HARDWARE HACKER

Finding out about bar codes, new fiber-optics goodies, a dual monitor for the Apple IIe, using a word processor to do isometric drawings, new data books

By Don Lancaster

If you happen to be in the neighborhood, why don't you stop in at a *Gila Valley Apple Growers Association* meeting, Thursday nights from 6 to 10 in Eastern Arizona College, Room T8, right here in beautiful downtown Thatcher. If you are very lucky, you might even get to be the first *Modern Electronics* reader to qualify for a free GVAGA tinaja quest. Also, Synergetics now stocks autographed copies of most of my books, in case you have been having trouble picking them up locally.

Lots of offbeat sources for neat stuff this month, so let's get with it.

How can I Find Out About Bar Codes?

Bar codes are those funny product code labels you've no doubt seen at the grocery store. The best running commentary I've run across on the societal impact of bar codes has appeared on the front cover of every issue of *MAD* magazine during the past several years.

Chances are that you would prefer some more technical information than this, though. It turns out there are five major bar-code standards. The one you already know the most about is called the UPC, short for Universal Product Code.

You can get a copy of the UPC standard from, of all places, the *UPC Council.* Actually, they just renamed themselves the *UC* for *Uniform Code.* While this sounds a tad presumptuous, they do seem to be running away with all the marbles.

Other competitive bar-coding schemes include the Code 3 of 9, used by the military and the automotive people; the Interleaved 2 of 5 used for containers and transportation; the Codabar also used for transportation; and the EAN European Article Number standard.

Some further details on these standards appear in the *Hewlett-Packard* bar code components folder, publication number 5954-2152. H-P has lots of fairly expensive solutions to bar-code scanning and reading, including their HBCR1000 series component bar-code readers, HBCS-4300 industrial bar-code wands, and HEDS-1000 reflective sensors. Check out their *Optoelectronics Designer's Catalog* for more details.

One Company that I've found has bar-code components parts at fairly low prices is *Scan-A-Matic.*

For a complete list of all major bar code manufacturers and suppliers, contact the *AIM* Automatic Identification Manufacturers trade group. Their free membership directory lists dozens of major bar-code outfits.

What's new in Fiber Optics?

Let's see. *Motorola* has evaluation samples of its fiber-optic links available. This gives you a 10-MHz infrared emitter, a fast PIN diode detector, and a meter of fiber-optic cable. The fiber cable is removable, and you can easily shorten it to any length with a plain old X-Acto™ or other utility knife.

Advantages of a fiber-optic link include total electrical isolation from input to output; the ability to work in hazardous locations; elimination of noise, coupling and ground loops; and lack of most EMI or RFI interference.

Hewlett-Packard has a well-written *Fiber Optics Handbook,* available from its German division. The handbook has a good fundamental review of the physics and electronics behind fiber-optic communications.

Finally, *Guidelines* is a quarterly *Corning Glass* in-house publication that centers on their fiber-optic activities.

I think all of this stuff is free, provided you make the usual professional-sounding requests, preferably on a business letterhead or by way of a direct phone call.

How can I put Two Different Monitors in an Apple IIe?

By now, it has become painfully obvious that the "enhanced" IIe monitor is pretty much useless when it comes to running older Apple software. And more than a few unfortunate epsilon minuses got sucked into letting an Apple dealer steal their old monitor ROMs when they attempted doing a so-called "upgrade."

Sadly, the "upgrade" is needed for releases of future software even if it utterly demolishes the value of most older software that you already own.

Both the old and new monitor chips are compatible with industry standard 28-pin 2764 EPROM chips by *Intel* and *Hitachi.*

The usual dual monitor solution is to take a mechanically similar, but electrically double sized 27128 EPROM and put two monitors in it, one in the top half and the other in the bottom. A quick and dirty way to switch between the two is to lift pin 2 from the socket and jumper clip it to ground for the "low" monitor and to +5 volts for the "high" monitor.

Figure 1 show us a cleaner and safer way to handle dual monitors at a cost of only a few dollars. You plug two adapter sockets into your Apple where the CD and EF monitor chips are supposed to go. Then you plug 27128 EPROMs into the adapters. A pair of switches is then flipped left for the high monitor and right for the low monitor.

One suitable source for EPROM programming is *E-TECH Services,* who give prompt and low-cost work. Note that you have to send them disk-based images of the code you want burned into both 27128 EPROMs.

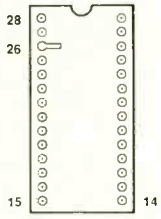
The key to the adapters is to use premium machined contact sockets that may be safely plugged into each other. These sockets are held apart by machined contact DIP strips that give enough separation to make room for the switch. Be sure to use a slide switch and not a toggle switch, and be sure the spdt slide switch is a "break-before-make" type.

There are some obvious modifications or improvements you might like to try. You could replace one switch with a wire that reaches over to the center of the other switch on the other adapter. This way, only a single switch flip will be needed to pick one monitor or the other.

Switch flipping is best done cold. If you try to flip the switches during a program, strange things may happen, depending on whether either monitor is being accessed

1. ( ) Place the 28 pin machined contact DIP socket pins up and identify pin 26. Carefully bend pin 26 towards the center as shown.

( ) Pins are numbered "backwards" from usual when they are viewed from the bottom.

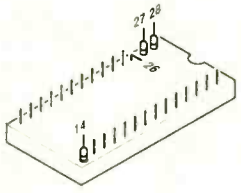


2. ( ) Push a single bare machined contact socket pin onto pins 14, 27, and 28 as shown.

( ) NOTE: In any soldering steps, snap an extra DIP strip onto the cool end of the pins being soldered. This keeps the pins aligned should the plastic soften.

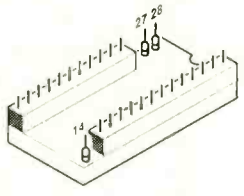
( ) Solder pin to socket at pins 14, 27, and 28.

DON'T GET ANY SOLDER ON THE PIN TIPS!



3. ( ) Push a 13 pin machined contact DIP strip onto pins 1-13 as shown.

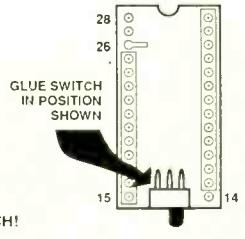
( ) Push an 11 pin machined contact DIP strip onto pins 15-25 as shown.



4. ( ) Carefully roughen one side of the SPDT slide switch and the bottom of the 28 pin DIP socket between pins 14 and 15. Use very fine sandpaper or steel wool.

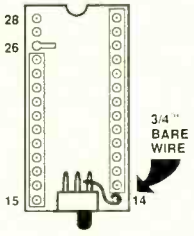
( ) Glue the switch to the 28 pin DIP socket as shown using superglue or epoxy. Let sit overnight and then verify that the switch still works.

DON'T GET ANY GLUE INSIDE THE SWITCH!



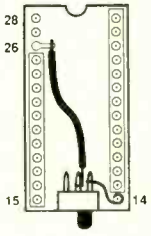
5. ( ) Prepare a 3/4 inch length of bare #24 wire. Connect this wire to pin 14 of the 28 pin socket and then to the nearest pin on the SPDT slide switch.

( ) Solder both connections, using a spare DIP strip as a safety backup heatsink. Cut off any remaining wire. Be very careful not to get any solder on the tip of pin 14.



6. ( ) Take a 1-3/4 inch piece of green #24 solid insulated wire and strip 1/4 inch from each end.

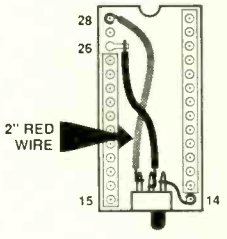
( ) Solder one end of this green wire to pin #26 and the other end to the center pin on the SPDT slide switch.



7. ( ) Take a two inch piece of red #24 solid insulated wire and strip 1/4 inch from each end.

( ) Solder one end of this red wire to the far unused pin on the SPDT slide switch. Solder the other end of this wire to pin #28 after looping it.

( ) Make sure that no solder gets on the tip of pin #28 and that there is no short to adjacent pin #27.



8. ( ) Turn the Apple IIe power off and remove the line cord at both ends. Carefully remove the original CD and EF monitor chips and store them in protective foam.

( ) Plug one adaptor into the CD ROM slot at D8 and the other adaptor into the EF ROM at D10 as shown. Plug your already programmed 27128 EPROMs into these adaptors.

( ) Be sure that the CD EPROM goes in the CD slot, and that the notch and dot on both EPROMs point forwards, towards the keyboard.

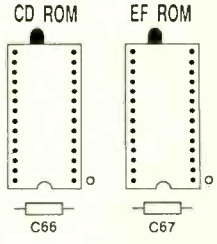


Fig. 1. How to install a dual monitor adapter in the Apple IIe computer. You need two adapters for the modification.

at the time the switch is flipped, and whether the code being used at this instant is different in one monitor than it is in the other.

One really neat trick would be to use a pair of 27512s instead, whose eight 64K banks are selected by an 8-way selector switch. This would let you have an old monitor, new monitor, word processor, spreadsheet, graphics program and three other programs all resident in your machine for instant access. A somewhat different adapter scheme would be needed.

By the way, all artwork (including legends and accompanying text) you see here were completely and totally drawn using Applewriter on a IIe. Not too shabby for a word processor, eh? I sure wish I could find a way to do graphics this good on a Macintosh.

Please keep me posted on your multi-monitor activities.

What's New in the Data Book Department?

Some careless *Modern Electronics* reader must have left two data books sitting too close together on the shelf, for there's now the pitter-patter of happy little data books everywhere. Actually, the terms "stampede" and "avalanche" and "torrent" come to mind. Let's quickly run through what showed up here during the last few weeks.

As usual, most data books have an "optional" price, typically between $5 and $10. You can often get these free if you make a professional enough request. Exceptions are *National Semiconductor, Motorola, Signetics,* and *Texas Instruments.* These outfits have such extensive

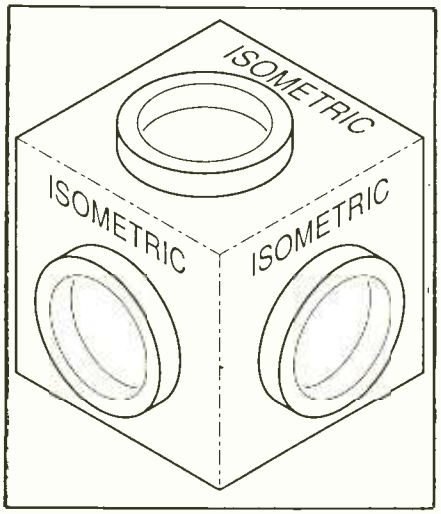


Fig. 2. Isometric drawings are easily done using a Laserwriter printer and Applewriter with the Apple IIe computer.

and detailed data-book libraries that almost everyone has to pay the going rate.

Where to start?

Monolithic Memories has a pair of new data books: the sixth edition of the *LSI Databook* and the second edition of the *Systems Design Handbook*. These are mostly about PALs, or programmable array logic devices, a new EPROM-like replacement for conventional digital logic. There's also a surprising amount of advanced electronic stuff here as well.

Texas Instruments weighs in with four publications: *Power Products Data Book* with lots of goodies on power transistors, power Darlingtons, triacs, SCRs and goodies like that; *MOS Memory Data Book* that covers dynamic and static RAMs, and EPROMs; *Field Programmable Logic Data Book* that covers second-sourcing of the Monolithic Memories PLAs; and *TMS3020 Users Guide* that describes in depth a new type of integrated circuit called a digital signal processor. These are most handy for things like spectrum analyzers, speech synthesis, digital filtering, and radar signal analysis.

Silicon General has a product catalog that includes such goodies as op amps, modulators, regulators, protection circuits, power drivers and a good collection of applications notes. Then *Plessey* has a thick *Integrated Circuit Databook* that covers all sorts of exotic linear ICs. It includes log amplifiers, low-noise amplifiers, radio communication circuits, specialized TV chips, frequency synthesizers, telephone circuits, hundreds of neat products in all.

Hitachi sent along a pair of specialized data books: the *HD65384 CRT Controller Users Manual* and the *HD64180 Microprocessor Data Book*. No less than three data books come from Siemens: the *Power Semiconductors* manual, *SIPMOST Transistor Data Book,* and *SIPMOST Transistor Applications Notes.* The last jewel includes circuits for power electronics, solar power, optoelectronics, audio and television.

Next in the pile is the *EXEL Data Book* that covers both data sheets and ap notes on electrically programmable PROMs, or EEPROMS, followed closely by the *Cypress Semiconductor CMOS Data Book* that covers a very large assortment of static RAMS, PROMS, PALs and general logic circuitry.

Ferranti provided a technical handbook on the *Super E-Line Transistors* that includes a bunch of ap notes on such things as motor speed controls, flashers, microphone amplifiers, infrared transmitters and a fluorescent lamp inverter.

Finally, at the very bottom of the stack was a technical data catalog from *MWS*

NAMES AND NUMBERS

AIM
1326 Freeport Road
Pittsburgh, PA 15238
(412) 782-1624

Allied Electronics
401 East Eighth Street
Fort Worth, TX 76102
(817) 336-5401

Corning MP-BH-5
Corning Glass Works
Corning, NY 14830
(607) 974-4411

Cypress Semiconductor
3901 North First Street
San Jose, CA 95134
(408) 943-2600

E-Tech Services
Box 2061
Everett, WA 98203
(206) 872-9004

EXEL Microelectronics
2150 Commerce Drive
San Jose, CA 95131
(408) 952-0500

Ferranti Electronics
87 Modular Avenue
Commack, NY 11725
(516) 543-0200

Gila Valley Apple Growers
Box 809
Thatcher, AZ 85552
(602) 428-4073

Hewlett-Packard Co.
640 Page Mill Road
Palo Alto, CA 94304
(408) 988-7000

Hitachi
2210 O'Toole Avenue
San Jose, CA 95131
(408) 942-1500

Intel Corp.
3065 Bowers Avenue
Santa Clara, CA 95051
(800) 672-1833

Jensen Tools
7815 South 46 Street
Phoenix, AZ 85040
(602) 968-6231

MAD Magazine
458 Madison Avenue
New York, NY 10022
(212) 752-7685

Motorola Semiconductor
Box 20912
Phoenix, AZ 85036
(602) 244-6786

Monolithic Memories
2175 Mission College Blvd.
Santa Clara, CA 95054
(408) 970-9700

MWS Wire Industries
31200 Cedar Valley Drive
Westlake Village, CA 91362
(818) 991-8553

National Semiconductor Corp.
2900 Semiconductor Drive
Santa Clara, CA 95052
(408) 721-5000

Plessey Solid State
3 Whatney Road
Irvine, CA 92714
(714) 951-5212

Scan-A-Matic
Route 5 West
Elbridge, NY 13060
(315) 689-3961

Howard W. Sams
4300 West 62 Street
Indianapolis, IN 46206
(800) 428-SAMS

Seimens
800 Hoyt Street
Broomfield, CO 80020
(303) 469-2161

Silicon General
11651 Monarch Street
Garden Grove, CA 92641
(714) 892-5531

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

Texas Instruments
Box 5012
Dallas, TX 75265
(800) 232-3200

UPC Council
7057 Corporate Way S-106
Dayton, OH 45459
(513) 435-3870

Wire Industries that gives technical information on the various sizes and grades of magnet wire and its insulation.

How can I do an Isometric Drawing?

Why, with Applewriter on a IIe, of course! How else could you possibly do an isometric drawing?

Figure 2 shows us some details. Isometric drawing is one standard way of showing three dimensional objects on a flat sheet of paper. The original *x* axis leans up 30 degrees to the right. The original *y* axis leans up 30 degrees to the left. The original *z* axis still goes straight up and down. You can measure actual scale lengths along all three axes.

I've put together some Postscript routines that easily let you do Laserwriter graphics directly out of Applewriter. The **cl, cr** and **ct** commands handle the circles as ellipses slanted and stomped just the right way for left, right and top faces. **al, ar** and **at** do the same thing for arcs. **lm, lrm, ld** and **lrd** commands handle left moves and left draws, both relative and absolute. Similar commands exist for the other two axes, while the **im, irm id** and **ird** commands do a triple isometric move or draw all in one command. These are needed for positioning or for slanting lines that go in two or three dimensions.

The dashes are done by using the SETDASH operator. Compound curves are handled with the cubic splines we looked at last month.

Neatest of all are the **pr, pl** and **pt** commands that print right, print left and print top, automatically slanting and arranging the letters so they seem to "belong" on any face.

The actual isometric transformations aren't really all that bad. They are:

$$\text{vertical} = z + 0.5\,(x + y)$$

$$\text{horizontal} = 0.866\,(x - y)$$

Here, *x, y* and *z* are the original three dimensions, while vertical and horizontal are the final directions on the final two-dimensional page. Circles are done as ellipses with a magic angle of 35 degrees and 16 minutes, either flat for the top, or rotated ± 60 degrees for the sides.

Trig freaks will note that 0.5 and 0.866 are the respective sine and cosine of 30 degrees, while 35 degrees and 14 minutes is the angle whose tangent is 0.5.

The lettering is nothing but a stock font that gets slanted and rotated. You either lean the letters forward or backwards 30 degrees (utterly trivial with Postscript) and then rotate the message up or down an additional 30 degrees as needed. The other nine lettering orientations not shown in Fig. 2 are also easily done.

Isometric is ideal for "exploded" views that show how things go together, particularly when lots of round parts are involved. One limitation is that boxy subjects seem a tad out of proportion with the far corner looking "too big." You can see if you stare at Fig. 2 long enough. This is caused by your brain being used to seeing things in perspective. (You'll find more isometric examples in Fig. 1.)

Actually, isometric is only one of an infinite number of possible *axonometric* projections. Draftsmen and tech illustrators typically avoid most of the other viewing angles like the plague, since they used to be a royal pain to draw. Oftentimes, some really offbeat axonometric projection will show an object or an assembly drawing in its best light.

But Applewriter and Postscript could not care less. A trig calculation is a trig calculation, no matter how weird the angle or how funny the ellipse. There are a nearly infinite number of ellipse templates sitting inside the Laserwriter, and they are all equally accessible. Thus, you can easily do virtually any 3-D axonometric drawing about as simply as you can do plain old isometric. Perspective, too.

More on axonometric projections appears in just about any book on drafting or tech illustration. Write or call if you need any more info on any of this. **ME**

NEED HELP?

Phone or write your Hardware Hacker questions directly to:

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