

Don Lancaster's

# RESOURCE BIN

number eighty three

## Fun with some neat stuff.

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals and off-the-wall networking on nearly any electronic, *tinaja questing*, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

I'm now in the process of setting up my new *Guru's Lair* web site you'll find at (where else?) [www.tinaja.com](http://www.tinaja.com) This is the place you'll go for instant tech answers. Among the many files in our library, you will find complete reprint sets for all of the *Resource Bin* and other columns. Plus a brand new [Research InfoPack Service](#).

You will get the best results if you have both [Netscape Communicator](#) and [Acrobat Reader 3.0](#) installed.

There's sure a lot of neat electronics and related high tech toys which are coming down lately. Both new and as surplus bargains. So, I guess we are overdue for a review of a lot of odds and ends that you just might decide are interesting or useful...

### Build Your Own Microprocessor!

Programmable gate arrays are now large enough and cheap enough that you can use them to create your own microprocessor. Ending up having the power of, say, a 6502 or a Z-80.

Besides being a superb teaching or learning experience, your own micro lets you run your things your ways. Using any mix of conventional, RISC, or DSP tricks you select. There's also those sole source and security factors. Others are not likely to guess exactly what you've got inside the box.

Typical FPGA's of interest include the *Xilinx XC4005L*. A new firm going by the name of *Space-Time Productions* now has new hardware and software support systems which literally can let you design your own micro.

These are also distributed by *Ultra Technology*. Whose lines do include a variety of *Forth* based products.

### PSD Optical Rangefinding

There is great interest these days in sensing distances. Traditional optical rangefinders using *parallax* methods all had a serious flaw. In that moving parts were always involved. But it is possible to "inside out" the *parallax* method and make an all solid state optical rangefinder. The trick is to use a special beastie called an infrared *Position Sensitive Detector*.

A pair of side-by-side plain old light sensors can even be used. You illuminate what you are measuring by using a laser or an infrared LED. You then arrange your optics so that your image moves across the sensor pair as the distance changes. The ratio of left to right output is trig related to your distance to the target.

There is one insider trick: To make the range signals independent of color and brightness, you'll *normalize* them. By calculating  $(A-B)/(A+B)$ . Leaving you with a *differential* output which is proportional to range only. Yeah, that division gets tricky to do analog, but is not that big a deal digitally.

**NEXT MONTH: Don looks at some possibilities in the medical electronics area.**

Position sensitive detectors are sold by *Sharp*, *Hamamatsu*, and *Ricco*. The *Sharp GP2D02* is a good starting point. This chip is both low cost and micro friendly. Several of the intended apps include camera autofocus, car "too close" alarms in garages, and even for use in restroom hand driers.

More details and bunches of further optical rangefinding resources appear in [www.tinaja.com/glib/muse131.pdf](http://www.tinaja.com/glib/muse131.pdf)

More theory about optical and PSD rangefinding in general can be found in various *SPIE* publications.

### Find That \$#@%# Cat!

The *Catfinder* is an interesting new take on mid-distance remote controls. There is a small handheld transmitter and up to four light weight remotes. You place one on your cat's collar to keep tabs on tabby. Press the button and the cat meows.

Well, beeps actually.

Another intended use is for people who always loose things. You attach a receiver to, say, your VCR remote or your pager or whatever. When it gets inevitably misplaced, you find your *Catfinder* and then use it to find the remote. The claimed range is fifty to eighty feet, or the better part of half an acre. My own tests showed useful ranges but were unable to reach their specified distances.

Cost is \$29 for a transmitter and one remote. And \$15 for extra remotes.

Your remotes get programmed to a selected channel by transmitting that channel while you install its coin cell battery. Programming is verified by a distinct double beep.

The reasonably waterproof remotes are also optionally offered as contact closures rather than beepers. Leading to all sorts of remote controls.

### Luminance Probes

When you measure light, you may want to sense *brightness*, finding out exactly how much light you have. But other measurement times, you might be more interested in how bright the light *appears* to a human observer. In this case, you'll be more interested in measuring *luminance*.

These two can be wildly different, because the human eye varies in its response to different colors. Your eye sees green strongest, red moderately,

but blue only rather weakly.

Typical silicon photocells are very strong in the infrared but wimpy in the blue. To measure luminance, you have to carefully collect the light from the precise area you want to measure. Then you'll have to carefully filter the light to exactly match the response of the photodetector. A calibration curve is a must. Finally, you'll measure the amplitude transformed light and then convert its value to digits.

Luminance measurement is used in everything from architectural lighting to color video monitor balancing to getting colors to print out properly as grays. Your classic luminance probe has been that pricey Tektronix J6523. These have recently become available surplus in "almost new" condition at sane prices. These are narrow beam devices that include viewfinding and focusing. They work everywhere from 18 inches to infinity as is. By adding standard photo closeup lenses, tiny or nearby dots can be resolved.

They are intended to work with the old Tek J-16 digital photometer, but should be fairly easy to interface into nearly any DVM lashup or PC based data acquisition system.

More on luminance probes is found at [www.tinaja.com/bargte01.html](http://www.tinaja.com/bargte01.html) More on shifting colors to realistic grays in [www.tinaja.com/acrob01.html](http://www.tinaja.com/acrob01.html).

### Class D amplifiers

There's been many decades of false starts, but it finally looks like Class D amplifiers are here to stay. A Class D amplifier is basically a pulse width modulator that drives a high power switch. Your switch is followed by a potent low pass filter to recover your PPM audio. Advantages of class D are quite low standby current, ultra high efficiency, and the ability to use low voltages. Laptop computer stereo is an obvious new application.

The Texas Instruments TPA005D02 is a good starting point. This \$3.48 chip provides two watts output from a five volt supply with under half a percent distortion. Other sources are Harris, Apex, Linfinity, and Tripath.

For a historical perspective on Class D, see my *Electronics World* story for February of 1966. A current listing of Class D amplifier resources appears in my MUSE128.PDF.

### Load Banks

A load bank is simply a giant toaster. Several loaves at a time, even. These get used for resistive (or sometimes

reactive) loads to test generators or windmills. And for industrial process heat. Or in student power labs. Or for alternate energy research.

Load banks come in several sizes. Um, it seems I picked up one that was a tad larger than I expected. Driving home why it really is a good idea to look at mil surplus before you bid on it. At any rate, this one is rated at 60 kilowatts and handles dc, normal ac, and three phase ac.

This dude is available at three cents on the dollar. Terms like "sturdy" and "adequate" come to mind. Yes, it has wheels. Sort of. FOB Thatcher. Truck or trailer available. Lots more on load banks at [www.tinaja.com/bargte01.html](http://www.tinaja.com/bargte01.html)

### Whenever the Chips Are Down

There's great heaping bunches of new integrated circuits coming down the pike. Here's a few candidates that I find rather interesting...

**Analog Devices ADXL05** - A member of their new nanotech accelerometer family, useful for everything from measuring the Earth's magnetic field to robot nav to air bags to premium microphones. Prices on these have finally dropped to reasonable. Free samples are sometimes offered.

**Medianix MED25101** - Digital Karaoke Audio Processor. Huh? Apparently it strips vocals from existing recordings so you can sing along with them. This is really a 16-bit digital signal processor in drag. Includes a seven band graphic equalizer and soundfield simulation.

**Maxim MAX4173T** - One of their high side current sensors. Used to monitor battery or circuit current values and directions. Some do provide internal sensing resistors; others are externally controllable. The high side connection preserves system grounds.

**Micro Linear ML4421** - It's a variable speed AC induction motor controller. The problem with speed control on a plain old ac motor is that you have to hold both amplitude and frequency in step with each other to keep the mag flux in bounds. Feedback sensing is also tricky. This chip seems to solve both problems quite well.

**Analog Devices AD9830** - This digital sinewave generator is also known as a DDS direct digital synthesizer. You'll input a sixteen bit digital word and get an analog sinewave back whose frequency is exactly controllable from

## 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.

### RESEARCH INFOPACKS

Don's instant cash-and-carry flat rate consulting service. Ask any reasonable technical question for a detailed analysis and complete report. See [www.tinaja.com/info01](http://www.tinaja.com/info01) for specifics. **\$75.00**

### 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

Tech Musings V or VI	\$24.50
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
Technical Insider Secrets	FREE

### 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**

### FREE SAMPLES

Check Don's Guru's Lair at <http://www.tinaja.com> for interactive catalogs and online samples of Don's unique products. Searchable reprints and reference resources, too. Tech help, hot links to cool sites, consultants. email: [don@tinaja.com](mailto:don@tinaja.com)

FREE US VOICE HELPLINE

VISA/MC

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

FREE Catalog: <http://www.tinaja.com>

## SOURCES FOR UNUSUAL NEW CHIPS AND DEVICES

**Apex Microtechnology**  
5980 N Shannon Rd  
Tucson AZ 85741  
(520) 690-8600

**Hewlett-Packard**  
PO Box 10301  
Palo Alto CA 94303  
(415) 857-1501

**Medianix Semi**  
100 View St Ste 101  
Mountain View CA 94041  
(415) 960-7081

**Ricoh**  
3001 Orchard Parkway  
San Jose CA 95134  
(800) 957-3436

**Tektronix**  
PO Box 500  
Beaverton OR 97077  
(800) 835-9433

**Aremco**  
PO Box 429  
Ossining NY 10562  
(914) 762-0685

**Kepro Circuit Systems**  
630 Axminister Dr  
Fenton MO 63026  
(800) 325-3878

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

**Sharp**  
Sharp Plaza  
Mahwah NJ 07430  
(201) 529-8757

**Texas Instruments**  
PO Box 655303  
Dallas TX 75265  
(800) 336-5236

**Curtis Cat Finder**  
4345 Pacific Street  
Rocklin CA 95677  
(800) 337-0901

**Lindberg**  
304 Hart St  
Watertown WI 53094  
(800) 873-4468

**MX-Com Inc**  
4800 Bethania Station Rd  
Winston-Salem NC 27105  
(800) 638-5577

**Space-Time Productions**  
219 N Vale Ave  
Rockford IL 61107  
msimon@tefbbs.com

**Tripath Technology**  
3900 Freedom Circle #200  
Santa Clara CA 95054  
(408) 567-3000

**Hamamatsu**  
360 Foothill Rd  
Bridgewater NJ 08807  
(201) 231-0960

**Linfinity Micro**  
11861 Western Ave  
Garden Grove CA 92841  
(800) LMI-7011

**National Semiconductor**  
2900 Semiconductor Rd  
Santa Clara CA 95052  
(800) 272-9959

**SPIE**  
PO Box 10  
Bellingham WA 98227  
(206) 676-3290

**Ultra Technology**  
2512 10th Street  
Berkeley CA 94710  
(510) 838-2149

**Harris Semiconductor**  
Box 883  
Melbourne FL 32902  
(407) 724-7000

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

**Qualcomm/VLSI**  
10555 Sorrento Valley Rd  
San Diego CA 92121  
(619) 597-5005

**Synergetics**  
Box 809  
Thatcher AZ 85552  
(520) 428-4073

**Xilinx**  
2100 Logic Dr  
San Jose CA 95124  
(800) 244-7778

near zero to around a third of its 50 Mhz clock frequency. Uses the phase addition method. Where a selected value gets added to the ongoing result and sent to a sine lookup table.

**Texas Instruments TSL235**– A single chip light-to-frequency converter has a silicon photodiode and a current to frequency converter inside a single low cost chip. Useful for measuring light intensity. Response is strongest in the read and infrared.

**MX-COM MX805A**– Unique *Subaudio Signalling Processor* lets you combine voice with very low frequency digital commands. Based on CTCSS squelch tones. This little known outfit has all kinds of interesting and oddball chips for voice communication. Everything from cordless telephone scramblers to tone controllers.

**National LM1971**– National, of course, has all sorts of unique low cost and high performance audio devices. This one is a digital audio attenuator. Otherwise known as an electronic volume control. It works directly in decibels, and gives a 62 db control over a 115 db dynamic range.

**Analog Devices SSM2163**– This new chip in their ongoing *Solid State Music* line is a complete high performance audio mixer. The eight input channels can be sent in any combination to a pair of stereo outputs. Provides 63 decibels attenuation in one decibel steps. For multimedia, hifi, broadcast, paging, or musical instruments.

**Qualcomm Q2220**– A second direct digital synthesizer for communication and audio uses. Qualcomm seems the leader in advanced digital radio and communications chips. They're also big in trellis encoders and similar low bit error rate devices. Check these folks out.

More info on these can be found at [www.questlink.com](http://www.questlink.com) or else by viewing their respective web sites.

### Some Other Toys

Here is some other stuff I've been recently playing with. Although once outrageously expensive, much of this is newly available as reasonable cost military surplus. Most of these have all sorts of "take it apart and make something new out of it" potential...

**Plodders**– The older *Hewlett-Packard* pen plotters were once ridiculously expensive in larger sizes. These days, most people who can afford them do prefer the newer, faster, and vastly more flexible inkjet systems. But these old models still work just fine if you are on a low budget. Even in E-size, they are sometimes bargain priced and probably can be converted into such things as vinyl sign cutters or silk screen mask makers as well.

**Industrial Furnaces**– Insulated boxes from *Lindberg* or *Aremco* easily hit temperatures of a thousands degrees or more and are now available at sane prices. Besides obvious arts and crafts uses, what can you do with one?

**Space Shuttle Receivers**– Data boxes which directly can receive 2287.5 MHz video are rather specialized, but these include a bandpass filter, attenuator, fancy receiver, even a quality power supply. There is all sorts of satellite monitoring potential here.

**Telemetry Downlinks**– Also known as Artery receivers, these unusual gray boxes offer lots of fancy fiber optic I/O combined with some expensive looking small gold plated VHF radio modules. Plus an easily modified 8035 computer and display.

**Sick Optics**– Most precision optics are extremely expensive. But sometimes you can find chipped or cracked items that work just fine for school demos or home experiments. For instance, badly mauled corner reflectors could often be masked or "stopped down" to create smaller and cleaner cubes. A retroreflector returns a light beam in the exact direction it came from.

**Inclinometers**– These sensors always know which way is up. Also known as *electronic levels*, the fancy rugged devices get installed on construction equipment for levelling. Some use the differential capacitance of a sloshing liquid in its butterfly-shaped sensor. The better ones are servo driven null seekers. Lots of possibilities here.

**Plate thru labs**– Yes, it is possible to do your own double sided plate thru printed circuit boards. No, these are neither cheap or simple. *Kepron* is the

leading source. These can sometimes be found as electronic surplus.

**Tail Twisters**– It turns out the HVAC air conditioning folks have long used power servos. Honeywell's Modutrol is one example. These are intended for damper controls, but are useful to open or close valves or similar apps. Typically moving ninety degrees in half a minute with up to 35 inch pounds of torque. This is the same as applying 17.5 pounds of twist to a three inch diameter valve handle. More on Modutrols in [MUSE130.PDF](#)

**Mystery Beer Coolers**– Not sure what these are, but the feds got conned into paying \$21,000 for the pair of them. They called them "ion gauges". Maybe so, maybe not. Try to picture a liquid hydrogen Dewyer around 18 inches in diameter and two feet high. A special probe reaches inside via an expensive looking vacuum fitting. There's some small electronics externally attached. EG&G Ortec is the brand. Definitely for sale cheap. You can use it for superconductivity demos or low noise amplifier experiments. For more details, contact [casholsen@zianet.com](mailto:casholsen@zianet.com).

**Huge Light Bulbs**– Airport beacons at one time needed large and impressive 1200 watt incandescent lamps. These are now cheaply available and make superb test loads, process heaters, or high intensity lights. These also seem

just bizarre enough to make a rather nice "monode" addition to an antique vacuum tube collection,

**Extension Phone Lockouts**– These low cost 2960 modules from the *Northern Telecom* folks include a pair of 17 volt bilateral switching diodes. One use is to stop a picked up extension phone from blasting an ongoing modem or fax. Full schematics and more device details can be found in [MUSE96.PDF](#) and [MUSE112.PDF](#)

**Mechanical Timers**– Stock "washing machine" timers consist of a small ac motor and scads of fairly heavy duty cam driven contacts. They are easily converted into such things as hot tub, farm, or irrigation controllers. It's a real challenge to discover what you *really* can do with these beasts. New ones are readily available surplus. Or try your local dump.

Useful details on working further with many of these items are found at [www.tinaja.com/bargte01.html](http://www.tinaja.com/bargte01.html)

### Two Contests

Let us have two different contests this month. First, the Catfinder folks have agreed to a special contest only for readers of my columns. Just tell them something new or unusual that you'd like to do with one or more catfinders. They'll award a dozen or more free evaluation units to what

they feel are the most interesting.

Send all of your entries on this one *directly* to the Catfinder address in the sidebar, or email [jgcurtis@inreach.com](mailto:jgcurtis@inreach.com)

Getting back to the usual stuff, just tell me about any fresh new tech toy you've found to play with. One that I haven't heard of before. They'll be a dozen or more of my *Incredible Secret Money Machine III* books going to the better entries. Plus an all expense paid *tinaja quest* for two (FOB Thatcher, AZ) going to the very best of all.

Send your written and snailmailed entries on this second contest directly to me here at *Synergetics*. Please be keep these two contests separate.

Let's hear from you. ♦

---

*Microcomputer pioneer and guru Don Lancaster is the author of 35 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also offers a free catalog full of his unique products and resource secrets. The best calling times are 8-5 on weekdays, Mountain Standard Time.*

*Don is the webmaster of his Guru's Lair found at <http://www.tinaja.com>*

*Full reprints and preprints of all Don's columns and ongoing tech support appear here. You can reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to [don@tinaja.com](mailto:don@tinaja.com)*

## PLEASE CLICK HERE TO...



**Get a Synergetics catalog**



**Send Don Lancaster email**



**Start your tech venture**



**Pick up surplus bargains**



**Sponsor a display banner**



**Find out what a tinaja is**



**Find research solutions**



**View recommended books**