

Self-focusing photodiodes, where to get an EPROM burned, how Apple software tells one machine from another

By Don Lancaster

Some questions are asked more than others. This month, we'll answer three of the more frequently asked questions. So, without further adieu, let's get right to it!

The first is the *Scan-A-Matic* S27301, shown in Fig. 1. This looks like a miniature TO-18 metal transistor, except it has four leads and a plastic dome. Down the middle of the plastic dome is a fiber-optic light pipe. Cost is around \$20.

Inside the package is an infrared light-emitting diode that shines through the entire plastic focusing dome, illuminating the object being sensed. The fiber-optic light pipe then transmits any reflected infrared light that it captures into the photodetector.

Operation is best when nearly touching whatever image you are scanning. A spacing of 10 mils or so gives you the highest resolution. One way to handle this is to put a clear and tough piece of plastic between the document and your scanner. This also protects the document from scuffing.

While fairly cheap and fun to use, the best resolution isn't quite good enough for serious scanning. In addition, certain inks will reflect infrared light nearly as good as white paper will, and some inks and ink colors just will not work at all.

Still, though, this is a great little device for such things as edge detection, robotics, sheet sensing, and stuff like this. It is also a cheap way to develop ideas and software, since the resolution can come later.

Our second self-scanner is the *Hewlett Packard* HEDS-1000, and is shown in Fig. 2. While not tiny and certainly not cheap at \$45, HEDS-1000 offers your usual HP high quality.

This dude is packaged in an oversize round 8-pin package, like were once used for op-amps and military ICs. Sockets remain available, but once again, not at jellybean pricing.

The HEDS-1000 uses visible light, which greatly eases color and ink hassles. Besides, you can actually see it in action.

A totally different imaging means is also used. Instead of a fiber-optic light pipe, the LED and photodetector sit side by side inside the case. Each is focused with a plastic lens to form a tight sensing spot with excellent resolution. The optimum focus point is some $\frac{3}{16}$ " from the case end. Usually, you will have a hollow plastic cap of some sort to hold this spacing for you. Something like a shortened penlight cap should work.

You can also get these as ready-to-use bar-code wands and readers at hoo-boy prices. Check into HP's *Optoelectronics Designers Catalog 1985* for details. Be sure to ask for a separate price list.

I've found a third source of self-focused photodetectors. But, judging from the stainless-steel case, the all-glass optics, and their snotty and elitist ads, the *Welch-Allyn* SS1D series products seem well beyond a hacker's budget.

There are zillions of possible new uses for sanely priced optically focused inputs to microcomputer. What new uses can you think of?

Where can I get an EPROM burned?

Any "old-line" electronics distributor will be happy to program an EPROM for you. All it takes is \$300, and either an exact working and debugged EPROM for them to copy, or else the code submitted on punched paper tape.

They will alternatively accept your duodecimal code written in cuniform on fired clay tablets. Provided, of course, that you sort them properly and then pack them with a 0.03 cubit spacing of papryus needs. Arrgh . . .

Probably the cheapest local way of getting an EPROM burned is to check your nearest hacker club, or leave a message on a regional electronic bulletin board. A complete list of most clubs and bulletin boards appears in *Computer Shopper*. Most clubs and bulletin boards have an up-to-date list of all the others in your neighborhood, so find one, and you have found them all.

I know of only one hacker EPROM burning service, and it is an excellent one.

It's called *E-Tech Services* out of Everett, Washington, and they do good work. For input, they want a hex image stored on a binary file on an Apple disk. Presumably, they will eventually have a direct modem burn process, as well as a way to convert whats-their-name diskettes as well.

Cost is unbelievably low, and varies with chip size—EPROM or theirs. Yes, they can handle anything up to the 27128 (16K × 8) EPROM you need for IIC monitor rework.

Where do I find a self-focusing photodetector?

There are very new uses for a combination lamp and photocell that focuses on a very small spot and sense black or white at that point. Naturally, these are essential for bar-code readers and product-identification code processing.

Above and beyond the totally obvious, you can put one of these into a plotter pen casing, and then use the plotter to scan artwork to "capture" it to computer files, either by tracing the image outline or by raster scanning it one line at a time. One obvious use of this is to copy a "cheat book" of typography fonts to capture complete large-type alphabets to disk with minimum fuss and bother.

Or, you can bolt a self-focusing scanner onto the side of the ribbon on a printer. This can give you a facsimile sending transmitter at a tiny fraction of the usual cost. The scanner converts white and black on the page into ones and zeros for your microcomputer. Once captured as a binary image on disk, you can send it over a modem to a stock printer anywhere in the world.

The really mind-blowing use of printed-document scanning is that you can capture the text message without having to hand key it! To do this, you scan the document into a bit-mapped image, and then use some elaborate machine-language software to figure out which characters go where. You will have the most luck if you teach your code a particular font first, and then stick with that font.

While considerably slower than a \$100,000 document reader, this approach

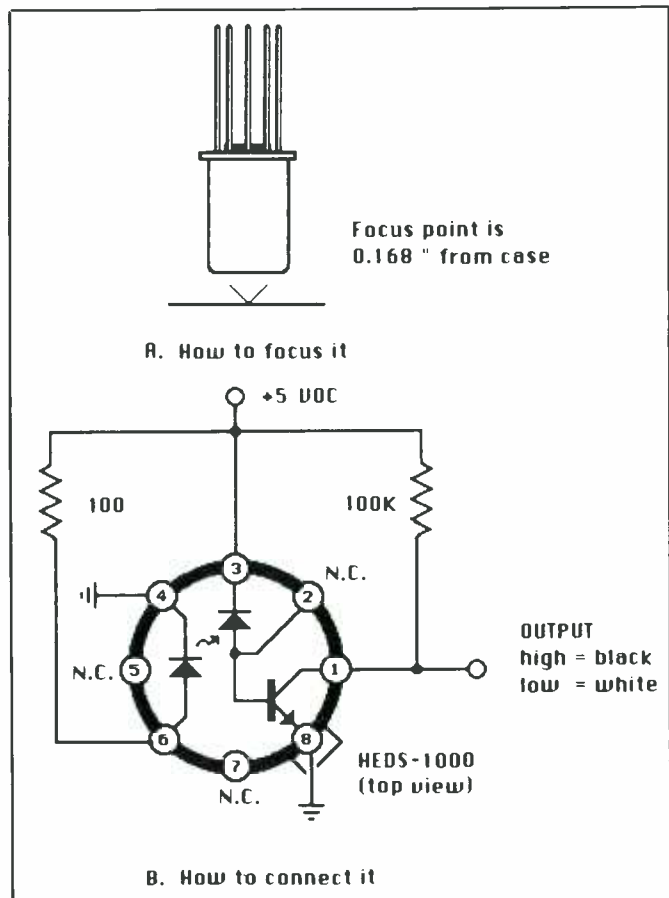
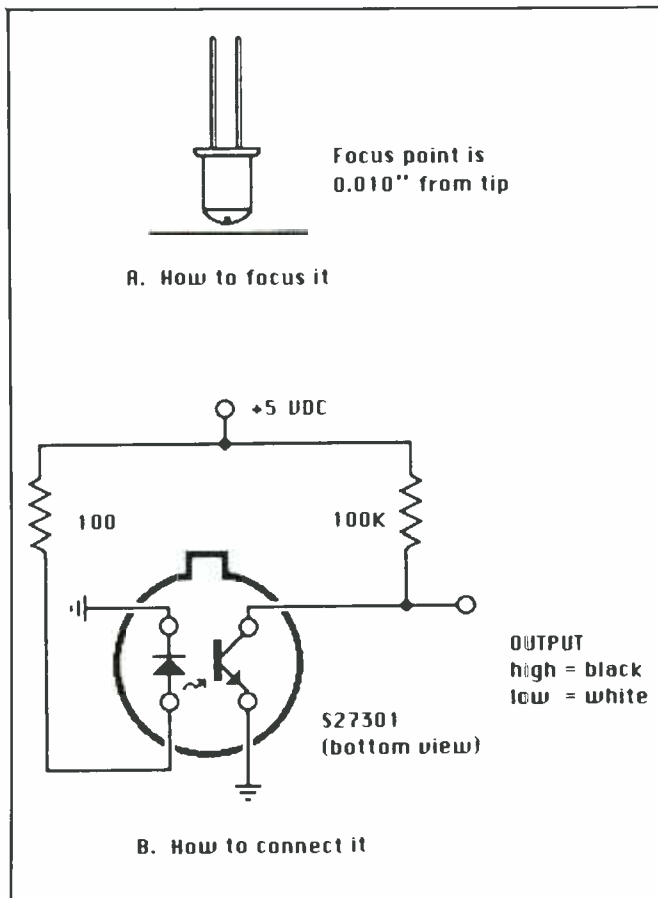


Fig. 1. The S27301 contains an infrared LED, fiber-optic light pipe, and phototransistor in a single package. Possible uses include barcode reading, artwork scanning, etc.

Fig. 2. The Hewlett-Packard HEDS-1000 is a larger and costs more than the S27301, but it has sharper focus, uses visible light, and readily handles color images.

is also \$99,960 cheaper. A hundred thousand here, a hundred thousand there, it eventually adds up.

You can try taking any old LED or semiconductor laser and any old photodetector and working up your own optics. But, according to Hornschnable's first law of optics design, "If you design your own optics, all the light you want will disappear, and all the interfering light you don't want will completely swamp whatever it is you thought you were trying to accomplish."

How can Apple software tell one machine from another?

There are now bunches of "Apple For-

ever" machines. There are the Apple II, II+, III emulation mode, IIe "old" ROM version, IIe "new" ROM version, and IIc. Speculating, since both 16-bit *pin-compatible* 6502 enhancements and 256K RAMs are now being shipped in quantity, we can someday expect to see a few "IIx" enhanced variations here and there.

If you are writing Apple software, and if it is going to do its task well, you must test for each machine and then optimize your program for what is or is not available. Important things to check for are how much memory is present, 40 versus 80 columns, and whether a clock/calendar card is present.

There are two methods to find which machine the code has just been booted into. One method that always works is to read certain magic monitor locations. Another method that works only when ProDOS is in use is to read a magic ProDOS location. The ProDOS check will also tell you about memory size, eighty columns, and clock cards.

Here are the Apple monitor locations:

Machine	\$FBB3	\$FB1E	\$FBC0
Apple II	\$38		
Apple II+	\$EA	\$AD	
Apple III emulation	\$EA	\$8A	
Apple IIe, "old" ROM	\$06		\$EA
Apple IIe, "new" ROM	\$06		\$E0
Apple IIc	\$06		\$00

HARDWARE HACKER...

And here's the same thing out of Apple ProDOS:
Read location \$BF98 and convert it to binary.

Apple II	00..	.0..
Apple II +	01..	.0..
Apple III emulation	11..	.0..
Apple IIe, "old" ROM	10..	.0..
Apple IIe, "new" ROM	00..	.1..
Apple IIc	10..	.1..
48K of memory	..01	....
64K of memory	..10	....
128K of memory	..11	....
80 columns ability	....	.1.
40 columns only	....	.0.
Clock card absent	....	...0
Clock card present	....	...1

Each dot in the above listing means "don't care." Thus bit zero is involved with compatible clock cards. Bit one handles 80 versus 40 columns. Bits four and five tell you how much memory is present. Bits two, six, and seven handle

the machine ID. Bit 3 is reserved for another use.

The machine-language BIT command is one easy way to isolate single bits for analysis. For instance, an LDA #\$01 followed by a BIT \$BF98 followed by a BEQ GOTCLOCK will take the branch if a clock card is present. More details on such funny goings-on appear in my *Assembly Cookbook for the Apple IIe* (SAMS 22331).

More useful information on ProDOS appears in the *ProDOS Technical Reference Manual* (Apple Workbench #030-0360A) or in *Beneath Apple ProDOS* by Quality Software.

You can tell an "old" IIe from a "new" one in that the "new" version displays "APPLE IIe" on bootup, has a faster and smoother screen scroll, includes a mouse nest, a 65C02 CPU, and accepts lower-case BASIC commands. Reasonably priced upgrade kits should be available from your Apple dealer by the time you read this.

Names and Numbers

E-Tech Services	Quality Software
Box 2061	21601 Marilla St.
Everett, WA 98203	Chatsworth, CA 91311
(206) 337-2370	(818) 709-1721

Hewlett-Packard Co.	Scan-A-Matic
1820 Embarcadero Rd.	Box S
Palo Alto, CA 94303	Elbridge, NY 13060
(415) 857-8000	(315) 689-3961

Welch Allyn
Jordan Rd.
Skaneateles Falls, NY 13153
(315) 685-8351

Need Help?

Phone or write your hardware hacker questions and comments directly to:

Don Lancaster
Synergetics
Box 809
Thatcher, AZ 85552
(602) 428-4073

NEW PRODUCTS...

(from page 15)



Loaded with features, the new receiver offers eight-band coverage in 16 preprogrammable channels, including: low-vhf (30 to 50 MHz), high-vhf (148 to 174 MHz), uhf (450 to 470 MHz) and uhf-T (470 to 512 MHz) Public Service bands; 2-meter (144 to 148 MHz) and 70-cm (420 to 450 MHz) Amateur radio bands; and military land mobile (138 to 144

MHz) and federal government land mobile (406 to 420 MHz) bands. Rated sensitivity is 0.8 μ V on the vhf and 1.0 μ V on the uhf bands.

Among the Bearcat 180's features, you will find: adjustable VOLUME and SQUELCH controls; a 0 through 9, plus decimal point and ENTER programming keypad; a nine-key OPERATION keypad; fluorescent numeric channel/frequency display; and a telescoping whip antenna. Functions include: a 16-channel programmable memory; patented Track Tuning for optimum reception; automatic and manual up/down scanning; priority channel select; automatic lockout; direct channel address; auto search; and selective scan rate (5 to 15 channels/second). The ac-powered unit measures 9½" D x 9" W x 3" H and weighs 3.5 lbs. \$249.95.

CIRCLE NO. 103 ON FREE INFORMATION CARD

Probe-Type Auto-Range DMM

A compact probe-type digital multimeter that features auto-ranging on all functions, audible continuity test, data hold and rfi/emi shielding has been introduced by B&K-Precision. The Model 2802 DMM has a 3½-digit liquid-crystal display (LCD), with annunciators for function, polarity, low-battery condition, and over-range indication. It measures dc voltage in five ranges from 200 mV to 500 volts, ac voltages in four ranges from 2000 mV to 500 volts, and resistance in six ranges from 200 ohms to 20 megohms full-scale. Basic dc voltage accuracy is rated at $\pm 0.7\%$, and all functions are overload protected.

When a DATA HOLD switch is pressed, the meter "freezes" the displayed reading and allows the probe