

Cyborg cosimano helmets  
Long range remote control  
Unique direct toner decals  
Powerful new PIC software  
Virtual ways CAM machine

There's lots of exciting new developments for this month, ranging from Scott Edwards' powerful new PIC tools, to an incredibly versatile hacker remote control, a stunning new *virtual ways* breakthrough in CAM tooling, better hacker printed circuits, and even your very own techno-shamanistic cyborg cosimano helmet....

### Long Range Remote Controls

The FCC has long been fussy over unlicensed transmitters. Most of the time, what you are allowed to use just barely misses being useful. But there is one class of unlicensed transmitters the FCC permits that lets you use *ten times* the usual power.

Mark Gottlieb and the rest of the folks up at *Design Tech International* have come up with a new "E" series of remote control modules which cry out for hardware hacking.

While intended mostly for several channels of on-off control, they have a reliable and effective range as far as 300 feet. They easily work through a car windshield or house walls.

Back to the basics. The full set of FCC regulations appear as Title 47 in the *Code of Federal Regulations*.

You will find several hundred parts to the regulations, usually offered in four or five volumes. They are found at most larger libraries, or can get ordered through the *US Government Bookstore*. We saw much more on FCC regulations in my [HACK45.PS](#) on [www.tinaja.com](http://www.tinaja.com).

Our main interest here is Part 15, which covers unlicensed radiations. In particular, check section 15.231. It is summarized in figure one.

A special class of service exists for *periodic* operation. This is defined as a transmitter that is never on for more than one second, nor repeats at more than a three percent duty cycle. The two most popular uses are automatic garage door openers and "where's my car?" keychain vehicle locators.

Operation is allowed in a narrow band around 40 MHz and anywhere above 70 MHz. At 330 MHz, a very

generous signal of 7000 microvolts per meter is allowed.

The allowable bandwidth is 0.25 percent, which translates to a highly useful 800 kiloHertz.

You are not supposed to transmit voice or music. Data is limited to id code sequences. Control of toys is specifically excluded.

"Scheduled" or timed non-random operation is also a big no-no. These restrictions are eased at lower power levels. In reality, if you are using one of these devices for personal and intermittent use, you are unlikely to get caught if you don't bend the rules too blatantly.

### More Details

The "E" system consists of a few receiver and transmitter modules.

The three transmitter modules are electrically identical, except that the number of buttons on them varies from one to three channels. These are conveniently keychain sized.

In operation, pressing a transmitter button sends a repeating 24 bit AM pulse modulated signal at 330 MHz. Power is from a long lasting pair of internal lithium cells.

Codes are factory programmed to one of the 16 million possible values, selected at random. The codes are generated by a 16C54LP PIC micro from *Microchip Technology*, running at an 8 MHz clock rate.

A 3-transistor transmitter powers

an internal small loop antenna that is capacitively trimmed. Battery power is only required when a button gets pressed. A light emitting diode cutely lights red, yellow, or green as the selected channel gets activated. The surface mount construction does all this in slightly over *one square inch* of circuit board space.

Your transmitter should be held horizontally. Operation is best over an unobstructed path.

Figure two shows you most of the receiver schematic. It measures two by three inches. This was originally intended as a long range retrofit for existing garage door opener systems. A new power jack has been added for general purpose hacker uses.

For hacker uses, you power the device from a 12 volt *negative tip* DC wall mounted power supply, such as a *Radio Shack* 273-1652 unit. The sensitivity drops off markedly if you try using a lower supply voltage.

Each receiver has a single relay in it, rated one amp at thirty volts. *Do not try to control 110 volt ac power with these contacts!* Use an external relay or triac instead.

Your receiver can respond to *four* different codings. The relay contacts close for a half a second.

You will find two portions to the circuit, digital and analog. Both have their own supply regulators. 8 volts for the receiver, and the usual 5 volts for the digital part. A preregulator

The allowable frequencies of operation are 40.66 through 40.70 MHz or any frequency above 70 MHz.

Maximum transmitter "on" time is one second with a three percent duty cycle. Minimum time between shorter retransmissions is ten seconds.

Allowable signal strength at 330 MHz is 7000 microvolts per meter. Up to 12,500 microvolts per meter are permitted above 470 MHz.

Bandwidth is restricted to 0.25 percent below 800 MHz.

Data transmission is restricted to identification codes.

Music, voice, control of toys, or scheduled operations are not permitted.

Fig. 1 – THE FCC ALLOWS UNLICENSED OPERATION at ten times normal power for "periodic" transmitters. Here's a part 15.231 summary.

limits input voltage peaks to 24 volts. The receiver portion is a fancy and hot superregenerative detector. Made from six transistors and an op-amp chip. The single tuning coil sets the center frequency. A six inch vertical wire serves as the input antenna.

Any amplifier that is on the verge of oscillation can exhibit incredible gain, due to positive feedback. One older type was called a *regenerative* detector. But these end up extremely touchy. Too little feedback, and you get low gain and bad selectivity. Too much and you oscillate.

The old superregenerative detector scheme beats this by purposely going into and out of oscillation. This gets done by a signal known as the *quench frequency*. The quench frequency is normally several tens of kiloHertz. It "saws" the detector in to and out of

oscillation. The circuit averages to an optimum sensitivity.

On any superregen detector, it is quite important to have a properly designed rf stage between it and the input antenna. Otherwise, you'll end transmitting garbage.

The output of your receiver is a repeating digital code, matching that of the activated transmitter.

The digital portion of the circuit consists of a second 16C54LP PIC micro, a small electrically alterable EEPROM serial memory chip, and a 2N2222 relay driver.

This microcomputer works in two modes. In *normal mode*, when one of four proper codes gets received, the relay closes for half a second. The red LED also lights. A *click-clack* can be heard as the relay activates.

In the *program mode*, you teach

the receiver to recognize the codes of additional transmitters. Up to a total of four. To do this, you'll press your *program* button and then activate your transmitter from several feet away. Your LED flashes two times when it goes into program mode, and three times when complete. This is pretty much similar to programming a universal TV/VCR remote.

Figure three summarizes costs and availability. Other more specialized units are available that do have more control outputs.

There are two ways you use this receiver, known as *garage mode* and *hacker mode*. In garage mode, a 24 volt ac or dc control loop is assumed. From which ten mils of current can be pirated *without* activating the main door relays. The receiver gets put in parallel with the manual switch.

During the off times, the receiver steals around ten mils of standby supply current. The 1000 microfarad capacitor stores enough energy to power your receiver during the brief "on" time when the relay shorts the main control line. See figure four.

Not all older garage door openers are compatible. Sometimes swapping the two leads will work. Other times, you'll have to go to hacker mode.

In hacker mode, an external 12 vdc *negative tip* supply gets plugged into a standard jack. You may want to alter the circuit slightly to isolate the relay contacts from the power supply. Details vary with your application.

Each transmitter comes from the factor permanently preprogrammed as one, two, or three unique codes out of 16 million. Each receiver can be taught to recognize any of four codes, all of which close the relay.

Considering the sophistication and performance of these units, they are surprisingly low in cost.

**Get the #^\$\*% Phone!**

I had an immediate use for an "E" remote just as soon as it showed up. My *Synergetics* operates out of my home, helped along by Bee and a few associates. The building is kinda "L" shaped and usually full of such noise generators as coolers, printers, rock music, dehumidifiers, and cat-dog philosophical discussions.

Getting me to the phone has been a real hassle. Because of the rooms and

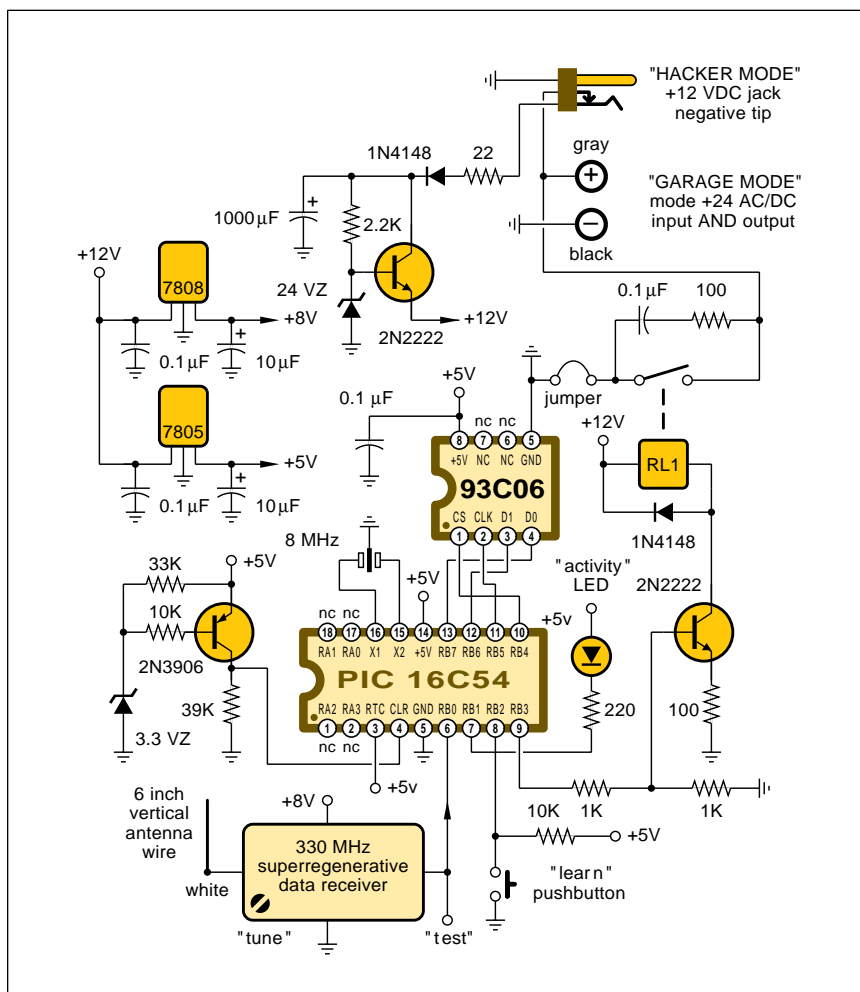


Fig. 2 – PARTIAL SCHEMATIC for the E-series universal hacker remote control receiver. Note the dual supply options. It can be taught up to four new input codes by pressing "learn". There are 16,772,216 possible codes.

walls, no way will any ultrasonic or infrared remote hack it.

Figure five shows how I modified the receiver to drive a piezo speaker. The receiver gets stashed in my usual lair, and the phone answerers all get to use the remotes.

Offhand, I could think up hundreds of hacker uses for this really great system. Robotics, construction sites, any long driveways, fire departments, farms, and security access. But why not tell me instead? As part of...

### This Month's Contest

Just tell me about a new or unusual use for a fairly secure medium range wireless remote control. There'll be a dozen or so of my *Incredible Secret Money Machine II* books going to the better entries, with one all expense paid *tinaja quest* (FOB Thatcher, AZ) for two going to the best of all.

In addition, development units may be awarded to the most interesting or most unusual new apps.

### Electronic Decals

Frank Miller of *DynaArt Designs* has just dramatically expanded his offerings for prototype and hobby printed circuits. He has got bunches of innovative wave etchers, shears, laminators, and support products.

Many of them optimized for his improved version of the *direct toner method*. Which lets you cheaply and quickly create all your own printed circuit boards at home.

A free catalog is offered.

I thought I'd zero in on a little known use for Frank's products. His direct toner transfer sheets can also be used to create high quality decals. In black and white *or* in full color. Obvious uses include panel artwork, dialplates, custom audio aps, antique restorations, and board callouts.

There are two decal methods you might like to try. One cold and one hot. Frank's *toner transfer film* is the key to both. The film carrier has a thin layer of a high temperature water soluble glue applied to it.

You create a *reverse* of your art and then run this paper through your PostScript speaking laser printer. The transfer film then gets placed against the panel or circuit board material you want the final image on.

You then apply heat and pressure.

The safest and surest way to apply exactly the right pressure for the right time is by using Frank's laminator.

The heat and pressure melts the toner and bonds it onto your circuit board or front panel or whatever. You then soak the panel in warm water for a minute or so, dissolving the glue out from under the transfer sheet.

You could also use a *Canon* color copier for stunning effects.

The cold method is more suited for traditional decals, such as you might need on a model railroad layout.

As before, you'll PostScript laser print your artwork onto a transfer sheet. This time, you print frontwards or "right reading". You then apply three *light* coats of ordinary art store lacquer over your sheet. Next, you cut out your artwork, while leaving a small margin all around.

You then soak the decal in water and slide it off the transfer sheet and onto wherever you want it. Just like plain old decals. The careful use of a Q-tip can get rid of any air bubbles. Once dry, you can optionally remove the lacquer film with alcohol.

Polyethylene in the toner makes

The following are available from DesignTech International, 7401 Fullerton Road, Springfield VA, 22153, (703) 866-2000 (voice), (703) 866-2001 (FAX):

#20051-E one code transmitter \$44.95; #30021-E one relay, four code receiver \$49.95; #30020-E factory matched transmitter-receiver pair \$79.95; #20061-E three code transmitter \$49.95.

Fig. 3 – PRICES & AVAILABILITY on the E-series universal remotes.

the actual hot method bond. This is fairly rugged. With the cold method, a water soluble adhesive does your bonding, and is less durable. Either can be protected with suitable clear epoxy overcoats.

An HO gauge railroad layout uses a scale of 87:1. With a 600 DPI laser printer, the simplest "five-dot" letters would equal a scale three-quarters of an inch high. Say two inches or so for fancy fonts that need more dots for accuracy. Thus, an incredible amount of detail is easily picked up with this technique. A single 600 DPI line is equal to a scale *one-seventh* inch.

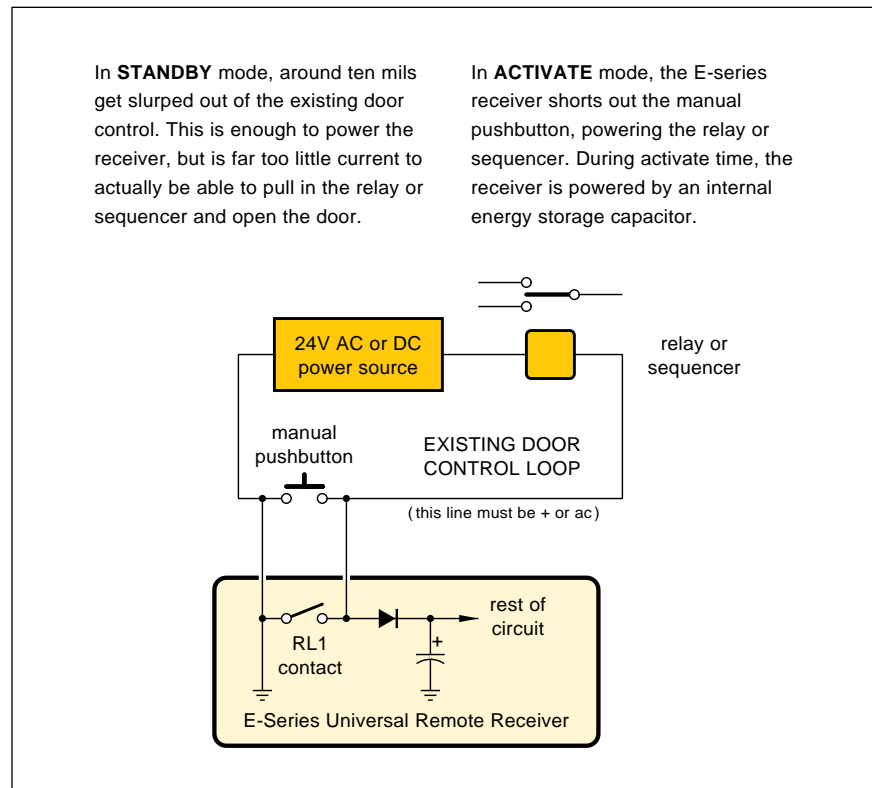


Fig. 4 – WHEN IN "GARAGE MODE", the E-Series receiver uses a two wire hookup that pirates its supply power from the main system.

**PSEUDOSCIENCE RESOURCES**

**Borderland Research**  
PO Box 429  
Gaberville CA 95542  
(707) 986-7211

**Electric Spacecraft Journal**  
73 Sunlight Drive  
Leicester NC 28748  
(704) 683-0313

**Free America Network**  
PO Box 777  
Frederick CO 80530  
(303) 833-4895

**High Energy Enterprises**  
PO Box 5636  
Security CO 80931  
(719) 475-0918

**Intl. Guild Advanced Sciences**  
255 N El Cielo Road #565  
Palm Springs CA 92262  
(619) 327-7355

**Intl. Assn New Science**  
1304 S College Ave  
Fort Collins CO 80524  
(303) 482-3731

**KeelyNet BBS**  
Box 1031  
Mesquite TX 75149  
(214) 324-3501 BBS

**Lor'd Industries Limited**  
Box 156  
Hancock WI 54943  
(715) 249-5611

**New Energy News**  
PO Box 58639  
Salt Lake City UT 84158  
(801) 583-6232

**Phaedra Enterprises**  
PO Box 1241  
San Bruno CA 94066  
(415) 359-0432

**Planetary Assn. Clean Energy**  
191 Promenade du portage  
Hull PQ CANADA J8X 2K6  
(819) 777-9696

**Rex Research**  
Robert Nelson  
PO Box 19250  
Jean NV 89019

**Skeptical Inquirer**  
PO Box 703  
Buffalo NY 14226  
(716) 636-1425

**Smithsonian Institution Press**  
470 L'Entant Plaza Ste 7100  
Washington DC 20560  
(202) 287-3738

**Space Energy Newsletter**  
PO Box 11422  
Clearwater FL 34616

**Super Science**  
101 E Stroop Rd  
Kettering OH 45429  
(513) 298-7116

**Tesla Book Company**  
Box 121873  
Chula Vista CA 91912  
(805) 646-3371

**Untapped Technology Review**  
PO Box 5185  
Mesa AZ 85211

And a whole new world opens up for the PostScript language. You can call or write for more details.

Much more on direct toner printed circuits is found in [HACK54.PDF](#) and [RESBN31.PDF](#) on [www.tinaja.com](http://www.tinaja.com) Along with great heaping bunches on PostScript as language.

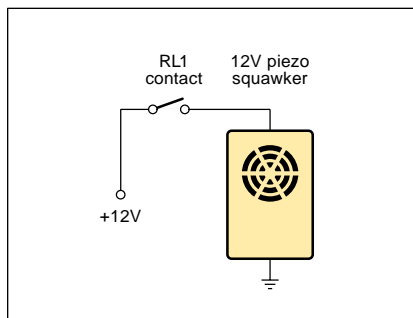


Fig. 5 – WIRELESS ANNUNCIATOR made up by modifying an E-series receiver in its Hacker mode.

**Pseudoscience Marches On**

There sure is still a lot of ongoing helpline interest in pseudoscience topics. Since there's several major new products from the pseudoscience industry this month, I thought we'd do a current update for this month's resource sidebar.

Pseudoscience is best defined as "Tain't likely McGee" beliefs which miss tests of scientific credibility and reproducibility. Often involving "not even wrong" labwork. And typically including hefty doses of conspiracy and paranoia.

Why bother with pseudoscience? Many of you do continue to demand more coverage. I certainly do like to encourage people to seek out oddball topics. And most of pseudoscience reading is highly entertaining and wondrously bizarre fiction.

**new from DON LANCASTER**

**ACTIVE FILTER COOKBOOK**

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. **\$28.50**

**CMOS AND TTL COOKBOOKS**

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. **\$28.50** each.

**INCREDIBLE SECRET MONEY MACHINE II**

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. **\$18.50**

**LANCASTER CLASSICS LIBRARY**

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. **\$119.50**

**LOTS OF OTHER GOODIES**

Ask the Guru I or II or III .....	\$24.50
Hardware Hacker II, III or IV .....	\$24.50
Micro Cookbook I .....	\$19.50
PostScript Beginner Stuff .....	\$29.50
PostScript Show and Tell .....	\$29.50
Intro to PostScript Video .....	\$29.50
PostScript Reference II .....	\$34.50
PostScript Tutorial/Cookbook .....	\$22.50
PostScript by Example .....	\$32.50
Understanding PS Programming .....	\$29.50
PostScript: A Visual Approach .....	\$22.50
PostScript Program Design .....	\$24.50
Thinking in PostScript .....	\$22.50
LaserWriter Reference .....	\$19.50
Type 1 Font Format .....	\$16.50
Acrobat Reference .....	\$24.50
Whole works (all PostScript) .....	\$380.00
Synergetics Surplus Catalog .....	<b>FREE</b>
Technical Insider Secrets .....	<b>FREE</b>

**POSTSCRIPT SECRETS**

A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. **\$29.50**

**BOOK-ON-DEMAND PUB KIT**

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. **\$39.50**

**THE CASE AGAINST PATENTS**

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This reprint set shows you Don's tested and proven real-world alternatives. **28.50**

**BLATANT OPPORTUNIST I**

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. **\$24.50**

**RESOURCE BIN I**

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. **\$24.50**

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FREE US VOICE HELPLINE VISA/MC

**SYNERGETICS**  
Box 809-NV  
Thatcher, AZ 85552  
(520) 428-4073

These also can be a "reality check" of how close to "the edge" I get with my own designs and explorations. It definitely is fun to research. Often, the closer you get to those original source documents, the worse things totally unravel.

And finally, I'd like to take all of pseudoscience and pile it up on a center stage somewhere, and shine a bright light on it. Then have you all objectively conclude "Yup, that sure is a big pile alright."

Let's start with *Watch the Skies! A Chronicle of the Flying Saucer Myth*. By Curtis Peebles and published by the *Smithsonian Institution Press*. It traces the evolution of UFO lore on through time, elegantly showing what came from where. His premise is that not one credible shred of true hard evidence exists anywhere.

Although obviously thorough and scholarly, much seems missing. Such as the Gulf Breeze scams and the ongoing crop circle hoaxes. The big intergalactic happy face on Mars is absent. The biggest international flap – Billy Meier – has but the briefest of mentions. And I personally felt that the crown jewels for all of UFOdom – Roswell 1947 – were dismissed far too lightly. For differing viewpoints, see *The Roswell Incident* or the brand new *Roswell* videos.

The best guide to the UFO industry is David Belevin's *Almanac of UFO Organizations*. From *Phaedra*.

*New Energy News* is an ongoing newsletter from the *Institute for New Energy*. Their focus is on cold fusion developments, new free space energy generation, and rotating "over unity" machines. They seem best at their book reviews and conference listings. They also mention the *Space Energy Newsletter*, a *Free America Network*, or the *Electric Spacecraft Journal*.

Several helpline callers have asked exactly what molecular frequency discriminators are. These are just a plain old power audio oscillator, a matching transformer and two ground injection probes.

Supposedly you can set these to "magic" frequencies for gold, silver, platinum, etc... and then use normal dowsing techniques to find what you are looking for.

I know of no credible scientific basis for such a machine. Even if it

## NAMES AND NUMBERS

### Altera

2610 Orchard Pky  
San Jose CA 95134  
(408) 894-7000

### Anton/Bauer

One Controls Drive  
Shelton CT 06484  
(203) 929-1100

### AP Professional

6277 Sea Harbor Dr  
Orlando FL 32887  
(800) 313-1277

### Scott Edwards Electronics

964 Cactus Wren Lane  
Sierra Vista AZ 85635  
(602) 459-4802

### Design News

44 Cook St S210  
Denver CO 80206  
(303) 388-4511

### DesignTech International

7401 Fullerton Rd  
Springfield VA 22153  
(703) 866-2000

### DynaArt Designs

3535 Stillmeadow Ln  
Lancaster CA 93536  
(805) 943-4746

### Focal Press

313 Washington Street  
Newton MA 02158  
(617) 928-2500

### GEnie

401 N Washington St  
Rockville MD 20850  
(800) 638-9636

### Growing Community

1118 Round Butte Drive  
Ft Collins CO 80524  
(303) 490-1550

### Intel Corporation

2200 Mission College Blvd  
Santa Clara CA 95052  
(800) 548-4725

### Maxim

120 San Gabriel Dr  
Sunnyvale CA 94086  
(800) 998-8800

### Media Magic

PO Box 598  
Nicassio CA 94946  
(800) 882-8284

### Micro Linear

2092 Concourse Dr  
San Jose CA 95131  
(408) 433-5200

### Microchip Technology

2355 W Chandler Blvd  
Chandler AZ 85224  
(602) 963-7373

### Radio World

5827 Columbia Pk #310  
Falls Church VA 22041  
(703) 998-7600

### Science/AAAS

1333 H St NW  
Washington DC 20005  
(202) 326-6400

### US Government Bookstore

720 N Main St  
Pueblo CO 81003  
(719) 544-3142

works, these \$4000 systems could be replaced by \$5 circuits such as the *Maxim* MAX238 or else the ML2035 from *MicroLinear*.

The KEELYNET BBS has scads of files on pseudoscience topics. And more or less objective trashing of the entire field often shows up in the *Skeptical Inquirer*.

Last but not least, I have located the ultimate pseudoscience treasure trove. The mother lode, fer sure. The *International Guild for Advanced Sciences* offers hundreds of books and videos on everything from alien contacts to perpetual motion up to techno-shamanistic radionics.

Neatest of all, though, are their antigravity machines, the time travel devices, teleportation systems, and even a cyborg cosimano helmet full of psychic energy amplifying magic crystals. Off the shelf hardware, no

less. Also off the wall.

Their free catalog is a must read.

Much more on these topics in the *Hardware Hacker* reprints and in the [HACK57.PDF](#), and [RESBN26.PDF](#) now up on my [www.tinaja.com](http://www.tinaja.com)

### New Tech Lit

*The PIC Source Book* is a brand new \$39 book and software package from *Scott Edwards Electronics*. It is for anyone who wants to go beyond the *Basic STAMP* in developing their own fast machine language code for the incredibly superb PIC series of low priced hacker microprocessors from *Microchip Technology*. This one is just about essential to design ultra low cost PIC circuits such as the "E" series remotes we just looked at.

Two new sets of free development software for the programmable logic devices: *FirstStep* from *Altera* and

*PLDshell Plus* from Intel.

New light emitting diodes that are *ten times* more efficient get described on page 943 of the August 17, 1994 issue of *Science*. Microcavities are the secret. Since the best of current LED lamps are newly approaching incandescent efficiency, this is truly a major development.

Any color you want. Even white!

A revolutionarily new *virtual ways* machine tool technology appears on pages 58-61 of the August 15, 1994 issue of *Design News*. Unlike older conventional mills or lathes, *there's nothing that slides!* Only plain old bearings and six ordinary jackscrews or linear steppers are involved. There are zero bending moments anywhere in the machine.

All stresses are simple tension or compression, leading to outstanding stability and precision. And this one looks great for hacker CAM.

More on RBDS data broadcasting

### NEED HELP?

Phone or write all your US Tech Musings questions to:

Don Lancaster  
Synergetics  
Box 809-EN  
Thatcher, AZ, 85552  
(520) 428-4073

US email: [don@tinaja.com](mailto:don@tinaja.com)  
Web page: [www.tinaja.com](http://www.tinaja.com)

by FM stations appears in the July 27, 1994 *Radio World*. Included is a list of over a hundred stations in 32 states and in-depth receiver reviews.

Two sources for multimedia books and software are *Media Magic* and *AP Professional*. Free catalogs.

The *Growing Community* is a well done newsletter on alternate and high tech intentional communities. Mostly in the Western US and mostly off of

the utility power grid.

A 46 page *Video Battery Handbook* is available from Anton/Bauer.

A new book by John Huntington is now titled *Control Systems for Live Entertainment* and published by the *Focal Press*. It covers the basics of theater, concert, and amusement park systems for lighting, sound, F/X and even pyrotechnics. Including MIDI time and show codes, SMPTE, and even SDX systems.

These days, it's a simple and easy matter to self-publish your own high quality books. Or set up a service bureau to instant publish for others. Full details are in my newly updated *Book-on-demand Resource Kit*. Per my nearby *Synergetics* ad.

Also a reminder that reprints and preprints of all my columns, my free insider secrets catalogs, and instant tech help is found on [www.tinaja.com](http://www.tinaja.com) per the *Need Help?* box.

Let's hear from you. ♦