If you are a student, about to take a Physics test—oh what a crib sheet you could create! Not only will the CC-40 keep track of all those equations you never memorized, but it will hold the comments you need to remind you which formulas are needed in which situations. And once the proper formula has been found, just key the variables into the equations and the machine will provide you with all the answers. □

CIRCLE 401 ON READER SERVICE CARD

August 1983 © Creative Computing

I have been using
TransForm for all
kinds of programming
... my time has been cut in half...
this is one of the very few utilities
I have never regretted
purchasing for one
instant.

by Dr. J.C. Gilland
Graphion/Vortex

Whether you are just a beginner, someone reasonably familiar with programming, or a veteran, **TransForm** can help you.

What is TransForm?

TransForm is a better way to write programs in Microsoft BASIC.® It is a structured translator which does away with the constraints of line numbers and the single line IF. It adds the high level structures of the block IF-ELSEIF-ELSE-ENDIF, REPEAT-UNTIL, and ON-GOTO-ENDGOTO—similar to languages like Pascal. Symbolic labels are used (such as "GOSUB @ QUICKSORT"). A very versatile INCLUDE-DECLARE feature has been added to enable you to build a library of the subroutine modules you use every day—write it once, then INCLUDE it. High level, structured code in—ordinary BASIC out. It's that quick and easy.

Now! Three great ways to order TransForm: The TransForm Tutor. Wanting to learn how to write clean, reliable, structured programs? Let the Tutor teach you with its detailed, easy to learn, step-by-step examples and tutorial. **Only \$39.95*!**

The TransForm Standard. Already familiar with structured programming? The Standard begins with a more complex example (a utility program) so you can dive right in. **Only \$39.95*!**

The TransForm Expert. Writing complex program series as a professional? The Expert provides the additional utilities of a source code formatter, destination code optimizer (for use with BASCOM® 5.3), and a "REL" file disassembler. Everything you need to master your applications. **Only \$39.95*!**

Place your order for **the Tutor, the Standard, or the Expert** toll free now: **1-800-845-7055**. Direct technical questions to 1-803-244-8174. VISA, MC, COD, company PO, or check accepted. For CP/M.® *Introductory price.

From the same company that created MCDISPLAY, the powerful display interface for Microsoft BASIC which allows you to develop screen-oriented application packages.

MCI Master
Computing
Inc.

"Practical Solutions Through Technology"
A Division of EDI Technology Companies
11 Regency Hills Drive, Greenville, SC 29615
CIRCLE 160 ON READER SERVICE CARD