VOL. 2 NO. 7 July 1985

# COMPUTER DIGEST

NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

## OPTICAL CHARACTER RECOGNITION

### Keeping Up With The State Of The Art


A GERNSBACK PUBLICATION

## YOU CAN ADD A HARD DISK

### It May Not Be As Difficult As You Thought

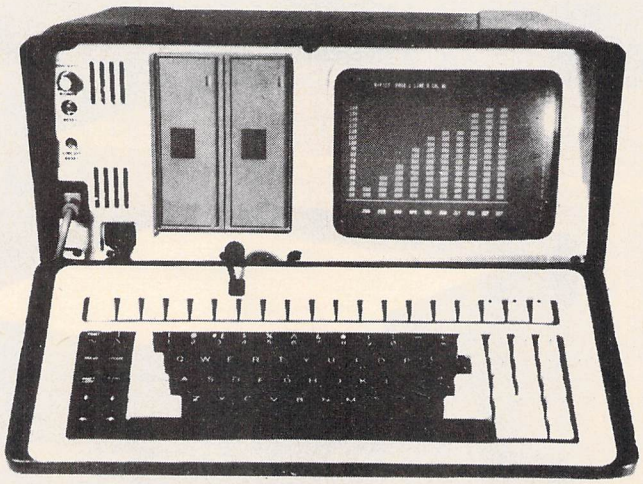
## WRITE PROTECT NOTCH BYPASS

### Now You Can Use Both Sides Of A Disk

# ZORBA
## PORTABLE COMPUTER
# THE EXPERTS' CHOICE

**FEATURES:**

- 9" GREEN OR AMBER CRT
- 19 INDEPENDENT 55 PROGRAMMABLE FUNCTION KEYS
- TWO 400K DSDD DRIVES
- 64K BYTES 200 NS RAM
- C BASIC COMPILER
- IEEE 488 BUS MASTER PORT
- 24.6 LBS
- CPM 2.2 OPERATING SYSTEM
- M80 (L80, LIB80, CREF80)
- SOURCE CODE OF THE BIOS PLUS UTILITIES
- DATA COMMUNICATIONS SETUP PACKAGE
- SERIAL & PARALLEL PRINTER PORT
- DATA COMMUNICATION PORT



**OPTIONS:**

- 16 BIT 256K RAM UPGRADE (8088 CPU) $600.00
- 800K DSQD 96TPI DRIVES $200.00
- COMPOSITE VIDEO OUTPUT $100.00
- SOFT VINYL CASE $25.00
- TUTOR KIT; $15.00 (CPM, WORDSTAR, CALCSTAR)
- SCHEMATIC SET $10.00
- 10MB HARD DISK DRIVE

VISA/MC

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WORDSTAR, MAIL MERG, SPELLSTAR,
DATA STAR, REPORTSTAR, CALCSTAR

**$849.00**
**W/O Bundle**

**DEALER INQUIRIES INVITED**

**$1049.00**
**With Bundle**

### General Specifications

ZORBA is the lowest cost full featured portable computer. This light weight computer is ruggedly packaged in a convenient carrying case. The case surrounds a strong inner chassis which further protects the Z80A based computer with its two double sided double density disk 400K drives, large easy to read 9" display screen and well designed detachable keyboard.

ZORBA uses CP/M, the industry standard operating system, which means that a wide range of existing software is readily available to the user.

The ZORBA users manual covers operation of the unit, all supplied software and all interface and internal information. A system diskette is supplied with all system files and utilities. A second diskette contains the sources for all ZORBA software including BIOS, SETUP, FORMAT, and PATCH.

### Keyboard

Keyboard communicates serially with CPU
Detachable with 2 foot coiled cord
95 keys in standard QWERTY format
13 Key Numeric pad
Independent Caps Lock and Shift Lock
55 Software programmable function keys
All keys auto-repeat after 1 second delay
All Standard cursor and terminal control keys

### Disk System

| | |
|---|---|
| Controller: | WD1793 |
| Drives: | 5.25 Double Sided, Double Density, 400K 48 TPI |

Built-in disk interchange formats: Xerox 820 (SD, DD), Kaycomp (DD), DEC VT-180 (SD), Osborne (SD) and IBM-PC (eg. CPM/86) and Televideo 802 (Read/Write and Format compatibility) (Expandable to 61 Formats)

### Specifications
### General Mechanical and Electrical

| | |
|---|---|
| Width | -17.5 inches (44.45 cm) |
| Height | - 9.0 inches (22.86 cm) |
| Depth | -16.0 inches (40.64 cm) |
| Weight | -24.6 pounds (11.1 Kg) |
| Power | -80-130 VAC or 190-245 VAC 50/60 Hz 170 watts max |

### Display

Display Tube:
9" diagonal, Green or Amber
High resolution display circuitry
60 Hz refresh rate

Display Format:
25 lines x 80 columns
5x7 Character Font with full descenders
128 ASCII Characters
8x9 32 Characters Graphic Font
2K Memory Mapped Display Buffer

### CPU Board

Z80A CPU running at 4 Mhz with no wait states
64K bytes of 200 ns RAM (58K after CP/M loaded)
16K bytes of EPROM (2732) can be switched in and out by software 12K available for user EPROMS
8275 CRT controller, DMA driven
1793 Floppy disk controller, SMC data separator
Bipolar proms configure 10 addresses
Fully structured interrupts prioritized by bipolar proms

### Interfaces

- Full asynchronous RS232 port with modem control. Baud rates and data translation and protocol programmable
- Full asynchronous full duplex RS232 port with hardware handshake (for printers). Baud rates and protocol programmable. (Serial Printer Port)
- One 8 Bit parallel port with independent strobe and ready lines. Supports Centronics interface with an available adaptor cable.
- IEEE 488 Bus Master Port (ie: General Purpose Instrumentation Bus) not Software Supported.
- 21 Standard Software Programmable Baud Rates: 45.5 to 19,200 BPS

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CIRCLE 264 ON FREE INFORMATION CARD

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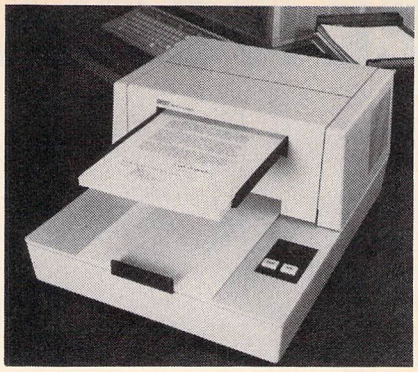

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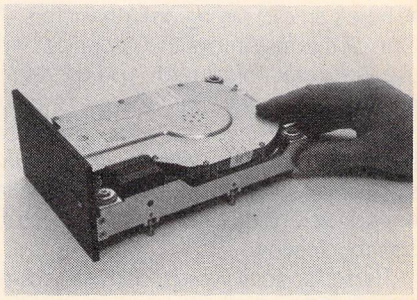

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# ON THE COVER

Optical Character Recognition (*OCR*) has come a long way since its inception. We now see a form of it in daily use at grocery checkouts with Uniform Price Codes. Our cover shows the Desk-Top unit from DEST, Inc. See page 8.


# NEXT MONTH

**DIGITIZING TABLETS**
Inputting without a keyboard isn't new but technological changes have been making it better.

**CASSETTE-TO-CASSETTE INTERFACE**
This simple construction project will take the drudgery out of tape copying for you.

**DELUXING THE RADIO SHACK COLOR COMPUTER**
Making your low-cost unit perform like a top-dollar investment.

# EDITORIAL

## *Language: A tool for communication.*

■There's an old saying among writers, "Write to *express* not to *impress*." One of the first things that technical writers learn, is that the first time you use a new technical term, you explain it. If you aren't communicating, no matter how well-written the piece may be, it's worthless.

We who are involved with computers are often guilty of the same kind of sin. We know what we mean, we know what we want to say, but we sometimes forget who it is that we're talking to. And if we use words, terms or expressions that our listeners do not understand, we are not communicating.

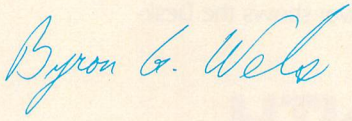
These "special words" that are indigenous to a specific field, are called "jargon." And they exist in every trade there is. Among the practicioners of that trade, the words are well understood, but to an outsider, they might as well be a complex foreign language.

While they form a sort of "spoken shorthand" to people within a given field, they only serve to confuse those who are neophytes. If you're out to impress people with your knowledge, you can sprinkle jargon into everything you say and when you see the utter confusion on their faces, you can mentally pat yourself on the back and remind yourself about how positively *brilliant* you are!

But rest assured that there are others—many others—who know a good deal more about computers than you do, and are capable of leaving you confused as well.

How much better to make certain that what you say is understood by everybody present. For one thing, it's only polite. For another, you'll be communicating. And if you really have something to say, it will be understood and appreciated by all. Those who are truly secure in their own knowledge don't feel that they have to impress anybody.

So of course, they make a much better impression!



Byron G. Wels
Editor

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# LETTERS

### Out Of Warranty

After I hit the necessary break-in mileage on my car, I finally got to floor the accelerator and see what it could do. Now, finally, my computer has passed the warranty date. Does this mean that at last I can open 'er up and start modifying some of the innards without having to worry?—Tony Richards, Corpus Christi, TX.

*It's not the same thing at all, Tony. Up until that warranty point, should anything have gone wrong, you could have brought your computer back for factory service—provided you had not opened it up. Now that the date has passed, anything that goes wrong, either with or without your help, is on your own shoulders and pocketbook. Good luck.*

### Glitch!

In the April, 1985 Issue of **ComputerDigest** there appear to be some mistakes in the program for "Resonant Circuit Design." One error was corrected by changing line 420 as follows:

420
T = SQR((Z*((9*D) + (10*G)))/D)
was published.

420
T = SQR((Z*((9*D) + (10*G)))/D/D)
is correct.

Also, line 100 should end with a quotation mark (") like line 90, and in line 140 the semicolon after CLS should be a colon. There should be a space between GOTO and 90. In line 220, delete the comma. And while line 450 is not *wrong*, I would recommend a space between the first quote-mark and the word IS.

After making these changes, the program ran quite well.—Jack Ivers, Westwood, MA.

*Thank you Jack. We've received a few calls and letters on that one, and your information certainly helped. We really appreciate it.*

### Dear Abie?

My girl friend left me for another guy who is loaded with money, and I can't get her out of my mind. What can I do?—Ken Harwood, Hilo, HI.

*Ken, I think you must have written TWO letters and put them in the wrong envelopes. I'm really curious to see how "Dear Abie" answers the one intended for us!*

### Computer Operator?

What exactly constitutes a "computer operator?" Granted, the guy who can write his own software and run it is a computer operator. But if this is true, how about the man who *buys* ready-to-use software and just runs it on his home computer? Isn't he an "operator?" What started all this was a friend who just bought a new car with a computer control in it, and now he's telling everybody he's a computer operator.—Frank Spevins, New York, NY.

*It seems to be a matter of degree Frank. But be tolerant. If this makes him happy, go along with it. It doesn't hurt anything, does it?*

# COMPUTER PRODUCTS

## For more details use the free information card inside the back cover

**SCHEMATIC DESIGNER SYSTEM,** the *DASH-2,* is designed for engineers using the IBM PC/XT or AT, adding a new coordinated set of enhanced, mouse-driven editing features.

*DASH-2* capabilities include:

*Tag and drag,* which enables the user to pick a symbol, a drawing area, or alphanumeric field and drag the targeted selection across the screen while maintaining connections.

*Snap,* which allows the user, when drawing a circuit connection, to position the cursor in the vicinity of a pin, "snapping" the connection in place. In the snap mode, when the cursor is inside a symbol cell, a pin cursor appears on the closest pin. The pin cursor jumps from pin to pin as the cursor is moved to locate the desired contact pin.

CIRCLE 21 ON FREE INFORMATION CARD

*Area definition, using mouse,* whereby the mouse is used to locate any two opposite corners of the desired area. The area boundary is displayed in "real time."

The *DASH-2* add-on package (model *D2-MAP-PC)* for the IBM PC is priced at $5,980, with the complete *DASH-2* system (model *D2-545-PC),* including the IBM PC and printer, selling for $9,980. *DASH-2* for the IBM XT (model *D2-MAP-XT)* is priced at $6280, add-on-package, and $12,980 for the complete system (model *D2-SYS-XT).—FutureNet Corporation,* 6709 Independence Ave., Canoga Park, CA 91303-2997.

**VIDEO DISPLAY TERMINAL,** the model *ADM 12plus,* is a smart editing terminal useful for word-processing, financial spreadsheets, and other specialized applications. The block mode terminal is compatible with the Tele-

video 925, 950, 912, and 920 terminals, and the Lear Siegler ADM 2, ADM 12, and the ADM 31.

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The terminal features programmable cursor keys for word-processing programs such as WordStar, a variable-format display memory, variable-speed vertical and horizontal scrolling. The model *ADM 12plus* provides two pages of 80/132-column by 24-line display memory (plus 25th status line), or a choice of wide and long page-memory configurations. A four-page memory option is also available to double the standard memory formats and add a 158-column by 48-line "Super Page" display-memory format.

The model *ADM 12plus* is priced at $745.00.—*Lear Siegler, Inc./Data Products Division,* 901 East Ball Road, Anaheim, CA 91805.

**SPEECH SYNTHESIZER,** the *Voice Master* for the Commodore 64, the Apple II, II+, and IIe (shown), is three products in one: a speech synthesizer, voice-recognition system, and music machine.

**CIRCLE 23 ON FREE INFORMATION CARD**

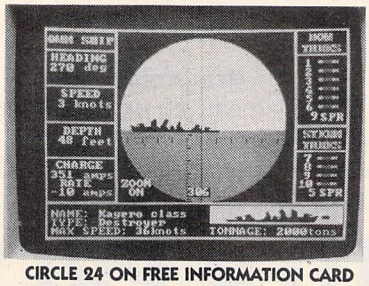
The *Voice Master* speaks clearly in your own voice, in any language, and with any accent. It is basically a digital tape recorder. To record speech, the user uses the command LEARN and speaks into the microphone what he or she wants the computer to say. To play back, the SPEAK command is used. Up to 64 different words, phrases, or other sounds can be in memory at one time, and entire vocabularies can be stored and loaded from disk.

To use the speech-recognition feature, the user stores the words or phrases to be recognized, using the RECOGNIZE command. Voice commands can be used to change letter keys to cursor keys and control cursor speed with voice pitch -- faster and easier than using a mouse or joystick. Other applications include voice-activated padlocks, telephone dialers, and aids for the physically handicapped.

To use the voice harp, the user can compose and perform music in real time by humming or whistling. The user's voice or whistle pitch will write the notes—including duration and rests.

The *Voice Master* for the Commodore 64 (specify disk or tape) is priced at $89.95; for the Apple II, II+, or IIe, the price is $119.95. The *Sound Master* only, with demo disk and 32-page manual, is available for $39.95.—*Covox, Inc.,* 675-D Conger Street, Eugene, OR 97402.

**EDUCATIONAL GAME,** *Torpedo Run,* is a simulation which presents eight historical World War II submarine missions in which the player sub confronts enemy surface vessels in the same sequence as actually occurred.

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Players can compare their performances against that of the U.S. sub in those historic naval engagements.

*Torpedo Run* puts the player in the role of captain of a diesel electric submarine operating in the South Pacific. The player is challenged to develop good judgment, strategy decisions, and battle tactics. Constant on-screen display monitors such variables as speed, heading, depth, and remaining power and torpedo supply, and provide immediate data on enemy vessels. Enemy surface patrols drop depth charges. Increasing speed for underwater maneuvering risks depletion of electrical power. Surfacing to recharge batteries opens sub to attack.

It is interesting to speculate on how the actual submarine commanders might do with this game could they reenact the original missions.

*Torpedo Run* has a suggested retail price of $39.95.—*Brainpower, Inc.,* 24009 Ventura Blvd., Calabasas, CA 91302.


**CIRCLE 25 ON FREE INFORMATION CARD**

**LANGUAGE SERIES,** *LINKWORD,* is available for all models of the Atari computer, as well as for the Commodore 64.The four programs in the series consist of Spanish, French, German, and Italian. *LINKWORD* uses a system based on imagery, linking foreign words to acoustically similar English words to provide an easy-to-remember visual association. Using both the computer program and the audio cassette, the student can expect to learn a basic 400-word vocabulary, plus grammar and pronunciation in about 10 hours. The suggested retail price of *LINKWORD* is $24.95 for each language.—*Artworx Software Company, Inc.,* 150 Main Street, Fairport, NY 14450.

**EXTENDER BOARD,** the model *3690-20,* has test points for all 86 bus lines adjacent to the card connector for fast troubleshooting. Each line is marked for convenient identification.

The 9.00-inch long by 9.75-inch wide board is fabricated of 0.0625-inch thick FR4 expoxy-glass laminate, clad with two-ounce copper-plated bus lines. Bus lines are protected by a thick solder-mask coating to prevent short circuits during testing.

Card-edge-connector contacts have a 10-micro-inch gold flashing over nickel plating, while receptacle contacts incorporate 30-micro-inch gold inlays. The model *3690-20* is priced at $50.70.—*Vector Electronic Company,* 12460 Gladstone Avenue, Sylmar, CA 91342.

**CIRCLE 26 ON FREE INFORMATION CARD**

# SOFTWARE REVIEW

## *Dysan's "Interrogator."*

■A floppy disk drive is a precision device. Everything, from the rotational speed of the floppy disk—called the "Spindle Speed"—to the tolerances of the mechanism that positions the read/write head is measured in minute increments, and everything must come together with the same relationships each time the drive is used. Whether it's the first access, the tenth or the ten-thousandth, the read/write head must take exactly the same position(s) every time.

Insignificant variations in the speed of the disk or positioning of the read/write head can prevent a drive from reading disk files written earlier in the year, or files written by the computer at the next desk: It's the reason why disk files written by your office PC won't read on your home PCjr, and vice versa.

To insure that any drive can read the disks written by any other drive, floppy disk drives must be maintained within a narrow range of tolerance limits. Variations from these tolerances are termed *misalignment.*

Unfortunately, ordinary misalignment read/write problems which can be rectified by a moderately-priced alignment usually appear to the non-technical user as a computer malfunction or as a glitched disk, and many a dollar has been wasted on phantom computer repairs, just as many a perfectly good disk has been glitched attempting to "repair" or "recover" from a non-existent glitch. Yet all these problems and hassles can be easily eliminated in less than a minute by using a software package called *Interrogator* to evaluate a PC's disk drives.

*Interrogator*, which is produced by Dysan, the same company that manufactures high quality disks and the special test disks used by disk drive manufacturers and service technicians, consists of two 5¼ inch disks and an instruction manual. One disk contains a self-booting, menu-driven control program, the other disk is Dysan's Digital Diagnostic Disk (called a DDD), the same test disk used by disk manufacturers and service technicians. Together, they can evaluate the floppy drives of an IBM PC, XT or PC Portable, and can uncover potential disk drive problems before they begin to seriously affect writing and reading of the disk files.

To use *Interrogator* you simply load the self-booting control program and then replace the control program disk with the DDD disk. The DDD, which runs under control of the menu driven software, contains several test functions for such things as the spindle speed, alignment and positioning of the read/write head, and actual reading of test writes. Since most of the checks and tests are intended for the service technician they are run as individual tests and the results are displayed graphically in a form understood by technicians, or by someone with an idea of how a disk drive works. For the layman there is a menu selection called *Auto Sequence Tests* that automatically steps the drive through the tests, displaying the test results in layman's rather than technical terms, also indicating by a single phrase whether the drive has passed or failed the tests (whether the drive is within predetermined tolerance limits). Any test result that does not fall within the range of the preset tolerance limits is highlighted so the user knows what test has failed.

The screen displays of the *Auto Sequence Tests* for each drive can be printed for side-by-side comparisons or for future reference. *Interrogator* even permits the user to type a short comment at the bottom of each display prior to printing.

At each step of the test selection and printing the user responds directly to on-screen prompts using only the function keys. It takes no technical skill, knowledge or even experience with a computer to use *Interrogator.*

The documentation works on two levels. It covers the layman's tests and what they represent, then progresses through an easily-understood discussion of a disk drive's parameters, and finally covers the use and interpretation of the technician-oriented checks.

A menu driven PROGRAM SETUP allows the user to change the default conditions of the disk drive's track-seek time, head-settle time, read/write retries, and the total sides tested: the *Auto* sequence tolerance limits: the program parameters (monochrome or color and sound on or off): and to create backup disks with user-determined setup values and parameters. As initially supplied, *Interrogator* is configured for a monochrome monitor, and while the color display is most decorative, it serves no functional purpose. Similarly, while it might appear there is some need to change the tolerance limits, the average user would have no reason to do so. While it's possible a disk-service technician might have some reason to change the tolerance limits, they are best left as they are. Although the use of *Interrogator* almost insures the compatibility of disk files between several IBM personal computers, it is also surprisingly effective at detecting the cause of intermittent read and write failures. For example, the computer on which this review was written has had a recent problem with intermittent reads and writes from the B: drive. *Interrogator* disclosed that the drive was sluggish and out of tolerance when the computer was first turned on, but after several disk operations—what is called "exercising the drive"—the drive "pulled in." Knowing what was wrong, by exercising the B: drive until *Interrogator* showed all parameters to be within the accepted tolerance range, it was possible to avoid defective reads and writes until the computer could be freed for overhaul of the disk drives. Considering that the *Auto* mode runs a complete check in nominally 20 seconds, one could not ask for a more convenient way to check the system. —Dysan Corp., 5201 Patrick Henry Drive, Santa Clara, CA 95050.◀◍▶

# OPTICAL CHARACTER RECOGNITION

*There are other ways to input than the keyboard—easier ways.*

**MARC STERN**

■If there's one thing you learn when you buy a microcomputer, it's this: the keyboard is a great input device, but sometimes you'll wish it were better. You usually realize this when you find a fantastic program which must be laboriously entered line-by-line from the keyboard.

### Relief at hand

The need for alternative input methods is strong and the market points this out. At the moment, you can find digital pen tablets and bar code readers, as well as keyboards available for data input. Each offers its own advantages and, its drawbacks.

The bar code reader can accept input from Universal Product Code strips, but can't recognize handprinted or written data. Which brings us to an input alternative that can save you hours at the keyboard, the optical character recognition device.

### The OCR

These can range from simple wand-like instruments that you draw across a typed or printed line, to sophisticated standalone devices which will read many typestyles and increase the versatility of any small-computer system. In fact, the key difference between the wand and the larger device is that the wand can recognize far fewer typestyles.

One of the most sophisticated units on the market—perhaps the most sophisticated—is manufactured by DEST Corp. of Milpitas, CA. DEST is one of the leaders in optical character recognition technology (OCR) and it offers this functionality in its WorkLess Station.

Looking like a standard office copying machine, the compact DEST device works automatically; recognizes over 100 characters from at least 10 typestyles, and inserts formatting codes for word processing programs. (See Fig. 1)

### Shrinking technology

If you've been involved with computers for more than a couple of years, you've probably run across OCR readers. Typically, they were big units, standing as much as three or more feet tall. That has changed.

For example, there's an OCR device made by Oberon which looks like a secretary's copying stand. It holds a piece of paper and you move the OCR head across the line of type. Then, there's the WorkLess Station, which occupies the desk space of a microcomputer system. That the manufacturers have been able to achieve these size reductions is due to very large-scale integration technology which has taken the functions once handled by many computer boards and has put those functions on integrated circuit chips.

STANDARD SPECIAL CHARACTERS

! @ # $ % ¢ & * ( ) + " ' : ; - = , . ? /

ADDITIONAL CHARACTERS RECOGNIZED BY WORKLESS STATION

§ ¶ ° [ ] £ ± ® © ™ † > < | ¼ ½

**FIG. 1—THE DEST WORKLESS STATION is an example of today's advanced OCR technology. It is capable of recognizing about 10 typefaces, which cover the majority of typestyles used commercially. Because of this, it can accept a wide variety of printed input.**

Further, these devices are smarter. In today's desktop, microprocessor-driven OCR device a 2,048-element linear photodiode array can recognize almost any typeface used commercially. This contrasts with older OCR devices which were limited to specially designed "computer" typefaces—Courier 10 and 12.

(In a recent test, in fact, a DEST unit recognized a typeface which it wasn't supposed to be able to recognize. The specifications on this unit, in fact, seem conservative. Although the company claims it will recognize 10 or so typefaces, chances are it will recognize many more.)

### Intelligent character recognition

Now that we've established that OCR is a vital input technology, it's interesting to see how a typical system works.

For starters, this system is driven by an eight-bit microprocessor (MPU) unit —DEST uses an 8085. The MPU controls the entire device.

Take a look at Fig. 2 and you'll see—in block form—how the system works. The photodiode array sends its information to a video unit, which digitizes the input and which, in turn, sends it to a control unit and on to the isolation unit where the MPU is housed. The isolation unit is connected to an optional format unit, which takes the raw, digitized output and formats it into word-processor-compatible text output. It also sends the formatted data to the host computer system. If a character isn't recognized immediately, recognition, correlator and typestyle extender modules are brought into play.

In essence, that's the entire system, but, it's a good idea to explore its operation in detail so you'll have a better idea of how OCR technology works.

When the system operator first inserts a sheet of printed material into the OCR unit, it is scanned by a lamp which illuminates a mirror and lens and focuses the line on the photodiode array. The array receives a focused, one-pixel high reflection and each diode detects the amount of light corresponding to one pixel. The diodes turn this information into a series of voltages representing the data and these analog signals

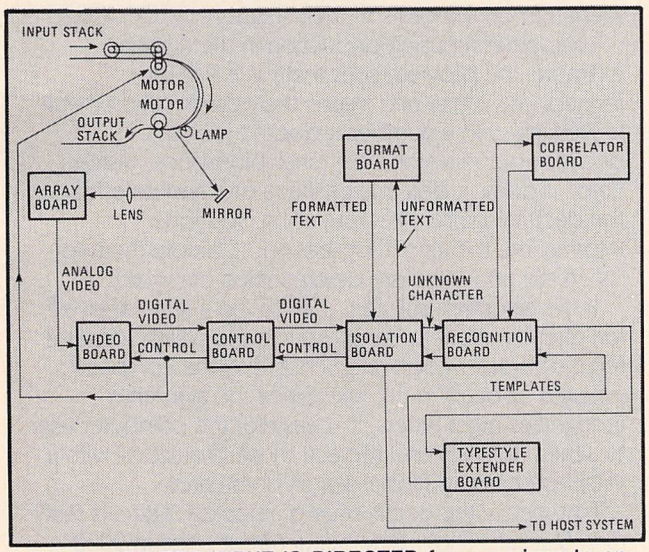


**FIG. 2—PRINTED INPUT IS DIRECTED from a mirror to an array module which turns the pixel-high scan lines into their analog equivalents. From there, it is processed by a video board and sent through a controller module to the isolation module. The isolation module filters input and directs the digitized character flow to the recognition module and correlator board. These are the essential pieces of the OCR picture, although some units add optional format and extended typestyle modules.**

are sent to the video module, where each pixel is digitized. (See Fig. 3)

That digitization determines whether the pixel is black or white and the information—similar to the image digitization in a facsimile machine—is sent through the control module to the isolation module where the image is stored in the unit's random access memory.

The isolation module is the heart of the unit. It usually contains the MPU, as well as a DMA controller. The rest of the circuitry contains serial to parallel conversion logic; 32K of read-only memory-based (ROM) character isolation routines; 32K of RAM, and a universal synchronous-asynchronous receiver/transmitter (USART) to communicate with the host computer system.

(The last feature makes this device system independent. It can be used with any small-computer system on the market that employs and RS-232C serial communications interface. Further, it can be immediately interfaced with that system, rather than requiring special interface cards or configuration routines. You can see the value of a universal type of input device.)

In operation, the isolation module of a typical OCR device isolates each character on a background frame. Some systems use a 24 by 32 pixel frame, which gives the system enough character definition to work with.

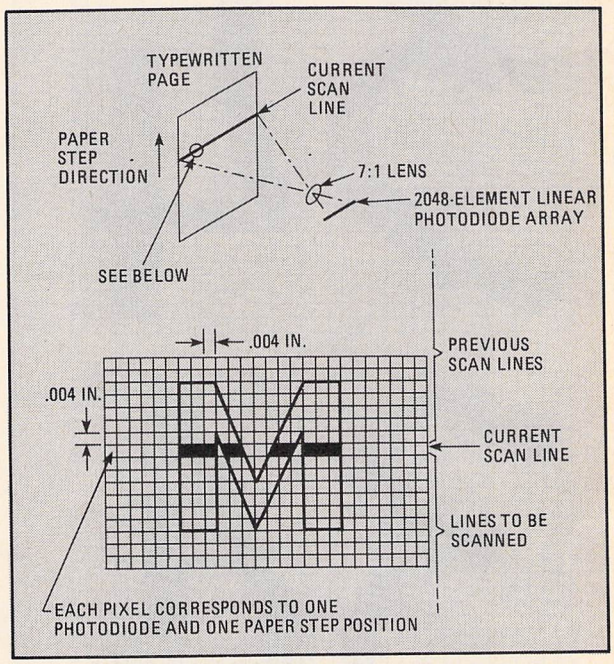


**FIG. 3—USING A 2,048-ELEMENT linear photodiode array, an advanced OCR unit creates a series of one-pixel scan lines. The diode array detects the light. Each character occupies a 24 × 32 pixel matrix.**

This type of definition is also great enough to compensate for skewed or bowed lines, close or touching characters or underlines.

When the system is finished isolating the particular character, it is sent to the recognition module, which, in conjunction with the correlator module, compares the characters to those stored in ROM. The recognition module contains RAM to store the still-unknown character and it contains a ROM-based recognition routine for the character identification. When the text is identified, it is sent to the computer in page form, using the RS-232C port. A format module can set this information up for a specific word-processing program if it is commanded to.

## Character recognition

The heart of today's OCR device is the typestyle recognition routine stored in ROM. This can be permanent ROM or erasable programmable read-only memory (EPROM).

In general, these routines are generic and are capable of recognizing a wide variety of typefaces from many manufacturers. (See Fig. 4.) There are some limited OCR systems which require typeface-specific ROM for the device to work correctly, but today's sophisticated devices are capable of recognizing a great range. For example, the DEST system can recognize about 10 generic typestyles, which cover about 95 percent of the typefaces used today.

The typical advanced OCR system today uses a character-recognition system that is as much a filter as it

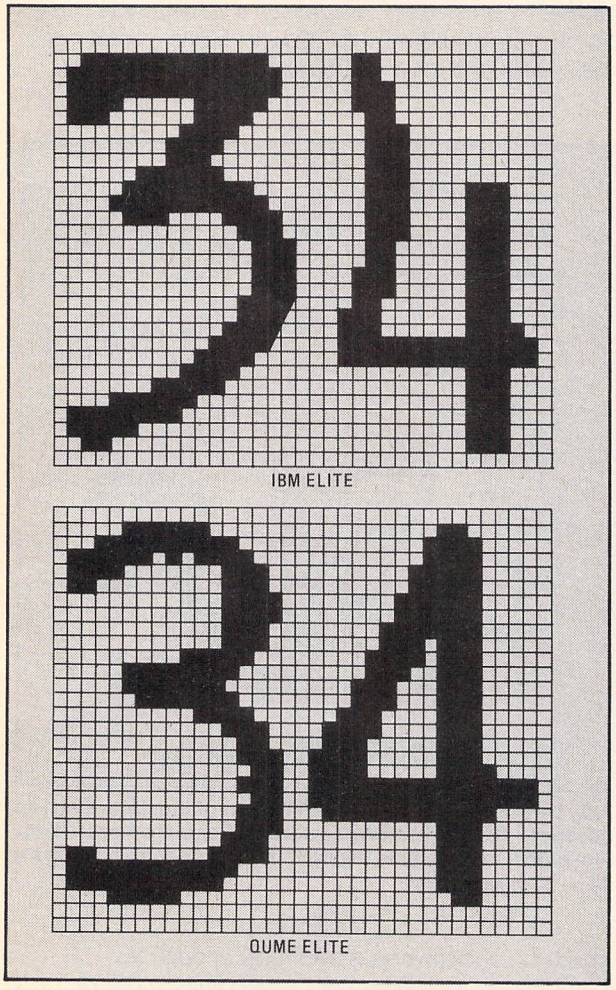


**FIG. 4—THE CHARACTER-RECOGNITION ALGORITHMS in an advanced OCR device, such as that made by DEST, is generic. This means it is capable of recognizing a wide variety of typestyles from various manufacturers.**

is a character-identifier. The algorithm used for character recognition also accommodates such things as ink splatter, copier specks and stroke-width variations. In this mode, it acts as a filter to take extraneous "noise" out of the picture. For example, let's say you are attempting to read a document loaded with copier specks. The device's programming makes allowance by filtering out any speck that is smaller than the dot on an i. The filtering action also normalizes any letter stroke abnormalities.

The character-recognition routine is actually a matrix-type matching algorithm, a system such as that employed by DEST matches unknown characters with those stored in ROM templates. And, if the system fails to achieve a good match, the character is rejected until the best known-to-unknown character match is achieved. Interestingly, the program algorithm also has the capability of dealing with a duplicate match situation. If an unknown letter falls best not only under one A template in the program's memory, but that it also fits under another A category. In this situation, the algorithm determines which is the better fit and recognizes that letter.

But if the system still can't determine what letter a character is supposed to represent, the algorithm has a fail-safe built in, a context resolution system which it uses to distinguish among characters of similar shape.

For example, with some typefaces the digit 1 and the letter "l" and the digit 0 and letter "O" are almost indistinguishable.

In this situation, the program takes advantage of artificial intelligence techniques and resorts to deduction. Look at the price $35.10 and the word still. In each case, there are characters that just can't be identified on the basis of their shape -- 0, "O", 1, "l."

Like someone using deduction in the numeric example, the program sees there is a 5 in the immediate vicinity and makes the determination that it is working with a number. It doesn't look at the decimal, but relies on positional information, instead. Since it does, it determines that a one and zero follow the decimal point. Likewise, using positional information, the algorithm sees an "i" before the two "ls" in still and therefore determines it is a word.

If the algorithm still can't determine a letter after all the filtering, the microprocessor in the system issues a reject-character code and sends it to the computer where it appears in the text. Since the algorithm recognizes most letters, it is easy for the computer user to search through and replace those characters with a word-processor's global search command.

Fortunately the occurrence of rejected letters is fairly rare. Statistics show they occur about once in 2000 characters. Further, those characters which might slip through the cracks in the recognition algorithm and which might turn up as incorrect letters are even more rare, on the order of once in 20,000 to 30,000 characters.

## Special cases

Today's advanced OCR has a feature that earlier systems lacked, the ability to recognize an extended character set. For example, earlier and more limited systems usually can recognize 80 to 90 characters at a maximum. However, today's advanced system can recognize 100 or more.

Today's OCR device can now be used by the microcomputer user and it will be a welcomed addition, indeed.◀Φ▶

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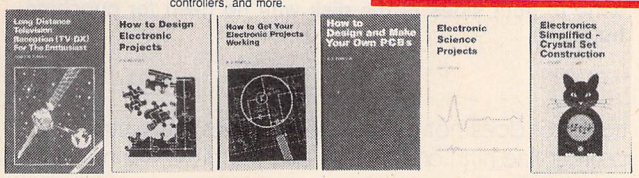


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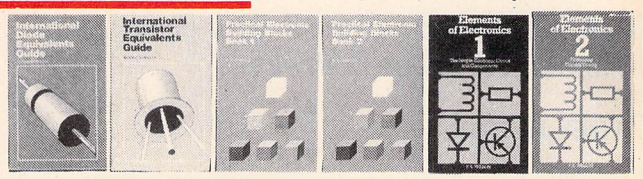


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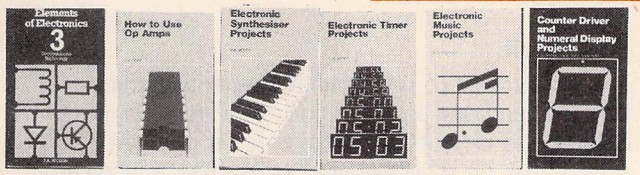


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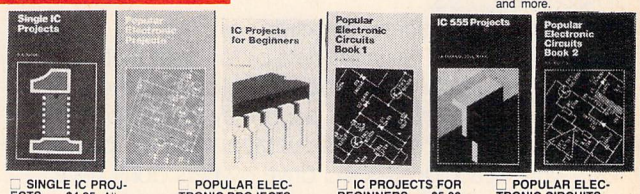


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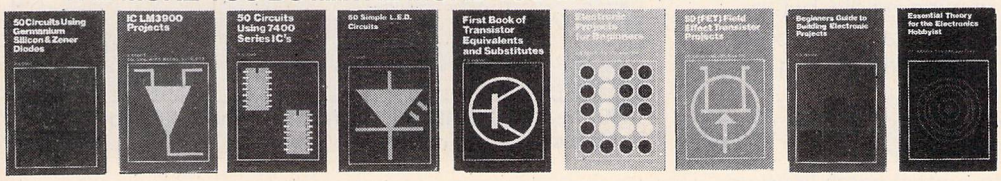


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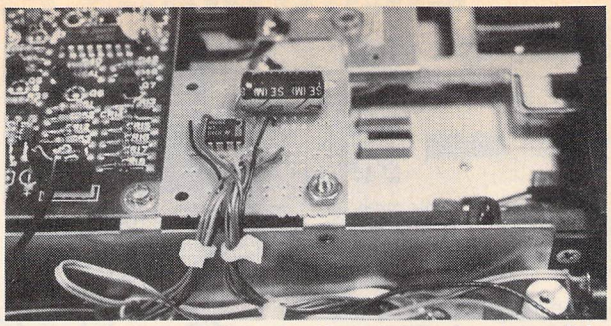
# WRITE-PROTECT NOTCH BY-PASS

*You paid for both sides of your disks. Here's how to use both sides.*

**NOEL NYMAN**



**SMALL CIRCUIT BOARD with IC, switch and resistor all in place illustrates the simplicity of this circuit. It allows you to write to both sides of the disk with no need for punching holes.**

■If you own a single-sided floppy disk drive, you may have read that the opposite side of your diskettes can also be used to store data and programs. During manufacturing, all disks are tested for data recording integrity on both sides. Those not meeting manufacturer's standards on one side are packaged as single-sided disks.

Using the uncertified "backside" of disks isn't recommended for valuable data or for disks that will be read frequently. When you flip a disk over, the cleaning material inside the jacket may release particles of dust and oxide to the disk surface and corrupt your read/write head. Dual-sided drive owners don't have this problem: their disks turn in one direction only. However, many computer owners use this technique for archival or back-up disks which are read infrequently.

To write on a disk, the write-protect notch must be uncovered. On a single-sided disk, there is no write-protect notch for the back. Special punches are available that will cut a neat, square notch. Most users prefer to use a conductor's punch or a scissors. Using any of those methods may damage the disk jacket or warp the disk itself.

## How it works

Here's how to modify your drive to electronically bypass the write-protect circuitry. We'll use the Commodore 1541 disk drive in our example, but the same idea should be adaptable to Atari drives or any other disk drive that doesn't use the small timing hole near the disk's center.

In most disk drives, the write-protect notch is sensed optically. An LED is mounted opposite a phototransistor with the write-protect notch lined up between them when the disk is inserted. If the notch is uncovered, the light from the LED causes the phototransistor to conduct.

On the Commodore 1541, this brings the write-protect line low (ground potential or near zero volts) and signals the drive circuitry that the disk can be written to.

If a write-protect tab is in place, or there is no notch on the jacket, the light path is blocked and the transistor does not conduct. This leaves the write-protect line high on the 1541 and the drive will not write to the disk.

To bypass the circuit, hold the write-protect line low by shunting the phototransistor with a resistor. This is easy in most drives since the phototransistor is mounted on the drive mechanism and the leads from it plug into the circuit board. No changes are required on the circuit board itself.

## Be careful!

You may want to wait until the warranty expires before attempting any modification. If possible, obtain a schematic of your drive from a dealer or repair service. The drive circuits use CMOS chips which can be damaged by improper handling. Use normal CMOS precautions when working around the circuit board.

First unplug all cables, then remove the top cover from the Commodore 1541 by loosening the four mounting screws accessed through holes in the bottom cover. Remove the metal shield that covers the circuit board. Two screws on the left side secure the shield.

Look for the largest plug, labelled "P6" on most boards. It is a 15-pin plug but only a few wires are connected. Counting from the back of the drive, locate pins 12 and 13. These are the wires coming from the phototransistor.

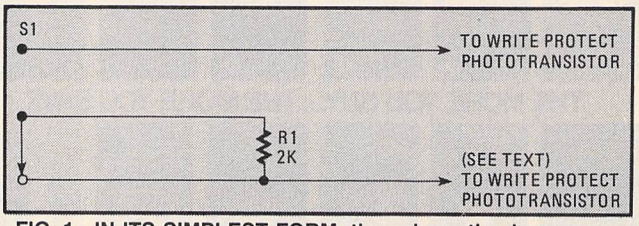



**FIG. 1—IN ITS SIMPLEST FORM, the schematic above uses only a switch and resistor.**

To make sure you have the right wires, carefully bare the insulation near the plug and connect a voltmeter or logic probe to them. Pin 13 is the negative or ground side. Plug in the power cord and turn on the drive. Be careful not to touch the circuit board while the power cord is connected. The voltmeter should read near zero volts.

Put a disk part-way into the drive so the write-

protect area is blocked. The voltage should increase to almost three volts, a TTL logic one or high. If you get these readings, you have the proper wires.

Figure 1 is a diagram for installing a switch and resistor to bypass the phototransistor. A 2K resistor (R1) worked on the drives we tested, but you may have to try values between 1K and 2K to get reliable operation. Do not simply short the two wires together, as this might damage the phototransistor or other circuit components. If you mount the resistor directly to the switch, no separate circuit board or stand-offs will be required to hold it.

### Additional circuitry

Although this simple modification will allow you to write to the uncertified side of the disk without punching notches in it, we recommend the circuit shown in Figure 2. This will flash the green "Power On" LED whenever the write-protect bypass switch is turned on.

We used the LM3909 (IC1) because it provides a bright LED flash at low voltage. This lets us use the 2 volts available at the green LED's plug directly with no

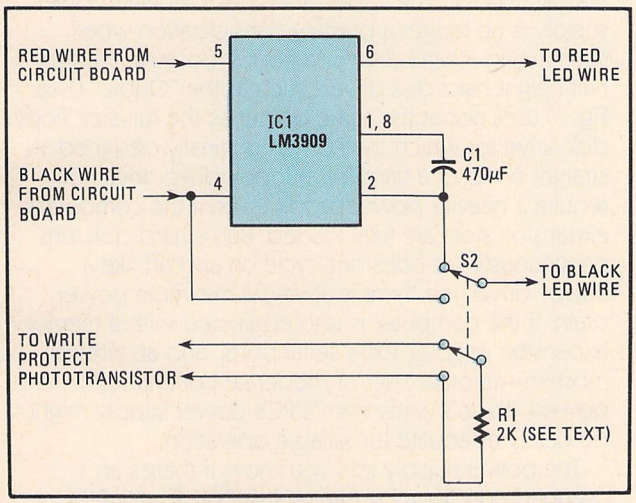



**FIG. 2—MORE ELABORATE CIRCUIT is still not complicated, but accomplishes a great deal more. Resistor R1 might have to be changed. See text.**

changes on the drive circuit board. Cut the red and black wires going to the green LED and connect them as shown in the schematic. You may want to use plugs and sockets to connect the circuit to the drive so you can remove it if you need to have your drive serviced.

Any double-pole, double-throw switch will work, but select one that will fit into the case past the drive chassis before you start punching holes. The switch we used is a miniature toggle that can be located almost anyplace. A slide switch might have been more compact, but would have required additional holes. The circuit board we used fits nicely in front of the "short" circuit board used in the newer 1541 drives and can be bolted to the unused circuit board mounting tab.

Once the switch and LED flasher are in place, test by trying to SAVE a program to a disk with a covered write-protect notch. With the switch in the on position, the green LED should flash and the program will SAVE to the disk.

### Avoid confusion

You should turn the switch on only when you SAVE to or format a disk with no notch. If the switch is left on, your drive can get very confused and give you strange errors. To illustrate this, turn the write-protect switch off, put a disk with an uncovered notch in the drive, and type the following in direct mode (Commodore only):

OPEN2,8,2,"X,S,W"

This tells the drive that we're about to write information to a sequential file we've called "X." The red LED should come on and stay on, indicating that a data channel is open to the drive. Now remove the disk from the drive. The red LED will go out. The drive "knows" that you've removed the disk and that the data

**PARTS LIST**

IC1—LM3909 LED Flasher
R1—2000 ohm, ¼ watt resistor
C1—470uF Electrolytic Capacitor
S1—SPDT Toggle Switch
S2—DPDT Toggle Switch
Circuit board, plugs and mounting hardware

channel shouldn't be held open.

Type: CLOSE2

To get rid of the open file in the computer, then try the same experiment with the write-protect switch on. This time, the red LED does *not* go out! The disk drive uses the high-to-low transition of the write-protect line as the back of the disk crosses the light path to tell that you've removed a disk. With the write-protect switch on, this line is held low and the drive doesn't see any change. If you change disks in this way, you will have difficulty LOADing files on the first try. More important, if you SAVE to the second disk, you may overwrite important data or programs because the drive will use the Block Availibility Map of the previous disk.

Properly used, the write-protect switch will give you access to the back of your disks without the need for expensive punches or danger of damage. It also gives you a measure of security since there's no telltale notch to indicate that anything has been recorded on the back.

Using the electronic circuits shown here, you can write to the back of the disk at your own volition; you'll find this a great convenience if you haven't had this facility before. It effectively doubles the capacity of your disks.

However, it's always a good idea to mark or number your disks so you'll know which disks are written on both sides, and what information is contained on the backs. A separate sheet or ledger can be maintained as a menu so you can quickly and easily locate the information you require at any given time. You might also want to carefully clip one corner of the disk envelope so you can easily tap out any collection of oxides and/or debris that might accumulate in the envelope and possibly foul your heads.◀CD▶

# ADDING A HARD DISK DRIVE

*Here's how to add that hard disk drive you've always wanted.*

**HERB FRIEDMAN**

■As software for personal computers gets more complex, programs require greater storage capacity for the program and related data. Even the two-sided disk is hard-pressed to hold a complete program; the PC-DOS version of *WordStar* and its spelling checker, *CorrectStar* can't fit on one disk: They require two disks, and become a pain to run from conventional floppy disk drives.

The easiest, most cost-effective way to increase storage capacity for an IBM and some IBM-compatible personal computers is to retrofit the PC with a hard disk drive having at least 10 megabyte capacity. Although the hardware for 10MB of storage can cost you anywhere from a shade under $800 to the price of a used car, higher cost equipment doesn't always make the system better: It often just makes it more expensive. (While hard disk systems of 15, 20 and even 30MB are available, their cost and capacity are often beyond what's needed by the average technician, so we'll restrict our comments to the 10MB equipment.)

### Three kinds of installation

There are three ways to add a hard disk drive to a PC: 1) *Internally*—the hard disk drive replaces the computer's floppy B: drive: 2) *Externally*—the hard drive is in an external cabinet with its own power supply and the PC retains both of its floppy disk drives: 3) *Expansion-External*—the external hard disk unit also has expansion slots for accessory adapters such as Asynchronous Communications and Parallel Printer Adapters.

As you might surmise, the least expensive hard disk retrofit is a straight internal replacement, while the most expensive is the expansion-external because it's going to have much of the same hardware as the original computer.

At the minimum you will need the hard disk drive and a hard disk controller, which is an adapter card that plugs into the computer, or the expansion unit. Although the hard disk drive and controller is the rock-bottom minimum configuration, the controller requires its own "long" expansion slot, which means the minimum PC configuration requires a floppy disk controller, a hard disk controller, and at least a monochrome or color monitor card: That's three slots out of a maximum of five before you add any other adapters. A multi-function card and an internal modem will fill the computer.

### The internal hard disk drive

An internal hard disk drive replaces the computer's floppy B: drive. The capacity of a PC's 63 watt power supply is no longer a primary consideration when substituting a hard disk for a floppy because the new half-height hard disk drives, such as the "Qubie" (See Fig. 1) uses about the same power as the full-size flopy disk drive for which the PC was originally designed. A straight swap of a hard for a floppy drive does not require a heavier power supply even if the computer's expansion slots are fully loaded. But, a hard disk runs continuously—it does not cycle on and off like a floppy drive—so there is always a minimum power drain. If the computer is also equipped with a memory expansion adapter, extra serial ports, and an internal modem—another user of moderate continuous power—the 63 watts from a PC's power supply might be barely adequate for reliable operation.

The power supply let's you know if there's an overload condition by turning itself off. If your PC's power supply can't accommodate the extra continuous load of a hard disk, the least-expensive way to provide extra power capacity is through an auxiliary power

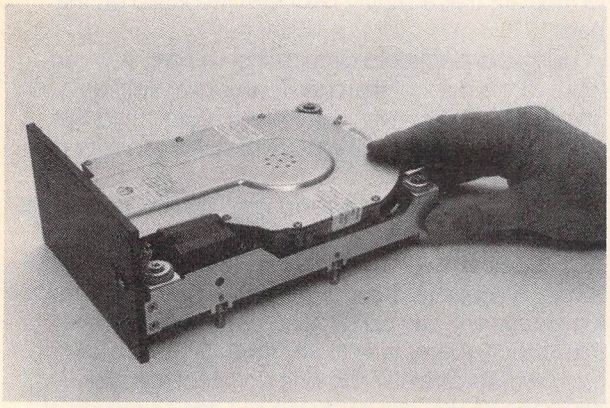


**FIG. 1—MOST RETROFIT HALF-HEIGHT hard disk drives come with a full size front panel so the drive can directly replace a full size floppy disk drive.**

**FIG. 2—TO INSTALL THE HARD DISK simply unplug the cables from the floppy B: drive, remove the two screws that secure the drive and slide the floppy drive out of the cabinet, replacing it with the half-height hard disk.**

supply for the hard disk drive that piggybacks on the rear apron. Qubie', and several other suppliers of hard disk units, sell "piggyback" power supplies specifically designed for retrofit hard disk drives. While you could just as easily replace the PC's power supply with a 130 watt unit, the piggyback supply is all you need, and it's about half the cost of a 130 watt retrofit or replacement power supply. (See Fig. 2.)

**The external hard disk drive.**

Although internal hard disks are relatively inexpensive and convenient to install—the hardware simply plugs together—they are often more trouble than they're worth because you lose the floppy B: drive (unless you also replace the A: drive with two half-height floppy drives, in which case the overall cost is going to get out of hand). The problems caused by loss of the B: drive can often prove insurmountable because much software is specifically intended for a data disk on drive B:, or works between drives A: and B: and won't run from a hard disk. Also, if you leave your computer connected to a telephone line for remote access via a modem, you leave the files on your hard disk exposed to unauthorized use: Someone can easily issue a FORMAT command and erase the hard disk's files.

All such problems are avoided by using an external hard disk unit, which can be nothing more than the

**FIG. 3—IF YOU WANT AN EXTERNAL hard disk the drive can be installed in a conventional enclosure/power supply such as used for floppy drives.**

same drive used for the internal installation, but in a separate cabinet with its own power supply (See Fig. 3). The connections are generally the same ribbon cables used for internal hard disks, only now they are passed from the hard disk controller, out the back of the computer, into the external hard disk cabinet. Normally, the cabinet and power supply for an external drive adds anywhere from $200 to $300 to the cost of the hard disk unit. You could do the same thing by using a conventional $45 floppy disk cabinet/power supply from Software Support, Inc. (One Edgell Road, Framingham, MA 01701).

Although an external hard disk still requires a hard disk controller in the PC, you don't have to remove the B: drive, and more important, you can turn off the hard disk by turning off its external power supply. (On boot-up the PC's POST (Power On Self Test) automatically determines if the hard disk is available.) If you now leave the PC connected on-line to the telephone only the A: and B: drives can be accessed; it's as if the hard disk doesn't exist at all. If you need to allow on-line access to some hard disk files, copy them to a floppy disk before putting the computer on-line.

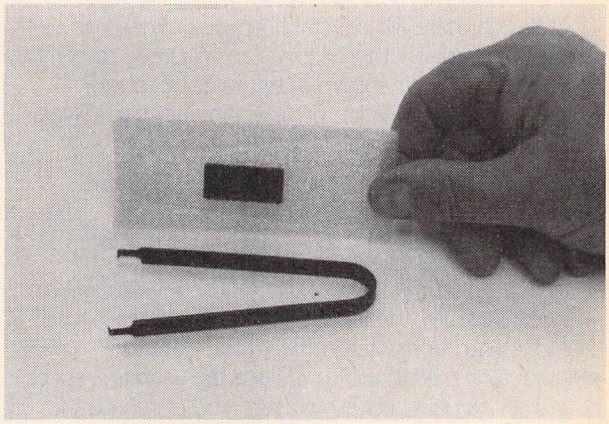


**FIG. 4—IBM's EXPANSION UNIT comes with a new BIOS ROM (on the conductive foam) and a removal tool which is used to extract the existing pre-March 1983 ROM.**

**External-expansion.**

Unless your budget can afford replacing your present floppy disk controller with one of the combination floppy/hard disk controller adapters, you must give up one more expansion slot, leaving a maximum of three for everything else including the monitor. If you require greater expansion capacity the best option is a device called an *Expansion Unit*, which contains a power supply, one or two hard disk drives, the hard disk's controller, a *Receiver Card*, and up to five open expansion slots. Let's explain the *Receiver Card*. Some sort of "communications system" system is required to exchange signals between the computer and the expansion unit. This is accomplished through an *Extender Card*—a "transmitter"—in one of the PC's expansion slots, and a *Receiver Card* in the expansion unit: A multi-conductor cable interconnects the two.

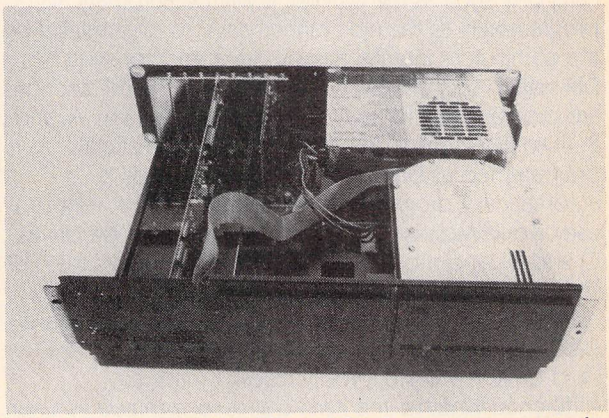


**FIG. 5—The expansion unit contains its own power supply, the controller, a Receiver Card, and one hard disk. An empty compartment (on the left) is provided for a second hard disk drive.**

The "communications circuit" permits some of the PC's adapters, such as Asynchronous Communication Adapters, Parallel Printer Adapters, a Prototype Card, a Game Control Adapter, and the Hard Disk Controller to be moved to the expansion unit. The Monchrome Display/Printer Adapter, memory expansion adapters and the floppy disk controller can not be moved to an expansion unit (unless the expansion unit provides DMA—Direct Memory Addressing) See Fig. 4.

Although there are several hard disk expansion units in the marketplace, the best value will prove to be the IBM Expansion unit shown in Figure 5, because it comes in a complete kit that even includes a ROM module and a special IC tool.

### Auto boot.

In order to access memory options of more than 544K and an Expansion Unit—to boot directly to a hard disk rather than Drive A:—an IBM PC requires a "late" BIOS ROM: the ROM installed in all PCs manufactured after March 1983. (The date of manufacture is attached to a cloth tag usually placed over the internal speaker wires.) If you purchase the IBM Expansion Unit the ROM is supplied in the kit along with a special tool used to remove the original ROM. (If you don't need the ROM you don't use it.) If you purchase a non-IBM Expansion Unit you don't get the ROM; instead, you usually get a software package containing a utility that allows the early model computer—usually called the PC-1—to recognize the hard disk after it boots from a floppy. Alternately, you could purchase an IBM ROM upgrade kit (under $30) so the PC-1 boots directly from the hard disk.

Unfortunately, as many users have learned the hard way, IBM has undocumented and proprietary features in their BIOS: If you want a guarantee that most future software will work both the new ROM and a fully PC-DOS 2.x IB—compatible hard disk expansion unit is suggested. For maximum convenience, a hard disk unit should permit the computer to boot directly from the hard disk without need for utility software.

### Programming the hard disk

If you use an IBM hard disk, or a fully IBM-compatible hard disk such as the Qubie', it will be automatically programmed as the next higher drive as determined by the computer's internal floppy drive selector switches: DIP switch sections SW1-7 and SW-8. If the DIP sections are programmed for two floppy drives—drives A: and B: —an IBM-compatible hard disk is automatically programmed as Drive C:; a second hard disk is automatically programmed as drive D:. If you want to use two RAMdisks (disk emulators) they will be drives C: and D:, and most RAMdisk software requires that DIP sections SW-7 and SW-8 be configured for four disk drives: two floppy and two RAMdisk; hence, the hard disk(s) will be automatically programmed as drive E: (and drive F:). While it really doesn't make any difference whether the hard disk is recognized as C: or E: (or anything else), some applications software which is intended for use on either a floppy or a hard disk specifically looks for the hard disk as drive C:. If your computer's DIP sections program the hard disk as drive E: the software will never locate the disk files.

IBM has built some very cute "tricks" into the POST which tells you a lot about the condition of the hard disk. If the hard disk in internal—if it's part of the PC—the POST automatically recognizes it as device 1801. If there are any problems with the installation the numerals 1801 will appear in the upper left corner of the screen at power up. If no numerals show the drive is most likely functioning correctly. External hard disks are automatically recognized as device 1701. The nice part about auto-recognition is that if you forget to turn on the external hard disk's power supply POST indicates a 1701 error on the screen, reminding you to turn on the hard disk and reboot. (you must reboot for the computer to recognize a change in device configuration.) On the other hand, if you want your hard disk turned off the 1701 display let's you know for certain that it's off. (See Fig. 6.)

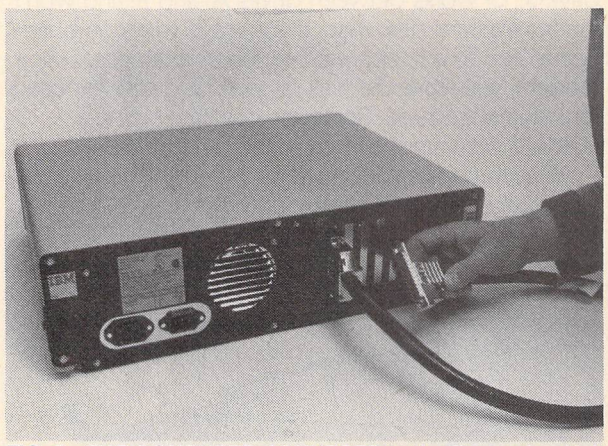


**FIG. 6—THE COMPUTER CONNECTS to the Expansion Unit through a somewhat bulky connecting cable. The Expansion Unit can be disconnected by simply "pulling the plug."**

If you install an internal hard disk retrofit and have any thoughts of eventually making it external make certain you have a BACKUP of everything on the hard disk because moving a hard disk into a new magnetic field—such as the power transformer of an external power supply—can glitch one or more tracks, sectors, or files. After you complete the external installation check both the DOS and your files for proper operation. If anything appears to have been glitched don't waste time trying to get it to work. Simply reformat the disk (which erases all data) and RESTORE the files from your BACKUPs; then avoid moving the hard disk unit because they are not as shock-resistant as the hard disk drives used for portable computers; shock and vibration can cause the head(s) to slam into the disk, damaging the magnetic surface and the recorded data. If you must move a hard disk unit, avoid the possibility of damage to the magnetic surface(s) by first *parking* the heads by running the *RELOCATION* program which is on the IBM DIAGNOSTICS that was supplied with your computer. The relocation program can be accessed as item No. 3 from the menu, or run the SHIPDISK.COM program on the diagnostics disk directly from PC-DOS.◀CD▶