Remote power control; laser die cutting; short time delays . . . .

By Don Lancaster

It has been a real zoo around here lately since the whole new world of laser printing and desktop publishing is now literally bursting at the seams. Laser printing seems to be *the* opportunity of the decade and is something that no serious hacker can any longer afford to ignore. The potential here is absolutely astounding. I have lots of stuff to get you started in this, some free, some for a small fee, so be sure to write or call. You may want to start exploring this exciting new world.

Several readers have asked where to get that oddball "shrink DIP" socket for the M50734 micorprocessor we looked at a few columns back. The *Electronic Molding* people have these for around $3 each.

I have several versions of this micro up and running. It looks like it will be absolutely outstanding for such things as data logging, student trainers, and dedicated "blue-collar" uses. Write or call for a preliminary schematic.

While I am thinking of it, let's make one important update to your copy of the *TTL Cookbook*. This one has caused some grief to several recent callers. At the time the book was written, *Motorola* had an MTTL voltage-controlled oscillator that had the unfortunate choice of a 4024 part number. Several of the circuits in the book used this original part. You most definitely can *not* substitute any of today's 4024 CMOS binary counters for this chip. These are totally different devices from the MTTL VCO.

On to whatever it is we are doing here.

How can I remotely control ac power?

Those older BSR remote power controllers, such as the ones offered by *Sears* and *Heathkit*, are often ideal for this sort of thing. They use low-frequency radio signals sent through the power-line wiring to control up to 256 different appliances or dimmable lamps.

Unfortunately, the original BSR versions did not offer any means for direct computer control. Worse yet, these devices use a "hot-chssis" circuit that is difficult and unsafe to directly connect to your personal computer. A number of manufacturers offer plug-in BSR interface cards for Apples and PCs that can be quite expensive, particularly for preliminary experiments.

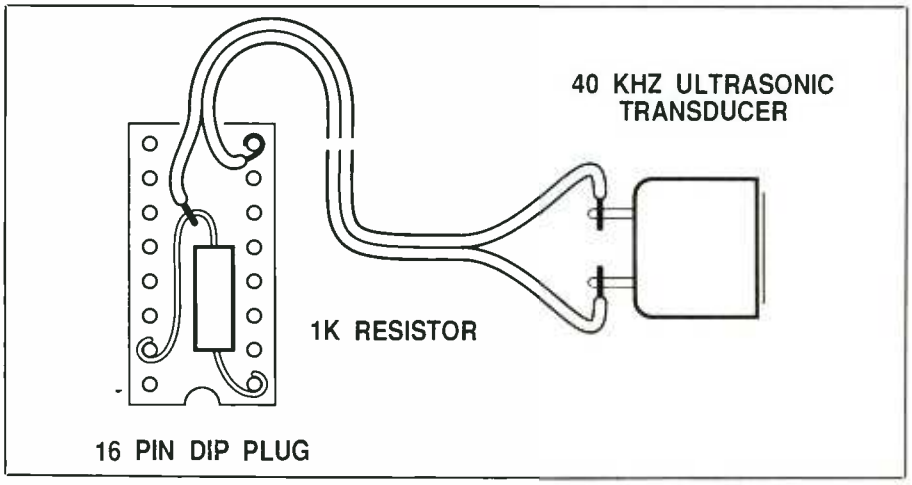

Fig. 1. Remote ac power controller interface construction details.

Instead, I would like to share with you a quick and simple $1 Apple-to-BSR interface that I worked up some time ago. It works like a champ. What this dude does is connect an ultrasonic transducer to the game paddle output of your Apple. This transducer "whistles" at the BSR controller in the same way that the handheld remote controller does. The whistling is done from one-to-three-feet away, completely eliminating any hot-chassis problems and any need to modify the BSR controller itself.

Please note before we begin that this takes the type of BSR controller that supports a handheld remote ultrasonic controller. Some low-end *Radio Shack* versions do not. The way to tell is by whether or not the handheld controller is listed in the catalog. You can also open the unit and see if there is an ultrasonic microphone present in the front-center of the case.

```
$0300:  A2 15 BD 5B 03 48 20 2D
$0308:  03 20 1B 03 68 49 FF 20
$0310:  1B 03 A2 F0 20 4D 03 20
$0318:  4D 03 60 A0 05 0A 90 06

$0320:  20 2D 03 18 90 03 20 3D
$0328:  03 88 D0 F1 60 48 A2 A0
$0330:  20 4D 03 8D 58 C0 A9 27
$0338:  20 A8 FC 68 60 48 A2 30

$0340:  20 4D 03 8D 58 C0 A9 32
$0348:  20 A8 FC 68 60 8D 59 C0
$0350:  48 68 EA 8D 58 C0 EA EA
$0358:  CA D0 F2 60 60 E0 20 A0

$0360:  10 90 50 D0 70 F0 30 B0
$0368:  00 80 40 C0 08 18 28 38
$0370:  48 58 00 A9 07 8D 72 03
$0378:  20 00 03 A9 8D 20 A8 FC

$0380:  CE 72 03 D0 F3 60 00 00
```

Fig. 2. An Apple IIe-to-BSR controller machine-language software driver.

The circuit works on an Apple II+, IIe, or IIGS in its slow mode. However, it will not run on a IIc.

As shown in Fig. 1, all you need are a DIP plug that fits the game I/O connector, a short piece of two-conductor wire, a pull-up resistor, and a 40-kHz ultrasonic transducer. The transducers are avail-

First, select a BSR command from this list:

CODE	HEX	DEC	CODE	HEX	DEC
Unit 1	$01	1	Unit 13	$0D	13
Unit 2	$02	2	Unit 14	$0E	14
Unit 3	$03	3	Unit 15	$0F	15
Unit 4	$04	4	Unit 16	$10	16
Unit 5	$05	5	Clear	$11	17
Unit 6	$06	6	All On	$12	18
Unit 7	$07	7	On	$13	19
Unit 8	$08	8	Off	$14	20
Unit 9	$09	9	Dim	$15	21
Unit 10	$0A	10	Bright	$16	22
Unit 11	$0B	11			
Unit 12	$0C	12			

Then poke this value into location $0301 or decimal 769.

To send a single command, do a JSR $0300 or CALL 768.

To send a more reliable burst of seven identical commands, do a JSR $0363 or a CALL 883.

Fig. 3. Steps to follow to use the BSR interface software driver.

able for as little as 50 cents from many surplus houses. *Mouser Electronics* also stocks them new.

Construction hint: Whenever you solder to a DIP plug, first plug it into a socket or two to keep the plastic from melting and knocking the pins out of alignment.

Also, it is usually a very good idea to "double up" all of your game I/O connectors by plugging them into a *machined-contact* DIP socket and then plugging the new plug into the actual port. This *must* be the type of socket with smooth, round pins that can be safely plugged into another socket. This way, when (*not* if) the pins bend or break, all you have to do is snap a new socket onto your "sandwich," rather than having to rewire everything.

You will also need the machine-language software driver shown in Fig. 2, which runs in the usual $0300 stash. Figure 3 shows you how to interface this driver to your controlling BASIC or other machine-language routine. The driver itself starts at $0300 or decimal 768, and is called as a subroutine, after you put the desired command into $0301 (decimal 769).

Just like the mule with the 2×4, it is best to "whap" the controller several times to make sure you get its attention. Entry to a simple routine at $0373 (decimal 883) will whap the main sub seven times. For lamp-dimming applications, though, you will have to experiment some with the repeats and the delays between those repeats to get the smoothest operation.

This interface works by creating bursts of 40-kHz square waves that the ultrasonic transducer converts to sound energy that it transmits to the receiving transducer on the BSR controller. The needed information consists of a long serial pulse-modulated code that is 12 units long.

A start unit or a "one" unit is on for 4 milliseconds and off for 4 milliseconds. A "zero" unit is on for 1.2 milliseconds and off for 6.8 milliseconds. Finally an "end" unit must be on for not less than 12 milliseconds.

The actual information needed by the BSR controller is a 5-bit command code. Various combinations of 1 and 0 in this 5-bit command code correspond to codes created by the buttons on top of the controller. The transmitted code consists of a start unit followed by the five-unit command code.

Next, to pick up some noise immunity and to ignore key jangles, the *complement* of the command code is transmitted. To complement a code, you make all of the 1s into 0s and vice-versa.

Finally, an end unit is transmitted. Thus, there are 12 units to the serial ultrasonic code, all but the last of which takes 8 milliseconds. You have a start unit, five command-code units, five complements to the command-code units, and then the final stop unit.

Let me know the most unusual use for remote power control that you come up with using this super-cheap circuit.

How can I create short elecronic delays?

I got a call from some students that were working up a dynamic memory demo as a class project and wanted to avoid buying a very-expensive short time-delay generator.

For quick, dirty, and cheap time delays in the 1-nanosecond to several microsecond region, just use ordinary small coax cable or twisted pair wiring. You will get around 1.6 nanoseconds per foot, or 1 microsecond for each 600 feet or so.

The bandwidth is very high and can accommodate analog and digital signals with equal ease. Both ends of the cable should be properly terminated to eliminate reflections.

Can I do die cutting on a laser printer?

The amazing answer to this question is that, yes, you can easily do die cutting on a laser printer. You can also do any of a number of other mind-bogglin things, including direct printed circuits, T-shirts, full vibrant color from plain old black

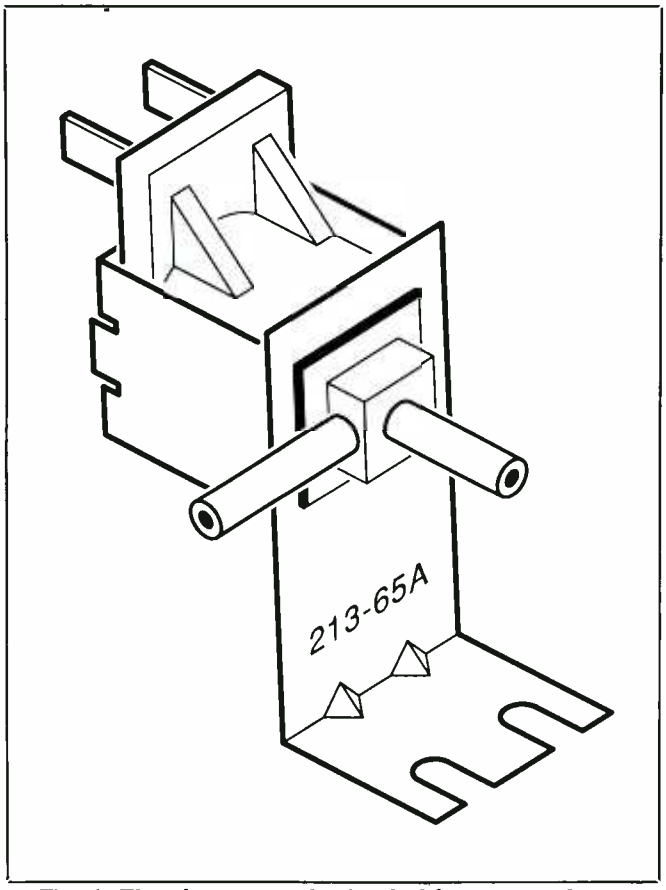

Fig. 4. This three-way valve is ideal for hacker robotics.

NAMES AND NUMBERS

Amperex Electronic Corp.
George Washington Hwy.
Smithfield, RI 02917
(401) 232-0500

BSR
Route 303
Blauvelt, NY 10913
(914) 358-6060

Electronic Molding
96 Mill St.
Woonsocket, RI 02895
(401) 769-3800

Eastman Kodak
343 State
Rochester, NY 14650
(716) 724-4000

Jerryco
601 Linden Pl.
Evanston, IL 60202
(312) 475-8440

Kroy Sign Systems
14555 N. Hayden Rd.
Scottsdale, AZ 85260
(800) 521-4997

Micronetics Inc.
36 Oak St.
Norwood, NJ 07648

Motorola Semiconductor
Box 20912
Phoenix, AZ 85036
(602) 244-6900

RCA
Route 202
Somerville, NJ 08876
(201) 325-1885

Reticon Corp.
345 Potero Ave.
Sunnyvale, CA 94086
(408) 738-4266

Revere
845 N. Colony Rd.
Wallingford, CT 06492
(203) 269-7701

Tektronix
Tektronix Industrial Park
Beaverton, OR 97005
(503) 644-0161

Texas Instruments
P.O. Box 9066
Dallas, TX 75380
(800) 232-3200

toner originals, silk screening, translucent overhead transparencies and much more. We've covered some of these in previous columns, but the die cutting is brand new and reported here for the first time anywhere.

Kroy Kolor has a super new material that is more or less like the sticky-back vinyl and carrier used by professional sign people, except for one major difference. This material is not cross-linked properly until it is exposed to light and treated with a simple chemical.

Here is how you use it: With your laser printer, print the die cut outlines onto a clear acetate sheet. Then place the sheet in contact with the diecut material and expose it to strong sunlight or the usual UV exposure boxes. The toner prevents the light from cross-linking the material. when you next wipe the material with a developing chemical, every place that toner was will dissolve, leaving you with perfect "die-cut" letters or whatever ready to peel and use. Neat stuff.

Contact Randy Bailey at *Kroy* for samples and more info on this exciting new material.

What's worth hacking this month?

There are so many unique new components that need looking into that it is hard to pick a starting point. To quote Pogo, "We are beset with insurmountable opportunities." At any rate, here goes.

We'll start off with my perennial favorite, the 30-cent three-way pneumatic value shown in Fig. 4. These remain available from *Jerryco* and many other surplus houses and are an outstanding bargain part that has gone begging. Low-pressure air has great hacker robotics potential, but it has been virtually ignored.

A premounted strain gauge useful for electronic scales and whatever is available from *Revere* as the Model FT-30 force translator transducer. It is available in ranges from 1 to 40 pounds and in resistances from 0.5 to 25 ohms.

The *Hewlett Packard Journal* is a good free source of technical detials on sophisticated electronic devices. The February 1987 issue has a good tutorial on wide-range optical and infrared sensors in it.

Speaking of IR sensing, *Amperex* has

some miniature and sensitive pyrolitic infrared detectors whose prices start at $3.50. These look like really great components, but I have not yet had the chance to test them. One obvious application is in "hot-spot" detectors for use by the fire service. Current devices are ridiculously expensive and many of the volunteer fire departments simply cannot afford them.

For some new information on electronic noise, and noise diodes for testing in particular, check out the *Micronetics* noise-diode catalog, which also contains a tutorial on noise and noise testing.

We seem to be turning the corner on solid-state imaging devices. These should soon be cheap enough to open up all sorts of new low-end hacker stuff, including image scanners, simple robotic vision, various desktop publishing accessories, and whatever. There's now even a toy camcorder being introduced that should list for under $150 and actually be sold in toy stores. Just as hackers ripped open the early *Speak and Spell* toys to get at the sound chips, you might now see a new generation of hackers ripping apart these "toys" for the imaging electronics.

The leader in charge-coupled-device CCD image sensors is now *Reticon*. But *Texas Instruments* has TC210, 220, 230, and 240 sensors and evaluation kits available, which include a 488 × 754 full-color RGB evaluation board.

Other companies that are introducing lower-cost CCDs include *RCA* with its SID504DD device.

As usual, be sure to write or call with any tech questions per the "Need Help?" box. I'll send you the usual free-stuff list plus some other goodies. **ME**

NEED HELP?

Phone or write your **Hardware Hacker** questions directly to:

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